Final Work Plan
Phase I Pre-Design Investigation

North Hollywood Operable Unit
Second Interim Remedy
Groundwater Remediation System Design

Revision 1

September 10, 2012

AMEC Project Number: 4088115718.4100.1

AMEC Environment & Infrastructure, Inc.
2101 Webster Street, 12th Floor
Oakland, California 94612-3066

September 10, 2012

Mr. Matt Salazar
U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, California 94105

Subject: **Final Work Plan**
Phase I Pre-Design Investigation
North Hollywood Operable Unit
Second Interim Remedy
Groundwater Remediation System Design
AMEC Project 4088115718.4100.1

Dear Mr. Salazar:

AMEC Environment & Infrastructure, Inc. is pleased to submit this Final Phase I Pre-Design Investigation Work Plan for the North Hollywood Operable Unit on behalf of Lockheed Martin Corporation and Honeywell International Inc., to the U.S. Environmental Protection Agency (USEPA), Region IX. This document has been prepared pursuant to the Administrative Settlement Agreement and Order on Consent for Remedial Design dated February 14, 2011 and revised in response to USEPA comments received on August 10, 2012.

If you have any questions regarding this report, please contact Michael Taraszki at (510) 663-3996.

Sincerely yours,
AMEC Environment & Infrastructure, Inc.

Michael Taraszki, PG, CHG, PMP
Project Manager

Margaret K. (Peggy) Peischl, PE
Quality Assurance Manager

mt/pp/smm

Enclosure

AMEC Environment & Infrastructure, Inc.
2101 Webster Street, 12th Floor
Oakland, California 94612-3066
USA
Tel (510) 663-4100
Fax (510) 663-4141
amec.com

DISTRIBUTION LIST

Mr. Matt Salazar (CD + 1 hard copy)
Environmental Protection Agency
75 Hawthorne Street
San Francisco, California

Mr. Vahe Dabbaghian (CD)
Los Angeles Department of Water and Power
111 North Hope Street, Room 1217
Los Angeles, California 90012

Mr. Jeff O'Keefe (CD)
California Department of Public Health
500 North Central Avenue, Suite 500
Glendale, California 91203

Ms. Poonam Acharya (CD)
Department of Toxic Substances Control
9211 Oakdale Avenue
Chatsworth, California 91311-6505

Mr. Larry Moore (CD)
Regional Water Quality Control Board – Los Angeles
320 West 4th Street, Suite 200
Los Angeles, California 90013

Mr. Richard Slade (CD + 1 hard copy)
ULARA Watermaster
12750 Ventura Blvd., Ste. 202
Studio City, California 91604

Mr. John Lindquist (CD)
CH2M Hill
2525 Airpark Drive
Redding, California 96001

Mr. Benny DeHghi (CD + 2 hard copies)
Honeywell International, Inc.
2525 W. 190th Street
Torrance, California 90504

Ms. Carolyn Monteith (CD + 2 hard copies)
Lockheed Martin Corporation
2950 North Hollywood Way, Suite 125
Burbank, California 91505

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Michael Taraszki, PG, CHG, PMP
Project Manager

CERTIFIED HYDROGEOLOGIST
MICHAEL D. TARASZKI
No. 586
EXP. 12/2012
STATE OF CALIFORNIA

Margaret K. (Peggy) Peischl, PE
Quality Assurance Manager

Warren Chamberlain, PG, CHG, PE
Project Principal

September 10, 2012

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ABBREVIATIONS AND ACRONYMS

1,2,3-TCP	1,2,3-trichloropropane
AMEC	AMEC Environment & Infrastructure, Inc.
AOC	Agreement and Order on Consent
bgs	below ground surface
CAO	Cleanup and Abatement Order
CDPH	California Department of Public Health
COC	chemical of concern
EDD	electronic data deliverable
FFS	Focused Feasibility Study
HASP	Health and Safety Plan
Honeywell	Honeywell International, Inc.
JMM	James M. Montgomery, Inc.
LADWP	Los Angeles Department of Water and Power
Lockheed Martin	Lockheed Martin Corporation
MWH	MWH Americas, Inc.
NAVD88	North American Vertical Datum of 1988
NH-C	cluster monitoring well
NHE	North Hollywood extraction well
NHOU	North Hollywood Operable Unit
OUFS	operable unit feasibility study
PCE	Tetrachloroethene
PDB	passive diffusion bag
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAO	Remedial Action Objective
RD	Remedial Design
RI	remedial investigation
ROD	Record of Decision
RWQCB-LA	Regional Water Quality Control Board, Los Angeles Region
SAP	Sampling and Analysis Plan
SFB	San Fernando Basin
SFBFS model	revised SFVRI model for feasibility study
SFV	San Fernando Valley
SFVRI model	SFV-wide remedial investigation model
TCE	Trichloroethene
ULARA	Upper Los Angeles River Area
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
VPGAC	vapor-phase granular activated carbon

1. INTRODUCTION

AMEC Environment & Infrastructure, Inc. (AMEC), has prepared this Final Work Plan on behalf of Honeywell International, Inc. (Honeywell) and Lockheed Martin Corporation (Lockheed Martin) to document the scope of work, procedures, and protocols for the Phase I Pre-Design Investigation as part of the North Hollywood Operable Unit (NHOU; Figure 1-1), Second Interim Remedy, Groundwater Remediation Design. Submittal of this Work Plan is consistent with the revised NHOU project schedule (Appendix A).

Scope items included in this Work Plan are based on recommendations included in the Final Data Gap Analysis (AMEC, 2012a). The following sections provide a brief summary of the project background information and the objectives and scope of the Phase I Pre-Design Investigation. Field Activities conducted in conjunction with this Work Plan will be performed in accordance with the quality assurance (QA) procedures provided in the Sampling and Analysis Plan (SAP), which includes Field Sampling Plans (FSPs; AMEC, 2012b), and with the site-specific Health and Safety Plan (HASP; AMEC, 2012c).

2. PROJECT BACKGROUND, PREVIOUS INVESTIGATIONS, AND OBJECTIVES

This section describes the NHOU study area conditions, the project background, previous investigations, and objectives associated with the Phase I Pre-Design Investigation.

2.1 Project Description

The San Fernando Valley Basin (SFB) is one of several groundwater basins in the Upper Los Angeles River Area (ULARA) within the Los Angeles River Watershed in the County of Los Angeles. The Verdugo, Sylmar, and Eagle Rock basins are hydraulically distinct from the SFB and are not discussed herein. The SFB area is approximately 145,000 acres (226 square miles), including the San Fernando Valley (SFV) proper, Tujunga Valley, Browns Canyon, and the alluvial areas surrounding the Verdugo Mountains near La Crescenta and Eagle Rock. The basin is bounded on the north and northwest by the Santa Susana Mountains, on the north and northeast by the San Gabriel Mountains, on the east by the San Rafael Hills, on the south by the Santa Monica Mountains and Chalk Hills, and on the west by the Simi Hills.

As defined in the Interim Action Record of Decision (ROD; USEPA, 2009), the NHOU Site "…comprises approximately 4 square miles of contaminated groundwater underlying an area of mixed industrial, commercial, and residential land use in the community of North Hollywood." As stated further in the ROD, the NHOU "…includes any areas to which and from which such hazardous substance groundwater contamination migrates." For the purposes of this investigation, the NHOU study area is depicted on Figure 2-1 and extends to depths over 400 feet below ground surface (bgs).

The SFB is an alluvial-filled basin consisting of fine- to coarse-grained sediments in the western portion and coarse-grained sediments (e.g., consisting largely of sand, gravel, and cobbles) in the eastern portion that are primarily derived from the San Gabriel Mountains. Various subunits have been identified within the SFB based on geophysical signatures and lithology, but in general, many of the locally identified marker units are difficult to correlate across the SFB without use of down-hole geophysical data. Within the NHOU study area, however, these units appear to correlate well and suggest relatively flat orientations with little structural dip. Aquifer hydraulic parameters of most units in the SFB suggest relatively high transmissivity conditions, consistent with a granitic source area and a high-energy depositional environment, also consistent with the mountainous topography surrounding the SFB.

2.2 NHOU Project Background

The NHOU was proposed by the U.S. Environmental Protection Agency (USEPA) in 1984 in response to the discovery in the late 1970s of trichloroethene (TCE) and tetrachloroethene (PCE) in groundwater from production wells in the San Gabriel Basin and throughout much of the eastern portion of the SFB (see Figure 2-1). The NHOU Extraction and Treatment system was designed to remove PCE and TCE from groundwater following an Operable Unit Feasibility Study (OUFS) in 1986. This interim approach allowed remedial actions to be implemented before a comprehensive remedial investigation (RI) was performed.

The NHOU treatment system, which was constructed between 1987 and 1989, consists of eight extraction wells (designated as NHE-1 through NHE-8), a collector line, and a central treatment

system consisting of an air-stripper tower, two vapor-phase granular activated carbon units, and a chlorination system. Treated water is discharged to the North Hollywood Complex where it is blended into the Los Angeles Department of Water and Power (LADWP) water distribution system. As of June 2011, six of the eight extraction wells remain in service. NHE-1 has never operated as part of the NHOU system and NHE-5 has not operated since 2008.

Throughout the 1980s and 1990s, chemicals of concern (COCs) in groundwater quality assessments primarily included volatile organic compounds (VOCs), specifically TCE and PCE. In 1995, the USEPA's SFB RI monitoring program analyte list was expanded to include hexavalent chromium because this metal was widely distributed in the eastern portion of the SFB. In 1996, 1,4-dioxane was added to the monitoring program analyte list. Other emerging chemicals (e.g., 1,2,3-trichloropropane [1,2,3-TCP], n-nitrosodimethylamine and perchlorate) were later added to the RI monitoring program analyte list. Groundwater samples have been collected either quarterly, semiannually, or annually since this monitoring program began in 1993.

The NHOU treatment system was originally designed to operate at a nominal flow rate of about 2,000 gallons per minute (gpm) and the extraction wells at a nominal discharge rate of approximately 300 gpm each; however, some of the extraction wells have not sustained their designed withdrawal flow rates and the actual influent flow rate to the treatment system has typically been less than 1,500 gpm and often below 1,000 gpm. Several performance assessments conducted between 1991 and 2008 concluded that design modifications were necessary to achieve the original remedial action objectives (RAOs), including containing the extent of the COC plumes in groundwater. The detection of emerging chemicals (e.g., chromium) at NHE-2, and of 1,2,3-TCP and 1,4-dioxane at monitoring wells upgradient and near the NHOU extraction wells led to a Focused Feasibility Study (FFS) conducted in 2009. Because the NHOU system was not designed to treat groundwater for these emerging chemicals, the existing system needs to be modified.

The USEPA subsequently developed the ROD for the North Hollywood Operable Unit (USEPA, 2009; CERCLIS ID No. CAD980894893). The Second Interim Remedy RAOs were defined in the ROD as follows:

- Prevent exposure to contaminated groundwater above acceptable risk levels
- Contain areas of contaminated groundwater that exceed the maximum contaminant levels and notification levels to the maximum extent practicable
- Prevent further degradation of water quality at the Rinaldi-Toluca and North Hollywood (west) production wells by preventing the migration toward these well fields of the more highly contaminated areas of the VOC plume to the east/southeast
- Achieve improved hydraulic containment to inhibit horizontal and vertical contaminant migration in groundwater from the more highly contaminated areas and depths of the aquifer to the less contaminated areas and depths of the aquifer, including the southeast portion of the NHOU near the Erwin and Whitnall production well fields
- Remove contaminant mass from the aquifer.

An Agreement and Order on Consent (AOC) for Remedial Design (RD), dated February 21, 2011, was executed between the United States, Honeywell, and Lockheed Martin to conduct

pre-design data acquisition and RD activities associated with the ROD (USEPA, 2011). COCs associated with the Second Interim Remedy are identified in scope of work contained in the AOC.

Because surrounding large-capacity production well fields capture portions of the VOC plume and will continue to operate to meet municipal water demand, it will not be possible to hydraulically capture all contaminated groundwater. Rather, the RAOs are directed to the extent practicable at containment of high-concentration portions of the plume and other portions of the plume where concentrations are above regulatory limits, so that no further groundwater quality degradation occurs near the Rinaldi-Toluca, North Hollywood (west), and Erwin and Whitnall production well fields to the southeast. Specific work scope items defined in the AOC are intended to achieve the RAOs and include the following:

- Groundwater Monitoring
- Replace Existing Extraction Well NHE-1
- Replace or Repair and Modify Existing Extraction Wells NHE-2, NHE-3, NHE-4, and NHE-5
- Wellhead Chromium Treatment at NHE-2 (to be addressed separately by Honeywell)
- Wellhead 1,4-Dioxane Treatment at NHE-2 (to be addressed separately by Honeywell)
- Construct New Extraction Wells
- Treatment of VOCs in Extracted Groundwater
- Ex Situ Chromium Treatment for Wells NHE-1, and recommended new wells NEW-2, and NEW-3
- Delivery of Treated Groundwater to LADWP

As discussed in the RD Work Plan (AMEC, 2011), Honeywell has been developing an approach to treat and dispose of water extracted from NHE-2 pursuant to a Cleanup and Abatement Order (CAO) issued by the Regional Water Quality Control Board, Los Angeles Region (RWQCB-LA). Subsequent discussions between Honeywell, the USEPA, and the RWQCB-LA resulted in an agreement to rescind the NHE-2 portion of the CAO and cede oversight of remedial design and remedial action of NHE-2 to the USEPA under a separate AOC with Honeywell. Because NHE-2 is an integral part of the NHOU, Honeywell's lead designer (MWH Americas, Inc. [MWH]) will adjust its design schedule to match AMEC's design schedule for NHOU.

Groundwater flow modeling conducted for the FFS indicated that up to three new extraction wells would be required northwest of the existing treatment system. The ROD states that new extraction wells are necessary to further limit contaminant migration to nearby well fields and to improve mass removal and that "further evaluation of specific pumping rates and extraction well locations will be performed during RD to ensure that implementation of the Second Interim Remedy will not cause additional degradation of the aquifer." The ROD also states that "if new data collected prior to or during RD indicates that a different configuration of extraction wells is more effective and cost effective than the configuration described in the Proposed Plan, then that different configuration will be considered for implementation as part of the Second Interim

Remedy." The AOC states that "a plan for optimizing the pumping rates of the new NHOU extraction well system shall be developed as part of the [Second Interim Remedy] design."

2.3 Previous Investigations

Groundwater conditions in the SFV have been investigated specifically with respect to VOCs and chromium since the early 1980s (LADWP, 1983). Analytical data from groundwater samples collected at existing water supply wells were used to design the first interim remedy (i.e., the existing NHOU extraction well field and treatment system). A basin-scale RI was conducted in the early 1990s by James M. Montgomery, Inc. (JMM), but did not specifically focus on the NHOU study area (JMM, 1990, 1992); data collected from this RI were used to develop the SFVRI model that described both the geology and hydrogeology of the basin. Subsequently, several investigations were performed to further delineate the extent of chromium, particularly hexavalent chromium, in the SFV (RWQCB-LA, 2002; ULARA Watermaster, 2003; CH2M Hill, 2006).

CH2M Hill modified and refined the SFVRI model to support the basin-wide Feasibility Study conducted by the USEPA in 1994 (CH2M Hill, 1994). Combined with simulated groundwater flow pathlines, the revised SFB model for the Feasibility Study (the "SFBFS model") was developed to evaluate conduct several evaluations, as follows:

1. The effectiveness of the NHOU, Burbank Operable Unit , and Glendale Operable Units
2. Potential impacts to human health under current conditions
3. Potential options for additional basin-wide remediation.

To address data needs identified in the FFS and Second Interim ROD, Honeywell installed 31 additional monitoring wells (NH-C07 through NH-C25) at 19 locations in the NHOU area between June 2009 and August 2010 "to better characterize the lateral and vertical extent of contaminated groundwater in relation to known and potential source areas for the purpose of supporting decision-making during design of the Second Interim Remedy" (MWH, 2011).

AMEC evaluated existing data to prepare a detailed Data Gap Analysis report (AMEC, 2012a). Existing data suggest that most COC mass resides in the uppermost saturated sediments to depths of approximately 350 to 400 feet bgs. Geologic and geophysical data were used to identify two hydrogeologic units within this depth range: the A-Zone and the B-Zone. The A-Zone consists of relatively fine-grain sand and silt deposits of variable thickness (because the upper surface is defined by the water table, which generally slopes to the southeast and fluctuates over time). All eight of the NHOU extraction wells penetrate this unit. The B-Zone underlies the A-Zone, is approximately 50 feet thick, and consists of coarser sand and gravel than the A-Zone. Depth-discrete data suggest that COC concentrations are highest in the A-Zone. However, AMEC concluded in the Final Data Gap Analysis report (AMEC, 2012a) that existing data are insufficient to proceed with a Second Interim Remedy that would reasonably be expected to meet RAOs. Critical data gaps identified pertained to depth-discrete groundwater analytical data, groundwater elevations surveyed to a single vertical elevation datum, depth-discrete aquifer hydraulic parameters, soil analytical parameters pertinent to COC fate and transport mechanisms, and hydraulic response to NHOU extraction wells. Table 2-1 correlates each data gap with the associated Phase I Pre-Design investigation action, as discussed herein.

2.4 Phase I Pre-Design Investigation Objectives

The overall objective of the Phase I Pre-Design Investigation is to fill critical data gaps that have been identified as necessary for the Second Interim Remedy design to meet RAOs, as defined in the ROD. Specific objectives for filling the data gaps are as follows:

1. Measure groundwater elevations from monitoring wells with reference points surveyed to the same vertical datum (e.g., North American Vertical Datum of 1988 [NAVD88]) to evaluate seasonal changes in groundwater flow directions and gradients
2. Collect depth-discrete groundwater samples and conduct vertical flow monitoring in existing monitoring wells to further evaluate the significance and relevance of the A-Zone and B-Zone that were identified in the Final Data Gap Analysis report (AMEC, 2012a)
3. Perform slug tests at existing monitoring wells to further characterize the A-Zone and B-Zone hydraulic parameters
4. Install piezometer couplets adjacent to existing NHOU extraction wells to evaluate depth-discrete geologic and groundwater quality conditions at depths equivalent to and below active NHOU extraction wells
5. Perform aquifer tests using existing NHOU extraction wells and the newly installed piezometers to assess the lateral and vertical extent of drawdown at each location and to further characterize A-Zone hydraulic properties
6. Incorporate groundwater elevation, groundwater quality, geologic, and hydrogeologic data into a refined numerical groundwater flow model
7. Assess whether sufficient data exist to proceed with designing the Second Interim Remedy such that RAOs can be reasonably expected to be met. If available data are assessed to be insufficient, then outstanding data gaps will lead to a Phase 2 Pre-Design Investigation. Enough data must be obtained to develop a sufficiently robust groundwater model which can adequately simulate plume containment and capture. AMEC's Phase I Pre-Design Investigation project team, roles and responsibilities, and lines of communication are summarized in Section 5.0. QA-related roles are documented in more detail in the SAP.

Table 2-1 lists each Critical Data Gap, the associated Phase I Pre-Design Investigation objective, and the associated section(s) of the Work Plan where each Critical Data Gap and Phase I Pre-Design Investigation objective is addressed. Field activities that are expected to achieve these objectives, and the rationale for each activity, are described in Section 3.0.

3. SCOPE OF WORK

The scope of work comprising the Phase I Pre-Design Investigation is based on recommendations presented in the Final Data Gap Analysis report (AMEC, 2012a) to obtain additional data related to the geologic and groundwater conditions in the NHOU study area to achieve RAOs, as specified in the AOC. The need for collecting additional data beyond the present scope (i.e., Phase 2) will be assessed upon completion of Phase I activities with respect to Second Interim Remedy RAOs, including revisions or clarifications (if any) provided by the USEPA. The following tasks make up the planned Phase I scope of field work:

- Measuring groundwater elevations
- Collecting groundwater samples
- Surveying monitoring well coordinates and reference point elevations
- Logging vertical groundwater flow
- Drilling boreholes
- Installing and developing piezometers
- Testing aquifers
- Managing investigation-derived waste

Additional details pertaining to specific field activities and methods are presented in Table 3-1 and the SAP (AMEC, 2012b). The Quality Assurance Project Plan (QAPP) contained in the SAP describes the quality assurance/quality control (QA/QC) procedures that AMEC will follow during the Phase I Pre-Design Investigation to ensure that the data collected and reported are representative of field conditions and suitable for site characterization. Health and safety procedures described in the HASP (AMEC, 2012c) will be followed during fieldwork activities to protect field personnel and the public during the investigation. The revised NHOU project schedule (Appendix A) contains field elements that will be coordinated with the USEPA, LADWP, and Los Angeles County of Public Health and other permitting agencies, as needed.

3.1 Pre-Field Activities

Fieldwork preparation will include reviewing additional documents as they become available, obtaining necessary permits, conducting a site visit to mark boring and sample locations and to consider potential access restrictions, and coordinating with LADWP and subcontractors regarding site access and the project schedule. Traffic plans will be prepared in accordance with Los Angeles County Health Department requirements and the Work Area Traffic Control Handbook to access wells located in streets. AMEC will coordinate with the USEPA and LADWP to avoid conflicts with other monitoring programs or activities that may be in progress, including NHOU treatment system operations during aquifer testing activities.

A California-licensed (C-57) drilling contractor will be procured. The selected drilling contractor will have demonstrated qualifications for drilling through sediments comprising the SFB or basins with similar geologic features. The contractor will also have demonstrated qualifications for completing mud-rotary-drilled boreholes as piezometers and controlling investigation-derived waste (including drilling mud, soil cuttings, formation water, and other drilling fluids). AMEC will

work with the selected drilling contractor to ensure that procured materials are consistent with the Phase I Pre-Design Investigation objectives.

AMEC will procure other subcontractors to perform subsurface clearance, laboratory analysis, surveying, and waste hauling. The selected subcontractors will conform to project health and safety requirements and demonstrate their ability to meet project expectations as stated in the SAP (AMEC, 2012b).

3.2 Groundwater Monitoring Activities

This section describes groundwater monitoring activities, including measuring depths to groundwater, collecting depth-discrete groundwater samples from existing monitoring wells, surveying existing monitoring wells, and collecting vertical profile samples from existing monitoring wells. Monitoring wells to be accessed for measuring groundwater elevations, collecting groundwater samples, and surveying top of casing elevations are shown on Figure 3-1.

3.2.1 Survey Monitoring Wells

As discussed in the Final Data Gap Analysis report (AMEC, 2012a), the USEPA uses reference elevation points at monitoring wells to monitor groundwater elevations to determine flow directions and gradients in the SFV that have not been surveyed to the same vertical datum. Wells installed in the 1980s and 1990s were surveyed to the National Geodetic Vertical Datum of 1929 and more recently installed wells have been surveyed to the NAVD88. These vertical datums differ by approximately 3 feet, which can result in an error of approximately 3 feet for calculated groundwater elevations. This error can affect the determination of groundwater flow directions and gradients, both of which are of fundamental importance for this groundwater investigation.

To correct this situation, 26 monitoring wells (where groundwater elevations will be measured) will be surveyed to ensure that all wells included in the investigation have been surveyed to a common elevation datum. Coordinates and elevations will be surveyed by a California-licensed surveyor relative to North American Datum of 1983 and NAVD88, respectively. The wells to be surveyed are summarized in Table 3-1. Details associated with this task are presented and discussed in Appendix A of the SAP (AMEC, 2012b).

3.2.2 Depth-to-Groundwater Measurements

To maintain consistency with the December 2010 monitoring event, depths to groundwater at 56 monitoring wells (including a subset of the monitoring wells monitored in December 2010 and other wells) will be measured quarterly for one year to monitor seasonal changes in groundwater elevation and gradients (as noted in Table 3-1). Measurements will be made from a surveyed reference point (as stated in the previous section) at the top of each well casing using an electronic sounder. Measurements will be collected independently from groundwater sampling to limit the duration of each gauging event to no more than two days and to maximize the correlation of the results. Details associated with this task are presented and discussed in Appendix A of the SAP (AMEC, 2012b).

3.2.3 Depth-Discrete Groundwater Sampling

As discussed in the Final Data Gap Analysis report (AMEC, 2012a), many cluster monitoring wells were installed with screen lengths that fully penetrate Depth Regions 1 or 2. However, because Depth Region 1 correlates with portions of both the A-Zone and B-Zone, groundwater samples collected from some of these wells may represent conditions in either the A-Zone or B-Zone, or a combination of both. SimulProbe™ data, however, suggest that highest COC concentrations are consistently present in the A-Zone and that concentrations in the B-Zone are generally below the threshold that may require hydraulic capture.

Depth-discrete groundwater samples will be collected to further delineate the lateral and vertical distribution of COCs in the NHOU study area with respect to the A-Zone and B-Zone. All samples will be collected using low-flow equipment installed in each well approximately 24 hours before sampling to minimize the disturbance of COC stratification in the water column. Sampling will be performed, as outlined below at monitoring wells that are screened within the A-Zone or B-Zone, or both (Table 3-1). The distribution of these wells is intended to provide groundwater quality data throughout the NHOU study area, including upgradient areas (i.e., north of Sherman Way), where other sources appear to have resulted in groundwater contamination that is impacting municipal production well fields that pertain to Second Interim Remedy RAOs.

- Two depth-discrete samples will be collected during two semiannual events from within approximately 28 monitoring wells to monitor COC concentrations in the A-Zone and B-Zone at seasonal extremes. Each semiannual sampling event is anticipated to be completed within a 10-day time frame.
- Up to five depth-discrete samples will be collected from two additional monitoring wells during a single event to evaluate COC concentrations across the complete vertical profiles of the well screens. Sampling depths will be separated by no more than 10 feet to evaluate the vertical distribution of COC with high resolution. Samples will be collected using passive diffusion bag (PDB) samplers and will be analyzed for VOCs as a proxy for other COCs.
- At least two depth-discrete samples will be collected from extraction well NHE-1 during a single event to further evaluate the potential utilization of the well (which has never operated as part of the NHOU Extraction and Treatment system) as part to the Second Interim Remedy.
- At least two depth-discrete samples will be collected from the upper perforation zones of production well NH-10 during a single monitoring event to evaluate groundwater quality in the A-Zone and B-Zone at that location.

Details associated with this task are presented and discussed in Appendix A of the SAP (AMEC, 2012b).

3.2.4 Vertical Flow Monitoring

As discussed in the Final Data Gap Analysis report (AMEC, 2012a), widespread pumping throughout the SFB results in seasonal groundwater elevation fluctuations; however, intra-well vertical flow data within the NHOU study area do not exist that could quantify how much vertical flow occurs through existing wells. Many cluster monitoring wells were installed with screen

lengths that fully penetrate Depth Regions 1 or 2. Because Depth Region 1 correlates with portions of both the A-Zone and B-Zone, vertical flow may be occurring within some of these monitoring wells. Additionally, many inactive production wells may provide vertical conduits from the A-Zone to deep aquifer zones; however, assessing those wells is not included in this Work Plan.

To evaluate how monitoring well construction may affect groundwater quality data, vertical flow will be monitored at 10 existing long-screened monitoring wells (at five locations) to evaluate the magnitude and direction of flow within the wells. Monitoring will be performed during two semi-annual events at seasonal extremes to evaluate vertical flow in response to seasonal pumping patterns. Electromagnetic borehole flow meter (or equivalent) equipment will be used to quantify vertical flow occurring under ambient conditions (i.e., pumping will not occur from the monitoring well being tested). Wells to be monitored are summarized in Table 3-1. Details associated with the proper operation of an electromagnetic borehole flow meter are addressed in Appendix A of the SAP (AMEC, 2012b).

3.3 Geologic and Groundwater Quality Characterization

This section describes characterization activities, including drilling activities, installation and development of new piezometers, inspection and potentially development of NHOU extraction wells, and aquifer testing at existing monitoring wells and NHOU extraction wells (NHE-3, NHE-5, and NHE-7). Piezometer couplet locations are illustrated on Figures 3-2 through 3-7.

3.3.1 Borehole Advancement and Piezometer Installation.

As discussed in the Final Data Gap Analysis report (AMEC, 2012a), groundwater quality and elevation data within the NHOU extraction well field either do not exist or are not specific to the A-Zone, and thus insufficient data exist to determine the extent to which select NHOU extraction wells need to be deepened to meet RAOs (i.e., plume capture). Additionally, aquifer testing has not been performed such that responses to pumping from NHOU extraction wells can be used to estimate aquifer-specific hydraulic parameters so the groundwater flow model could be refined to represent the A-Zone and B-Zone.

To correct this situation, three piezometer pairs will be installed to further assess groundwater quality conditions adjacent to and beneath existing NHOU extraction wells, and to verify the size and shape of the NHOU extraction wells' capture area. Mud rotary drilling rigs will be used to install one pair of piezometers at each of the NHE-3, NHE-5, and NHE-7 locations. As discussed below, these locations were selected to facilitate aquifer testing activities and to obtain spatially distributed data representative of the entire NHOU well field. The first borehole at each location will extend to approximately 400 feet bgs and will be geologically and geophysically logged to evaluate A-Zone and/or B-Zone conditions. Each geophysical log will include a standard suite (long and short normal resistivity, spontaneous potential, natural gamma, and caliper) and a sonic velocity log, which has proven to be an effective method of differentiating the aquifer zones. If the B-Zone is identified based on the geophysical log, a grab-groundwater sample will be collected and that portion of the borehole will be sealed before constructing the piezometer. Findings from the geologic and geophysical logs will be used to verify the proposed piezometer designs, in consultation with the USEPA, and adjustments to the proposed construction depths will be made as needed.

Each piezometer pair will be installed approximately 30 to 50 feet away from an extraction well, as described below:

- The first (deeper) borehole will be completed as a single-screen piezometer with the following anticipated construction details:
  - Schedule 80 PVC casing and slotted screen
  - A nominal inside diameter of 3 inches
  - Screen length up to 20 feet, placed within the A-Zone and below the adjacent extraction well screen interval; if the distance between the bottom of the extraction well and the bottom of the A-Zone is insufficient to install a well, a B-Zone well may be installed
  - A section of bottom-capped blank casing (i.e., a 5-foot-long sump) will be extended below each screen interval to collect sediments
  - Flush-mount surface completion in a traffic-rated well box
  - Final well designs to be based on the geological and geophysical logs at each location.
- The second (shallower) borehole will be completed with a piezometer with the same construction details as the first borehole, but to a depth that correlates with the adjacent extraction well screen interval.
- Each piezometer will be developed to remove drilling mud and fines from the piezometer, filter pack, and borehole wall and formation material that may have entered the piezometer and filter pack. Development may include surging, air-lifting, swabbing, and bailing sediments from each piezometer.
- Once the sanitary seal has cured for at least 24 hours, a groundwater sample will be collected from each piezometer using low-flow sampling methods.
- Waste management will include drilling mud and cuttings generated from drilling activities, and sediment and water generated from piezometer development activities. Solid and liquid waste will be analyzed for the Title 22 metals and VOCs and results will be compared to 40 CFR 261 and CCR Title 22, Division 4.5, Chapter 11 to assess hazardous characteristics necessary for proper disposal.

Details associated with this task are presented and discussed in Appendix B of the SAP (AMEC, 2012b).

3.3.2 Aquifer Testing

As discussed above, NHOU extraction wells have not been monitored by observation wells to assess the size and shape of the associated cone of depression and capture area and, as such, the effectiveness of these wells cannot be demonstrated with empirical data. Similarly, the vertical extent of capture cannot be determined because measurements of pressure responses at depths below the extraction wells do not exist. Understanding the lateral and vertical extent of the existing NHOU capture area, in combination with depth-discrete groundwater quality data, is needed to establish the extent to which selected extraction wells should be deepened or replaced to comply with RAOs specified in the AOC.

As such, aquifer testing will be performed on monitoring and extraction wells to verify aquifer hydraulic parameters as discussed below. Details associated with this task are presented and discussed in Appendix C of the SAP (AMEC, 2012b). Aquifer test locations are shown on Figure 3-8.

3.3.2.1 Monitoring Well Testing

Slug tests will be performed at 14 monitoring wells screened primarily in either the A-Zone or B-Zone to estimate hydraulic conductivity values. The resulting hydraulic conductivity values from slug testing will be used to guide development of the hydraulic conductivity matrix in the groundwater flow model. Electronic pressure transducers will be used to monitor drawdown during testing. Where applicable, AMEC technicians will perform pneumatic slug tests by pressurizing each well with compressed air, allowing the water level to stabilize, releasing the air, and monitoring the recovery of the water column. If well construction precludes using the pneumatic test method, a C-57 contractor will be procured and a rig with a wire-line winch will be used to perform physical slug tests under AMEC supervision. Wells to be slug tested are listed in Table 3-1.

3.3.2.2 Extraction Well Testing

Pumping tests will be performed on extraction wells NHE-3, NHE-5, and NHE-7 to estimate the hydraulic conductivity and storativity of the A-Zone. These wells were selected because they are distributed throughout the NHOU well field, and findings will provide hydraulic data that may vary from west to east (i.e., eastern extraction wells operate at higher flow rates than western extraction wells). Also, each well is bounded to the east and west by an extraction well that will remain active during the test and, as such, hydraulic interference (if present) may also be observed by testing these wells.

According to LADWP, NHE-5 has not been operational due to low water levels. As such, the temporary pump will be installed and tested before drilling and piezometer installation activities begin. If sustainable pumping cannot be established at NHE-5, an aquifer test will not be performed at this well. However, piezometers at this location will be installed regardless to obtain depth-discrete geologic and groundwater quality data to assess whether a replacement extraction well is deemed necessary and, if so, to what depth.

Before testing begins, each extraction well will be inspected with a video log (unless the LADWP has performed a recent video log that is available for our review) to determine whether redevelopment is necessary or possible; this action will be performed while adjacent piezometer couplets (PZ-NHE-3, PZ-NHE-5, and PZ-NHE-7) are being installed. If deemed necessary, redevelopment will be performed to improve the operation of each extraction well; results of this task will be evaluated to determine the potential benefits of rehabilitating other NHOU extraction wells. The following rehabilitation activities (if implemented) may be conducted:

- All activities associated with these extraction wells will be conducted in coordination with LADWP, pursuant to a formal access agreement with Honeywell and Lockheed Martin.
- The depth to groundwater will be measured with an electronic sounder at each extraction well, wellhead access permitting, before and after deactivation of each pump.

- The existing submersible pump will be removed and safely stored to allow for a video inspection of each screen interval. If significant debris, fouling, or scaling is observed, the extraction well will be developed (e.g., swabbing, air-lifting or pumping, jetting) to potentially improve its performance. Chemical treatment of these wells is not included as part of this activity.
- Liquid waste generated from development activities will be stored and analyzed for the Title 22 metals and VOCs. Results will be compared to 40 CFR 261 and CCR Title 22, Division 4.5, Chapter 11 to assess hazardous characteristics necessary for proper disposal. If acceptable to LADWP and California Department of Public Health (CDPH), development water will be filtered and discharged to the NHOU Extraction and Treatment System.

As part of the extraction well inspection activities, preparation for each aquifer test will include the following steps:

- A submersible pump will be installed in each extraction well for aquifer testing purposes. The original pump will be installed and restored to normal operations after each aquifer test is completed.
- Power will be supplied by a generator (with a sound barrier) during each aquifer test.
- In addition to a temporary pump, a flow-control valve and flow meter will be installed at each extraction wellhead to maintain or vary the discharge rate, as needed, for the duration of each aquifer test. The pump intake will be set to within 5 feet of the well bottom.
- Pressure transducers will be installed in each extraction well after installation of the temporary pump. Transducers will be installed in adjacent piezometers and other monitoring wells used for background monitoring approximately one week before initiating aquifer test activities. Initial depth to water measurements will be collected upon installation of each pressure transducer. An absolute pressure transducer will also be used to record barometric pressure changes over the duration of aquifer testing activities.

Each aquifer test will proceed as follows:

- Day One: a multi-stage step test will be conducted to evaluate extraction well performance
- Day Two: a 72-hour constant-rate discharge test will be initiated (after confirmation that water levels have recovered to at least 70 percent of levels observed prior to Day One activities)
- Day Five: a recovery test will be initiated
- Day Seven: remove equipment installed for aquifer testing purposes; reinstall original submersible pump as needed
- Aquifer testing will be performed at one extraction well at a time to evaluate the influence of each well (for a given discharge rate) and consider variations throughout the well field area.

- All water generated during aquifer testing will be discharged directly to the NHOU treatment system (with LADWP permission). We assume that discharge to the NHOU treatment system with a temporary pump during aquifer testing will be permissible, but because treated effluent is discharged to the LADWP distribution system, CDPH will be consulted prior to initiating this activity.

Note that the NHOU treatment system is expected to remain in operation during aquifer testing activities but that the total flow rate will decline by not operating NHE-3 and NHE-7 (NHE-5 is currently not operational). NHE-3 and NHE-7 typically operate at approximately 60 gpm and 270 gpm, respectively. Treatment system performance is expected to return to normal conditions after aquifer testing activities have been completed.

In response to a CDPH request (Appendix B), AMEC has performed a preliminary evaluation of the potential impact of pumping test flow variations on the chromium and 1,4-dioxane influent concentrations using recent concentration and flow rate data, considering that groundwater at NHE-5 has not been analyzed for COCs since 2008. The CDPH concern is based on the fact that the existing treatment system is not capable of treating these two compounds because they are not susceptible to air-stripping treatment. Our preliminary evaluation, based on available recent data (as discussed in Appendix B), indicates that influent concentrations of hexavalent chromium or 1,4-dioxane would likely remain below or near current concentrations as a result of the proposed tests because of the relatively small volume contribution that will originate from NHE-5. However, AMEC will coordinate with LADWP to determine whether and when additional samples will be collected from NHE-5.

4. DATA MANAGEMENT, DATA EVALUATION AND REPORTING

Analytical data and field measurements will be managed as specified in the SAP (AMEC, 2012b). Specifically, analytical laboratory reports will be provided in both hard-copy and electronic data deliverable (EDD) format; field measurements will be recorded in field notebooks or the electronic equivalent. All data will be stored in AMEC's NHOU project database to facilitate data evaluation. Analytical data will be provided validated using a third party data validator and submitted to the USEPA pursuant to requirements included in the AOC and as specified in the SAP (AMEC, 2012b).

Surveyed coordinates and elevations for existing monitoring wells used for groundwater elevation monitoring will be tabulated and submitted to the USEPA for inclusion in the San Fernando Valley Superfund Site database. Quarterly depth-to-groundwater measurements will be subtracted from surveyed elevation reference points to calculate groundwater elevations, which will be contoured and displayed using geographic information system tools to illustrate groundwater flow directions and gradients. Groundwater elevations will be tabulated for each monitoring event.

COC concentrations measured in semiannual groundwater samples will be used to develop plume maps specific to the A-Zone and B-Zone. Contours will be prepared in consideration of groundwater flow directions (lateral and vertical), pumping activities, and known or suspected source areas to portray plume maps, as opposed to statistically generated contours or COC distribution maps. Analytical data will be tabulated as hits-only and summary tables with respect to regulatory criteria.

Slug test results will be evaluated in parallel with pumping test results to estimate aquifer hydraulic parameters (e.g., hydraulic conductivity) and to refine the groundwater flow model. Hydraulic parameter estimates from slug tests typically are lower than those from constant-rate discharge tests because of the scale associated with each test type. Differences in aquifer test method results will be considered when incorporating results into the groundwater flow model. Slug test data will be evaluated using Hantush, Cooper-Jacob, and/or Kansas Geological Survey methods, as appropriate for each test (i.e., unconfined or confined conditions and for oscillatory responses, respectively) (Butler, 1998). Recorded responses from each slug test will be plotted as changes in groundwater elevation (drawdown) versus time and compared to theoretical curves to estimate hydraulic parameters.

Groundwater elevations recorded at background observation wells, as well as recorded barometric pressure changes during each aquifer test will be used to reduce background noise that may obscure pressure responses (e.g., drawdown) induced by pumping each extraction well. Subsequently, pumping test results will be evaluated using appropriate straight-line and/or curve-matching methods to estimate aquifer hydraulic parameters (including storativity) (Kruseman and de Ridder, 1989). Step-drawdown test observations will be used to evaluate the efficiency of each extraction well, which will be considered for extraction wells that will be included in the Second Interim Remedy design. Changes in pressure response at each extraction well, observation well, and barometric data will be plotted against time for each aquifer test.

Geologic logs will be prepared for each borehole consistent with the Unified Soil Classification System; geophysical logs will be presented in graphical format for each deep borehole.

Piezometer construction details will be summarized for each piezometer to present as-built conditions, including screen depth intervals, casing diameter, screen slot size, total depth. Surveyed coordinates and elevations will also be tabulated for each piezometer and provided to the USEPA.

AMEC will summarize findings from field tasks described in Sections 3.2 and 3.3 in a Phase I Pre-Design findings report. The report will contain a summary; discussion; recommendations (as appropriate); and graphical presentation of groundwater elevations, groundwater sample analytical results, surveyed coordinates and reference point elevations, geologic and geophysical observations, piezometer construction details; piezometer development records; waste management profiles (soil and water) and disposition of wastes; and aquifer test findings. This report will evaluate Phase I data and will recommend that a Phase 2 Pre-Design Investigation be performed if it is determined that insufficient data exist (at that time) to fill critical data gaps associated with the Second Interim Remedy and comply with RAOs and meet CDPH 97-005 requirements.

5. PROJECT MANAGEMENT AND COORDINATION

Information pertaining to the Phase I Pre-Design Investigation project team, roles and responsibilities, and lines of communication is summarized here. A more detailed description of QA-related roles is documented in the SAP. An organization chart showing the relationships between various entities and personnel participating in the project is illustrated on Figure 5-1. The USEPA will approve the Work Plan and SAP and review the results of the Phase I Pre-Design Investigation. Access to NHOU extraction wells, as required for drilling and aquifer testing activities, will require coordination with and permission from LADWP.

5.1 Project Organization and Roles and Responsibilities

This section outlines the management responsibilities of key project personnel and lines of authority and communication. Personnel assigned to management positions are shown on the project organization chart (Figure 5-1). As stated in the AOC, the “Respondent” is identified as Honeywell and Lockheed Martin and the “Contractor” is identified as AMEC. The management responsibilities are described below.

5.1.1 U.S. Environmental Protection Agency

The USEPA Region 9 Project Manager, Mr. Matt Salazar, has USEPA oversight responsibility.

5.1.2 Honeywell and Lockheed Martin

The Respondent Project Coordinators, Mr. Benny DeHghi (Honeywell) and Ms. Carolyn Monteith (Lockheed Martin), are responsible for implementing the work and have the authority to commit the resources necessary to meet project objectives and requirements. The Project Coordinators have directed AMEC to prepare this Work Plan and perform the Second Interim Remedy work. The Project Coordinators will work directly with the Project Manager to ensure that the project objectives and standards are addressed.

5.1.3 AMEC Environment & Infrastructure, Inc.

AMEC is contracted to the Respondent to provide environmental consulting services associated with this Work Plan. The following subsections describe the Project organization and duties of the AMEC personnel assigned to the Project.

5.1.3.1 Project Principals

The Project Principals, Mr. Warren Chamberlain, PE, PG, CHG, and Neven Kresic, PhD, PG, PH, CGWP, are responsible for reviewing the technical aspects of the project to ensure that all work elements meet the project objectives and technical standards, and are completed in accordance with the QAPP standards.

5.1.3.2 Health and Safety Coordinator

The Project Health and Safety Coordinator, Mr. Don Kubik, Jr, PG, CIH, is responsible for directing all health and safety aspects of the investigative, observation, sampling, and testing activities conducted by AMEC personnel during the Phase I Pre-Design investigation. He will also ensure all AMEC personnel have received required training, are aware of the potential hazards associated with site operations, have been instructed in the work practices necessary

for personal health and safety, and are familiar with the site HASP procedures for scheduled activities and emergency actions. The Health and Safety Coordinator will also be responsible for reporting all accidents, incidents, and findings regarding work practices to the Project Manager and preparing any accident/incident reports.

5.1.3.3 Project Manager

The AMEC Project Manager, Mr. Michael Taraszki, PG, CHG, PMP, is responsible for the scope, cost, and technical considerations related to the project; staff and project coordination; and implementation of review of overall project quality related to the collection, completeness, and presentation of data, ensuring that documents prepared by AMEC follow QA/QC procedures, making final decisions on recommendations, personnel assignments, and submission of final reports. The AMEC Project Manager oversees the technical work conducted by the Task Manager, QA activities conducted by the QA Manager, and health and safety activities conducted by the Health and Safety Coordinator. The AMEC Project Manager is responsible for all the project files.

5.1.3.4 Quality Assurance Manager

The QA Manager, Ms. Margaret K. (Peggy) Peischl, PE, is responsible for reviewing the project QA program as it relates to the collection and completeness of data from field and laboratory operations, including training personnel to follow established protocols and procedures. The QA Manager will also be responsible for approving modifications to the QAPP as needed, and distributing the approved modifications to all parties; reviewing data validation reports prepared by the third-party Data Validator, independent of the laboratory; directing and reviewing the management of data by the project team; and reviewing project deliverables.

5.1.3.5 Data Manager

The Data Manager, Mr. Fred Albrecht, a Senior Technical Specialist, is responsible for reviewing laboratory reports for accuracy and completeness, performing data validation according to the National Functional Guidelines (USEPA, 2008, 2010) and coordinating with the providing laboratory oversight. The Data Reviewer has been trained in data validation and has extensive experience on projects requiring detailed data review. He will submit laboratory reports to the QA Manager and third-party Data Validator within three working days of receiving final, complete analytical reports from the laboratory. He will also be responsible for setup and maintenance of the electronic database and EDDs.

5.1.3.6 Task Manager

The project Task Manager, Mr. Mike Barnes, Senior Environmental Scientist is responsible for executing the planned work elements, issuing specific instructions for performing assigned work elements, and performing and directing the work so it is conducted in compliance with project-specific objectives and applicable QA procedures. The Task Manager will coordinate with the Project Manager and QA Manager to review general work plans and specific work elements. For field sampling activities, the Task Manager will be responsible for performing or overseeing the fieldwork, proper documentation preparation, and sample handling for all sampling activities.

5.1.3.7 Field Team Leaders

AMEC Field Team Leaders are Ms. Eileen Bailiff, PG, CEG, Senior Geologist for the groundwater monitoring and sampling task; Mr. Damian Hriciga, PG, Project Geologist for the

drilling and piezometer installation task; and Mr. Sean Culkin, PG, Project Geologist for the aquifer testing task. The Field Team Leaders have the responsibility for leading and coordinating AMEC activities undertaken during the field investigation tasks as described in the FSPs (Appendices A, B, and C of the SAP). All field tasks, including drilling and piezometer installation activities, will be overseen by a California-licensed Professional Geologist and/or a California-licensed Professional Engineer. The AMEC Field Team Leaders report directly to the AMEC Task Manager and Project Manager. Field Team Leaders are qualified staff with expertise in geology, hydrogeology, and groundwater monitoring. They will be responsible for overseeing and documenting the field activities and coordinating the sampling efforts with the QA Manager and Project Data Reviewer; overseeing implementation of the FSPs and site-specific HASP (AMEC, 2012c); coordinating field activities with subcontractors, as appropriate; communicating to the project team potential changes in field conditions that may require modification of the Work Plan, SAP, and/or HASP; and assisting with data analysis and preparing project deliverables. The Field Team Leaders maintain all field documentation and deliverables in the project files while assigned tasks are being performed.

6. PROJECT SCHEDULE

The NHOU project schedule was updated to include Phase I Pre-Design Investigation activities and in response to USEPA comments dated August 10, 2012 (Appendix A).

7. REFERENCES

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TABLES

Table 2-1 Summary of Data Gaps and Phase I Pre-Design Investigation Objectives
North Hollywood Operable Unit
Los Angeles County, California

Data Gap	Phase I Pre-Design Investigation Objective	Where Addressed in Phase I Work Plan	Comment
1. Recent analytical data are insufficient to delineate the lateral and vertical distribution of COC mass (and temporal variability) in the A-Zone and B-Zone and to define the necessary target capture area required to achieve Second Interim Remedy RAOs. This data gap applies both to areas throughout the NHOU study area and to areas near the existing NHOU extraction wells.	2	Section 3.2.3 Depth-Discrete GW Sampling Section 3.2.4 Vertical Flow Monitoring Section 3.3.1 Piezometer Installation	The need for additional groundwater sampling activities to support the design of the Second Interim Remedy will be evaluated at the conclusion of the Phase 1 Pre-Design Investigation.
2. Groundwater elevation data have not been measured from a sufficient number of wells surveyed to a common elevation datum (e.g., North American Vertical Datum of 1988 [NAVD88]) to verify and clarify groundwater flow directions, particularly north of Sherman Way.	1	Section 3.2.1 Survey Monitoring Wells Section 3.2.2 Depth to GW Measurements	
3. Aquifer test results are insufficient to estimate hydraulic parameters specific to the A-Zone or B-Zone; these estimates are needed to accurately simulate groundwater flow directions, NHE hydraulic capture areas, and influent pumping rates to the new treatment system.	3	Section 3.3.2 Aquifer Testing	
4. The monitoring well network is insufficient to characterize vadose zone and groundwater conditions beneath known and potential source areas to further delineate the lateral and vertical distribution of COC mass within the NHOU source area to achieve Second Interim Remedy RAOs.	Not part of the Phase 1 Pre-Design Investigation	N/A	The monitoring well network required to evaluate compliance with the RAOs will be developed after the formulation of the Groundwater Management Plan and the preparation of the Groundwater Modeling Memo.
5. The EPA's SFB RI groundwater monitoring network is inadequate to achieve Second Interim Remedy RAOs. Recently installed wells in the NHOU have not yet been incorporated into this program. Sampling methods need to be revised such that groundwater samples are collected from depths that specifically relate to either the A-Zone or the B-Zone. Not all wells used for measuring groundwater elevation have been surveyed to the same vertical datum, while reference elevations on old wells may have undergone change (e.g., settlement, grade changes, wellhead maintenance).	1, 2	Short term, the groundwater elevation data gap will be partially addressed: Section 3.2.1 Survey Monitoring Wells Section 3.2.2 Depth to GW Measurements	Long term, a NHOU groundwater monitoring network/program will be addressed with a Groundwater Monitoring Plan, as stated in the AOC
6. Objective projections of pumping and recharge rates, including beyond year 2015, are not yet available; this prevents meaningful simulation of future groundwater flow conditions and elevations pertinent to the Second Interim Remedy design.	Not part of the Phase 1 Pre-Design Investigation	N/A	To be addressed as part of on-going discussions with EPA/LADWP/ULARA
7. Performance monitoring wells have not been installed and monitored to demonstrate the size and shape of the existing NHOU extraction well capture area. Similarly, drawdown measurements at each extraction well have not been recorded for calculating well efficiency changes over time to support the need for well rehabilitation.	4, 5	Section 3.3.1 Piezometer Installation Section 3.3.2 Aquifer Testing	
8. The existing numerical groundwater flow model is not sufficiently structured or discretized vertically to evaluate hydraulic capture specifically within the A-Zone and potentially the B-Zone.	6	Section 3.3.2 Aquifer Testing	
9. Available analytical data are insufficient to assess A-Zone source water to the new NHOU treatment system to meet CDPH 97-005 requirements.	2, 3, 4, 5, 6, 7	Section 3.2.3 Discrete Depth GW Sampling Section 3.2.4 Vertical Flow Monitoring Section 3.3.1 Piezometer Installation	
10. Vertical conduits throughout the NHOU study area have not been sufficiently evaluated to quantify the volume of groundwater and COC mass that is induced to depths below the A-Zone in response to various municipal pumping patterns or scenarios.	Not part of the Phase 1 Pre-Design Investigation	N/A	Assessment of the inactive wells is the responsibility of the well owner. Inactive wells will be further addressed as outlined in Section 6.1.4 of the DGA recommendation #3 - collaboration with LADWP

1 Final Data Gap Analysis, North Hollywood Operable Unit, Second Interim Remedy, Groundwater Remediation System Design. (AMEC, March 14, 2012)

Table 3-1 Work Summary
North Hollywood Operable Unit
Los Angeles County, California

Well Name	Bottom of A-Zone Contact (depth bgs.)[1]	Bottom of B-Zone Contact (depth bgs.)[1]	Screen Interval (ft. BTOC)	Assumed Representative Screen Zone(s)			Semi Annual Depth Discrete Monitoring Well Sampling [2]	Sample Depth Configuration	Vertical Profiles	Vertical Flow Logging	Surveying	Quarterly Water Levels [7]	Slug Testing	Well/Piezometer Installation	Aquifer Testing
				A-Zone	B-Zone	Below B-Zone									
4909C	345.7	430.7	230-240, 290-300, 390-400, 480-490	X	X	X	X	[8]							
4909F	340.0	N/A	138-348	X	X		X	[9]							
4918A	400.6	N/A	230-240, 290-300, 390-400, 480-490	X	X		X	[9]							
4919D	346.2	431.2	230-240, 290-300, 390-400, 480-490	X	X	X	X [2]	[8]							
4928A	383.8	N/A	225-433	X	X		X	[9]							
GW-18B	342.3	405.3	400-450		X	X	X	[10]							
GW-19B	339.0	406.0	400-450		X	X	X	[10]							
LA1-CW05	284.8	358.8	336-376		X	X	X	[10]							
LC1-CW01	342.9	418.9	461--491			X		N/A			X	X			
LC1-CW02	343.0	N/A	382-392		X			[11]			X	X			
LC1-CW03	343.2	N/A	259-280	X				[12]			X	X			
NH-10	346.8	407.8	160-535	X	X	X	X	[8]							
NH-C01-325	366.1	N/A	275-325	X				[12]			X	X			
NH-C01-450	366.2	N/A	400-450	X	X		X [4]	[9]			X	X	X		
NH-C01-660	366.2	459.2	630-660			X		N/A			X	X			
NH-C01-780	366.3	459.3	740-780			X		N/A			X	X			
NH-C02-220	268.5	N/A	170-220	X				[12]			X	X			
NH-C02-325	268.7	N/A	275-325		X			[11]			X	X	X		
NH-C02-520	269.0	343.9	470-520			X		N/A			X	X			
NH-C02-681	269.0	344.0	641-681			X		N/A			X	X			
NH-C03-380	321.3	N/A	340-380		X			[11]			X	X	X		
NH-C03-580	321.4	382.4	540-580			X		N/A			X	X			
NH-C03-680	321.5	382.5	640-680			X		N/A			X	X			
NH-C03-800	321.6	382.6	760-800			X		N/A			X	X			
NH-C04-240	N/A	N/A	270-320					N/A					X		
NH-C05-320	349.2	448.2	390-460 [5]	X				[12]		X	X	X			
NH-C05-460	349.2	N/A	245-295 [5]		X			[11]		X	X	X			
NH-C07-300	N/A	N/A	240-300	X				N/A					X		
NH-C08-295	337.9	N/A	245-295	X				[12]				X			
NH-C09-310	329.8	N/A	250-310	X				[12]				X	X		
NH-C10-280	**320.7**	N/A	220-280 [5]	X				[12]		X		X	X		
NH-C10-360	**320.7**	N/A	310-360 [5]	X	X		X	[9]		X		X			
NH-C11-295	317.9	N/A	235-295	X				[12]				X			
NH-C12-280	**326.2**	N/A	210-280	X				[12]				X	X		

Table 3-1 Work Summary
North Hollywood Operable Unit
Los Angeles County, California

Well Name	Bottom of A-Zone Contact (depth bgs.)[1]	Bottom of B-Zone Contact (depth bgs.)[1]	Screen Interval (ft. BTOC)	Assumed Representative Screen Zone(s)			Semi Annual Depth Discrete Monitoring Well Sampling [2]	Sample Depth Configuration	Vertical Profiles	Vertical Flow Logging	Surveying	Quarterly Water Levels [7]	Slug Testing	Well/Piezometer Installation	Aquifer Testing
				A-Zone	B-Zone	Below B-Zone									
NH-C12-360	**326.2**	N/A	310-360	X	X		X	[9]				X			
NH-C13-385	**342.6**	N/A	335-385	X	X		X	[9]				X	X		
NH-C14-250	306.2	N/A	200-250	X			X	[12]				X	X		
NH-C15-240	**290.6**	**379.0**	180-240	X				[12]				X			
NH-C15-330	**290.6**	**379.1**	270-330	X	X			[9]				X			
NH-C16-320	**359.6**	N/A	250-300 [5]	X				[12]		X		X			
NH-C16-390	**359.6**	N/A	340-390 [5]	X	X		X [6]	[9]		X		X			
NH-C17-255	**286.0**	N/A	185-255	X				[12]				X	X		
NH-C17-339	**286.0**	358.3	279-339				X	N/A				X			
NH-C18-270	**329.4**	N/A	220-270				X	N/A				X			
NH-C18-365	**329.4**	**406.8**	305-365	X	X		X	[9]				X			
NH-C19-290	**337.6**	N/A	230-290	X			X [4]	[12]	X [6]			X	X		
NH-C19-360	**337.6**	N/A	300-360	X	X		X	[9]	X [6]			X			
NH-C20-380	**342.4**	N/A	320-380	X	X		X	[9]				X			
NH-C21-260	**310.8**	**388.1**	210-260	X			X	[12]				X			
NH-C21-340	**310.8**	**388.3**	280-340	X	X		X	[9]				X			
NH-C22-360	**367.9**	**462.3**	300-360	X				[12]				X			
NH-C22-460	**367.9**	**462.6**	390-460		X			[11]				X	X		
NH-C22-600	**367.9**	**462.5**	550-600			X		N/A				X			
NH-C23-310	**367.9**	**399.7**	250-310 [5]	X			X	[12]	X [6]	X		X	X		
NH-C23-400	**340.0**	**399.7**	340-400 [5]	X	X		X	[11]	X [6]	X		X			
NH-C24-305	**340.0**	N/A	245-305	X			X	[12]				X			
NH-C24-410	**340.0**	N/A	340-400		X			[11]				X	X		
NH-C25-290	334.7	N/A	240-290	X				[12]				X			
NHE-1	329.1	N/A	190-276	X			X	[12]							
NHE-3	324.9	N/A	190-300	X				N/A							X
NHE-5	305.0	N/A	190-286	X				N/A							X
NHE-7	310.0	N/A	180-270	X				N/A							X
NH-VPB-02	314.5	N/A	241.6-261.6	X				[12]			X	X			
NH-VPB-03	284.6	N/A	200.05-220.35	X				[12]			X	X			
NH-VPB-05	267.3	N/A	185.16-205.46	X				[12]			X	X			
NH-VPB-06	339.9	N/A	287.43-307.73	X				[12]			X	X			
NH-VPB-07	349.3	N/A	270-58-290.88	X				[12]			X	X			
NH-VPB-08	280.3	N/A	205-225.55	X				[12]			X	X			
NH-VPB-09	379.9	N/A	271.06-291.46	X				[12]			X	X			
NH-VPB-10	357.1	N/A	305.42-325.72	X				[12]			X	X			
NH-VPB-11	358.6	N/A	301.14-321.44	X				[12]			X	X			
PST-MW-1P	319.7	N/A	207-287	X			X [6]	[12]							
PST-MW-2P	321.1	N/A	204-284	X			X	[12]							

Table 3-1 Work Summary
North Hollywood Operable Unit
Los Angeles County, California

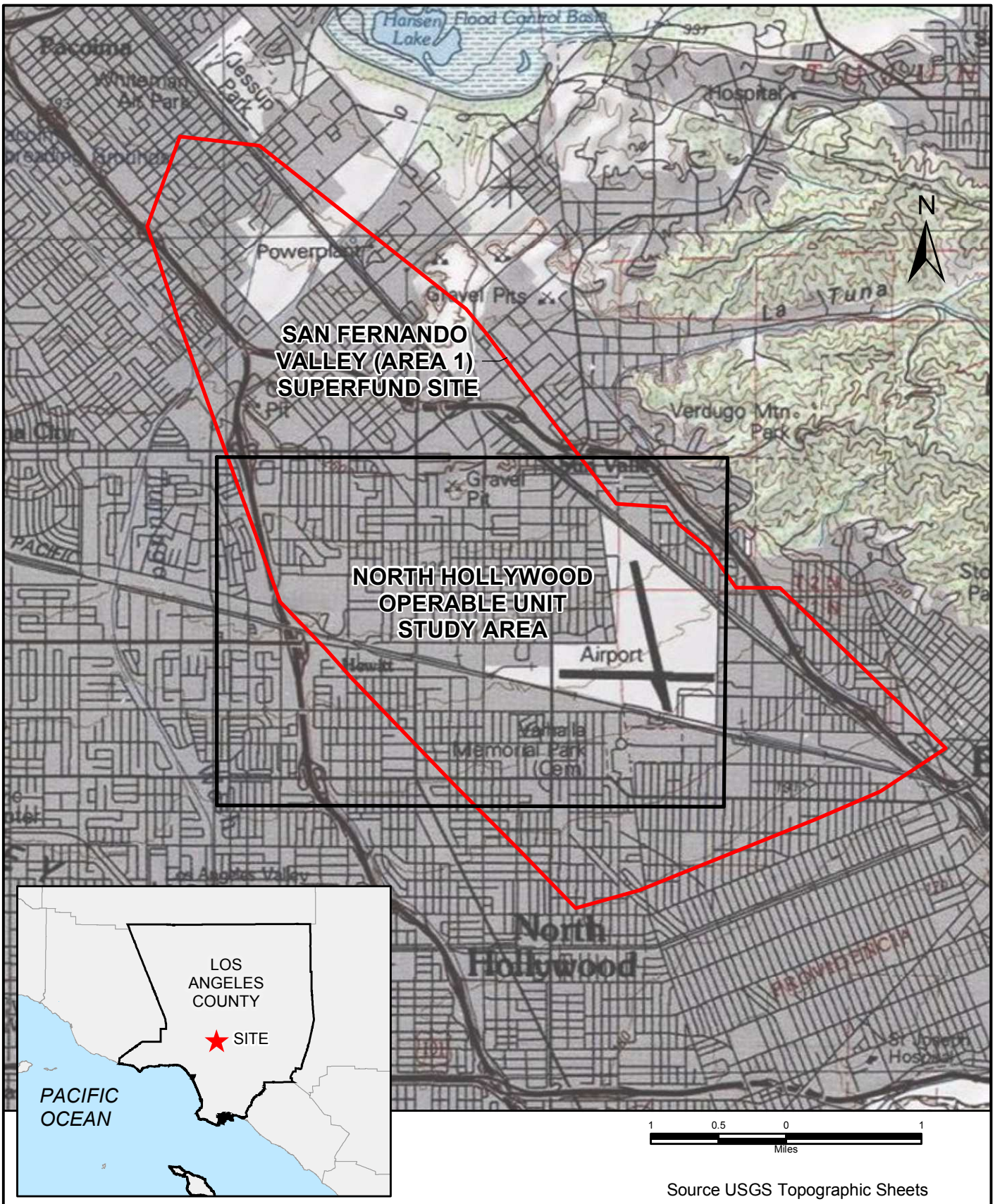
Well Name	Bottom of A-Zone Contact (depth bgs.)[1]	Bottom of B-Zone Contact (depth bgs.)[1]	Screen Interval (ft. BTOC)	Assumed Representative Screen Zone(s)			Semi Annual Depth Discrete Monitoring Well Sampling [2]	Sample Depth Configuration	Vertical Profiles	Vertical Flow Logging	Surveying	Quarterly Water Levels [7]	Slug Testing	Well/Piezometer Installation	Aquifer Testing
				A-Zone	B-Zone	Below B-Zone									
PZ-NHE-3 shal	324.9	N/A	250-270	X				12			X	X		X	
PZ-NHE-3 deep	324.9	N/A	305-325	X				12			X	X		X	
PZ-NHE-5 shal	305.0	N/A	230-250	X				12			X	X		X	
PZ-NHE-5 deep	305.0	N/A	275-295	X				12			X	X		X	
PZ-NHE-7 shal	291.0	N/A	230-250	X				12			X	X		X	
PZ-NHE-7 deep	291.0	N/A	285-305	X				12			X	X		X	

Notes

N/A Not Applicable

1. Bolded depths from well e-log. All other depths from interpolated surface of contact.
2. Semi annual samples will be analyzed for constituents listed in Table A.3.
3. Collect duplicate and MS/MSD sample.
4. Collect duplicate sample.
5. Interval to be profiled.
6. See Section 6.3.4 of FSP for PDB deployment depth criteria.
7. Total depths of wells will be sounded during first quarterly event.
8. Collect A-Zone sample near top-of-screen or static water level (within 3 feet if practicable). Collect two B-Zone samples near bottom of A-Zone contact and bottom of the B-Zone contact (within 3 feet of each contact if practicable).
9. Collect A-Zone sample near top-of-screen or static water level (within 3 feet if practicable). Collect B-Zone sample near middle of bottom-of-screen and bottom of A-Zone contact.
10. Collect two B-Zone samples near top-of-screen and bottom of B-Zone contact (within 3 feet of each if practicable).
11. Collect two B-Zone samples near top-of-screen and bottom-of-screen (within 3 feet of each if practicable).
12. Collect A-zone sample near top-of-screen or static water level (within 3 feet if practicable).

FIGURES



Source USGS Topographic Sheets

amec

Site Vicinity Map
Phase I Pre-Design Investigation Work Plan
North Hollywood Operable Unit
Second Interim Remedy
Groundwater Remediation System Design

FIGURE
1-1

DRAWN	JOB NUMBER	CHECKED	CHECKED DATE	APPROVED	APPROVED DATE
TJH	4088115718		4/2012		

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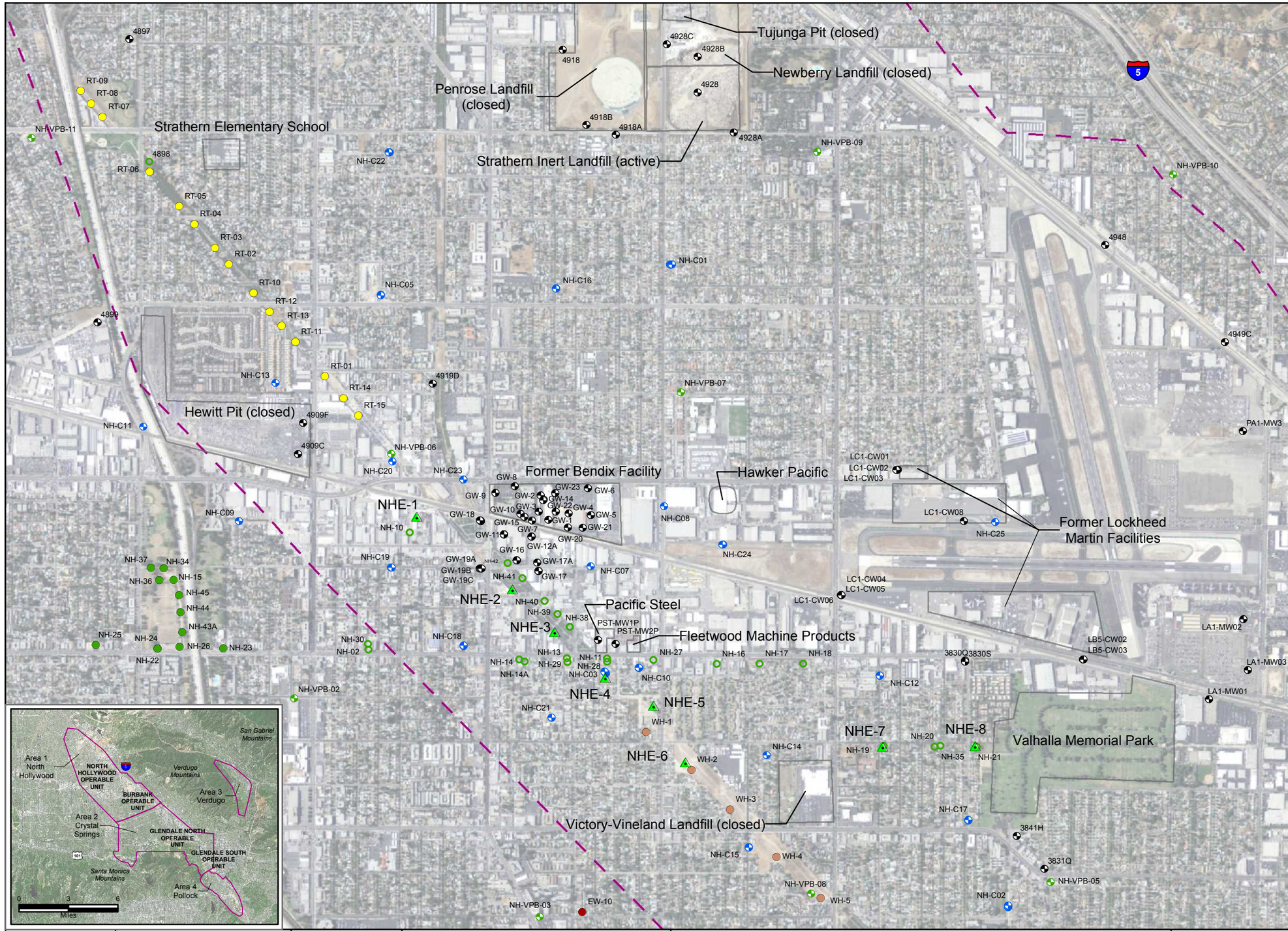

EXPLANATION

- NHOU Extraction Well

PRODUCTION WELLS

- Erwin Well Field
- North Hollywood Well Field (West)
- North Hollywood Well Field (East)
- Rinaldi-Toluca Well Field
- Whitnall Well Field

MONITORING WELLS

- NHOU Monitoring Well
- North Hollywood Vertical Profile Boring Monitoring Well
- Facility Monitoring Wells
- Study Area Features
- Approximate Boundary San Fernando Valley Investigation Area 1

N

0 1,500 3,000
Feet

Aerial Photograph: DigitalGlobe, June 2009

DRAWN: TJH	PROJECT NO: 4088115718		
REV:	SCALE: AS SHOWN		
CHECKED: MSB	APPROVED: MDT		
DATE: 4/2012	DATE: 4/2012		

amec

Phase I Pre-Design Investigation Work Plan
North Hollywood Operable Unit
Second Interim Remedy
Groundwater Remediation System Design

Site Area Map

FIGURE
2-1

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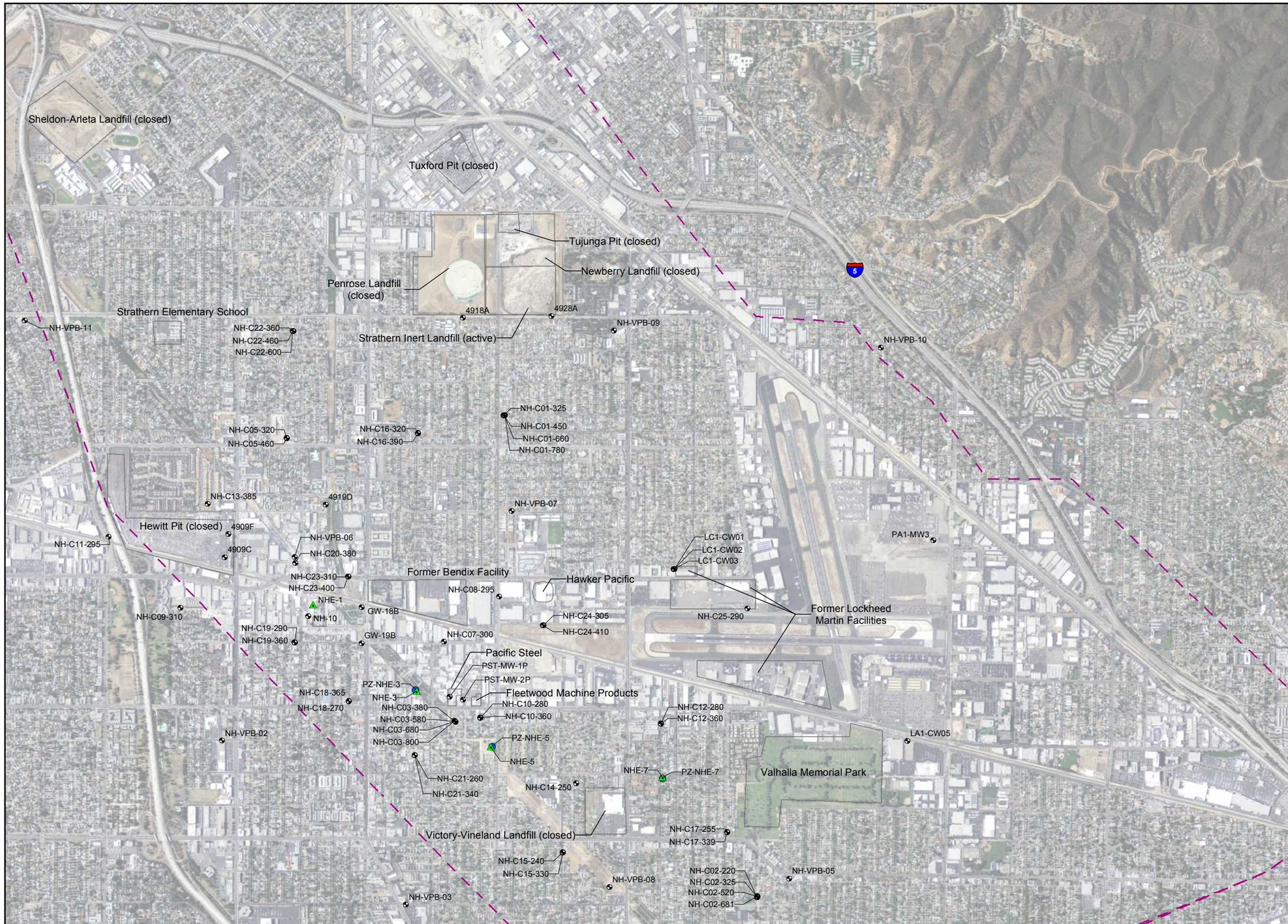

EXPLANATION

- Proposed Piezometer Couplet Location (Phase 1)
- NHOU Extraction Well
- Monitoring Wells
- Approximate Boundary San Fernando Valley Investigation Area 1

N

0 2,000 4,000
Feet

DRAWN: TJH	PROJECT NO: 4088115718	amec	Phase I Pre-Design Investigation Work Plan North Hollywood Operable Unit Second Interim Remedy Groundwater Remediation System Design
REV:	SCALE: AS SHOWN		
CHECKED:	APPROVED:		
DATE: 9/2012	DATE: 9/2012		

Groundwater Monitoring Well and Survey Locations

FIGURE 3-1

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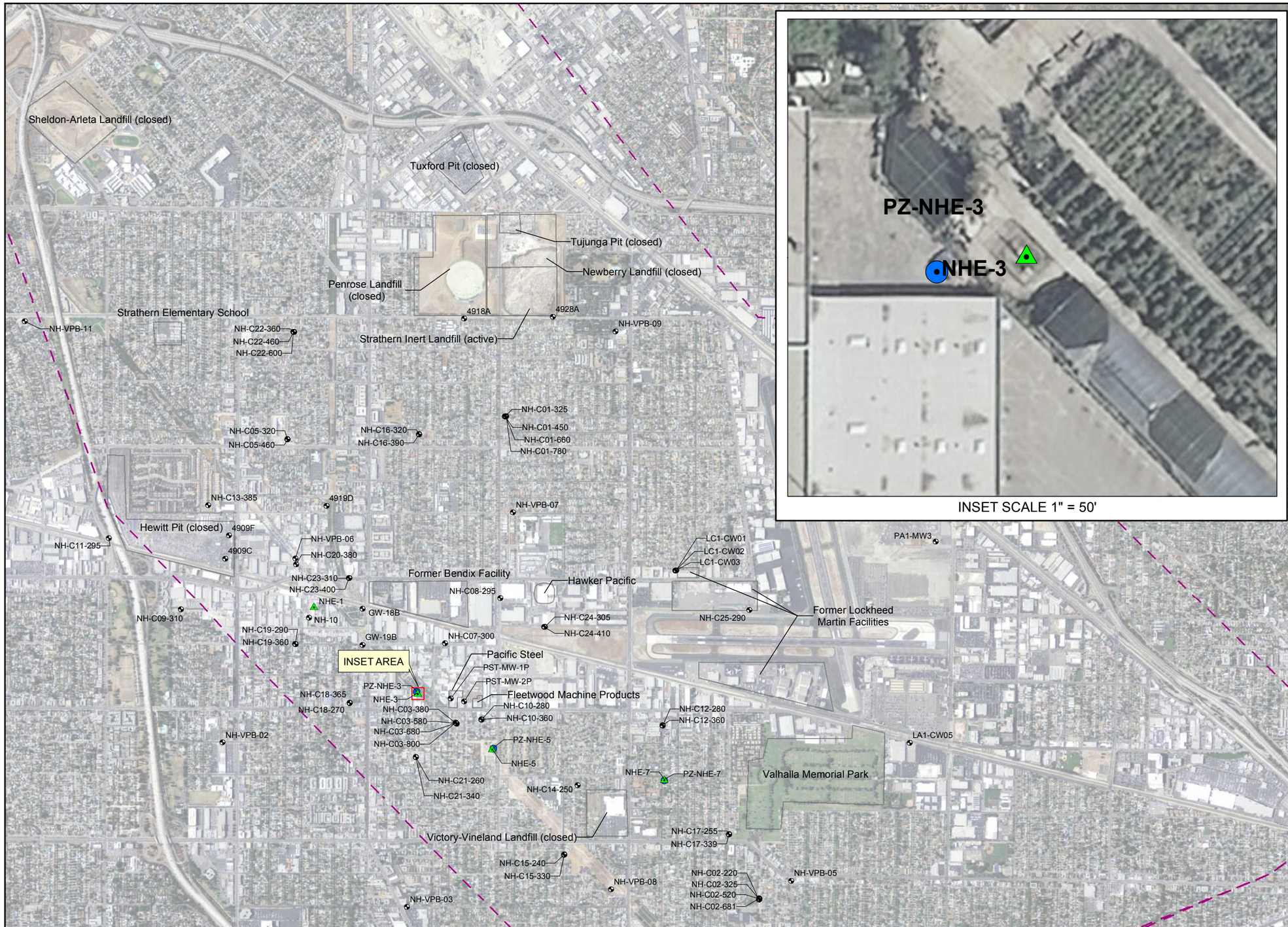

EXPLANATION

- Proposed Piezometer Couplet and Aquifer Test Location (Phase 1)
- NHOU Extraction Well
- Monitoring Wells
- Approximate Boundary San Fernando Valley Investigation Area 1

DRAWN: TJH	PROJECT NO: 4088115718	amec	Phase I Pre-Design Investigation Work Plan North Hollywood Operable Unit Second Interim Remedy Groundwater Remediation System Design
REV:	SCALE: AS SHOWN		Proposed PZ-NHE-3 Area Detail Map
CHECKED:	APPROVED:		FIGURE 3-2
DATE: 4/2012	DATE: 4/2012		

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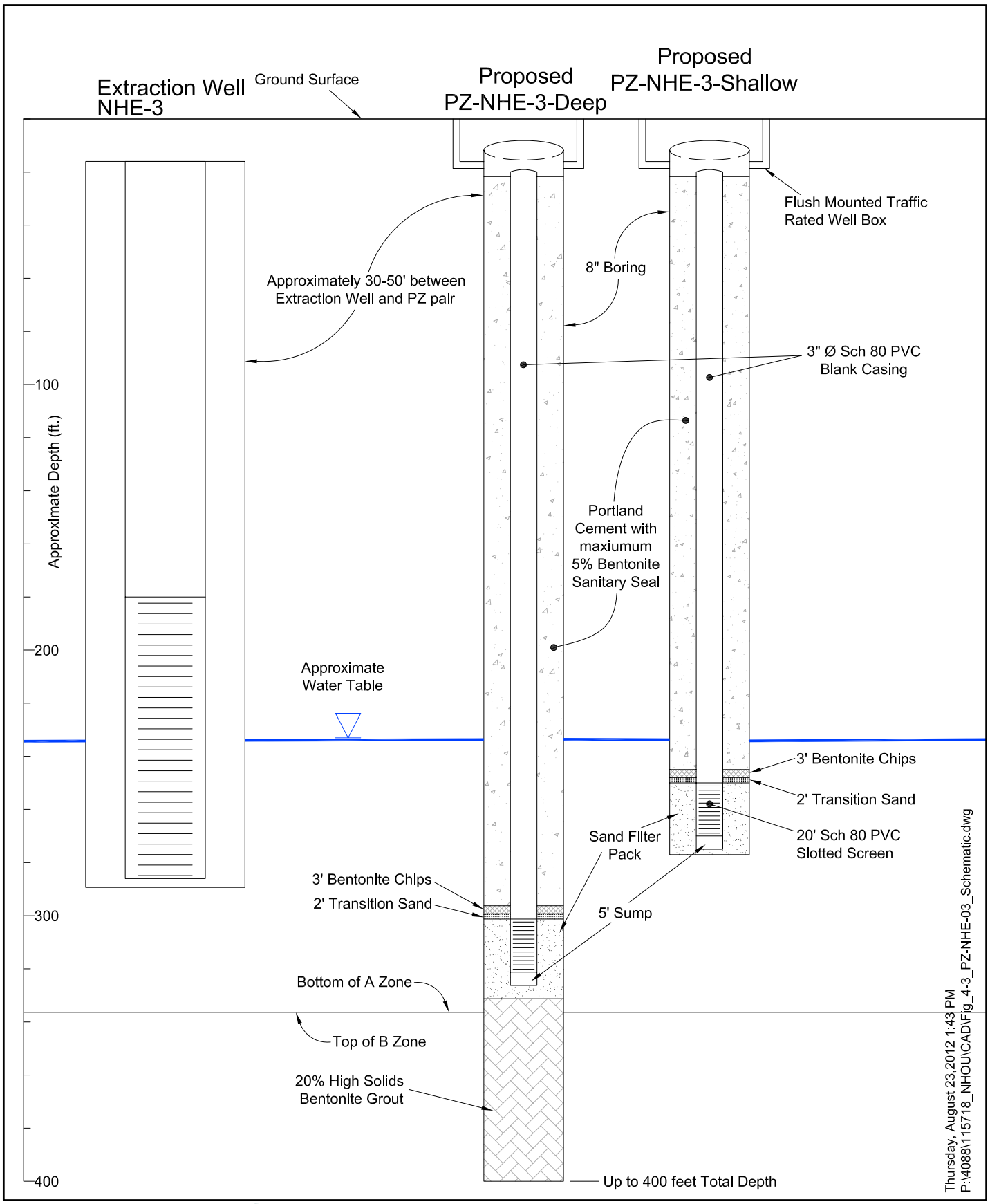

Proposed PZ-NHE-3 Schematic Diagram

Phase 1 Pre-Design Investigation Work Plan
North Hollywood Operable Unit
North Hollywood, California

FIGURE
3-3

DRAWN	JOB NUMBER	CHECKED	CHECKED DATE	APPROVED	APPROVED DATE
PCB	4088115718	DH	4/2012	MDT	4/2012

EXPLANATION

- Proposed Piezometer Couplet and Aquifer Test Location (Phase 1)
- NHOU Extraction Well
- Monitoring Wells
- Approximate Boundary San Fernando Valley Investigation Area 1

DRAWN: TJH	PROJECT NO: 4088115718	amec	Phase I Pre-Design Investigation Work Plan North Hollywood Operable Unit Second Interim Remedy Groundwater Remediation System Design
REV:	SCALE: AS SHOWN		
CHECKED:	APPROVED:		
DATE: 4/2012	DATE: 4/2012		

Proposed PZ-NHE-5
Area Detail Map

FIGURE
3-4

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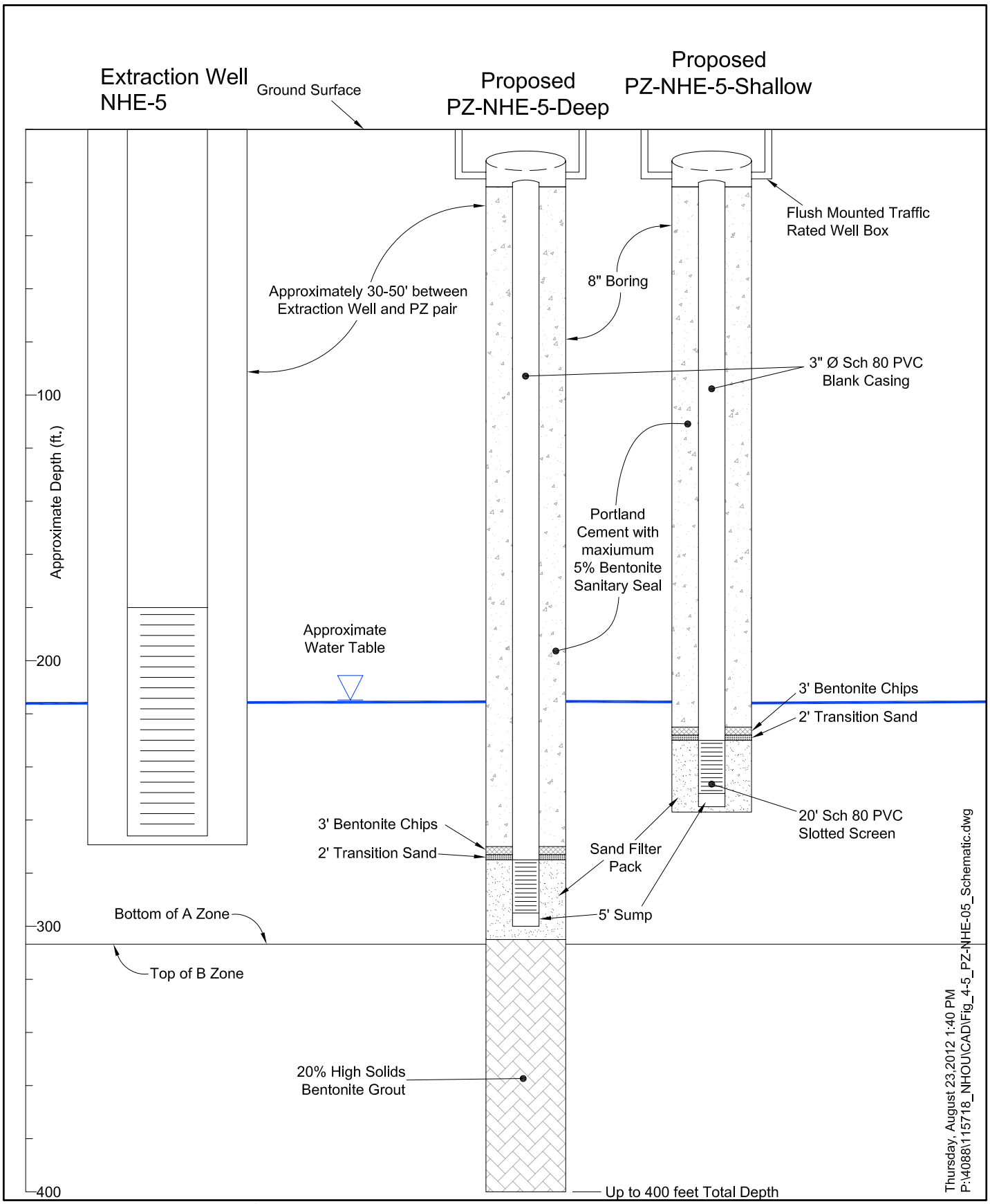

Proposed PZ-NHE-5 Schematic Diagram

FIGURE

Phase 1 Pre-Design Investigation Work Plan
North Hollywood Operable Unit
North Hollywood, California

3-5

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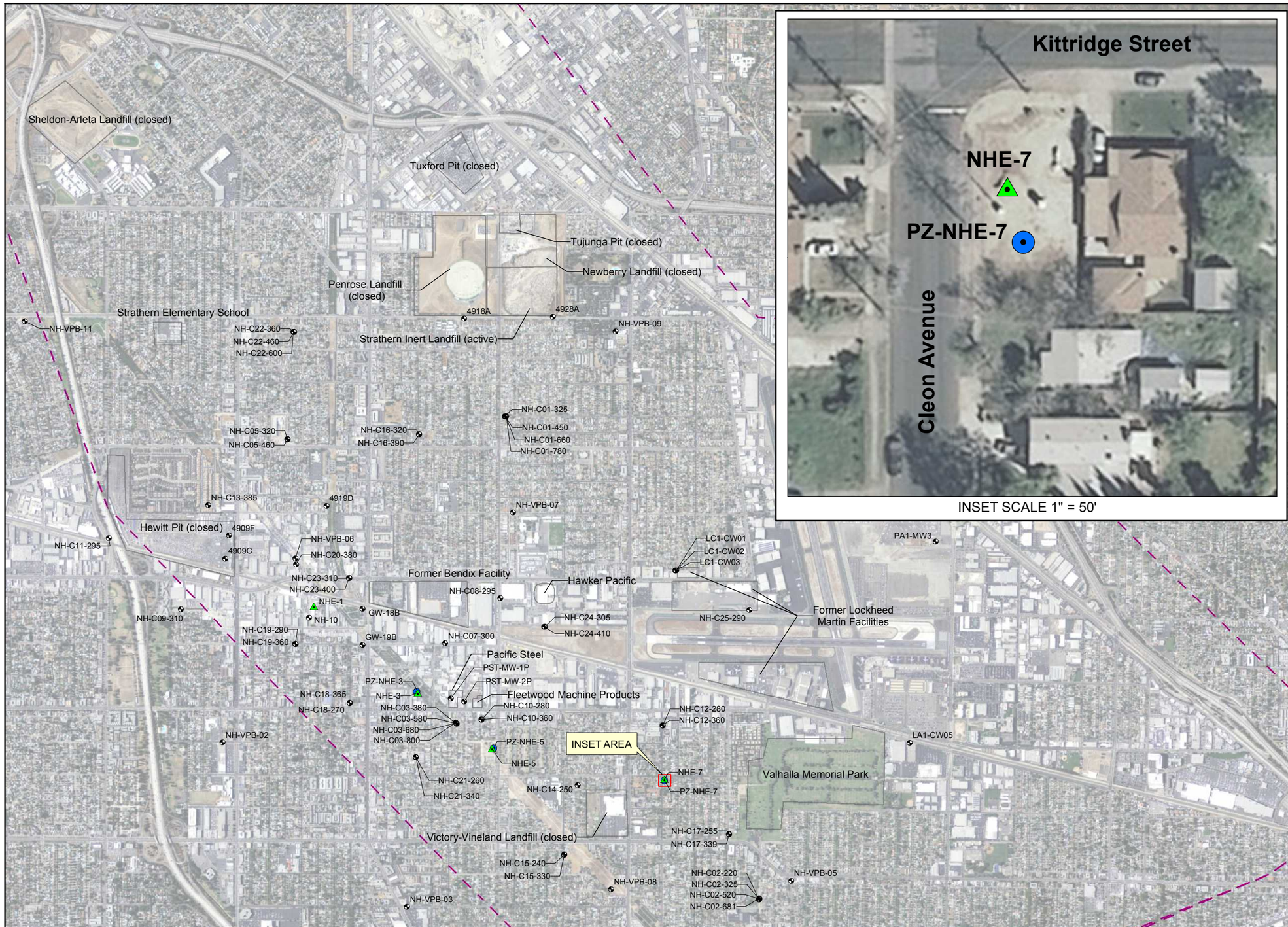

EXPLANATION

- Proposed Piezometer Couplet and Aquifer Test Location (Phase 1)
- NHOU Extraction Well
- Monitoring Wells
- Approximate Boundary San Fernando Valley Investigation Area 1

DRAWN: TJH	PROJECT NO: 4088115718		amec	Phase I Pre-Design Investigation Work Plan North Hollywood Operable Unit Second Interim Remedy Groundwater Remediation System Design	Proposed PZ-NHE-7 Area Detail Map
REV:	SCALE: AS SHOWN				FIGURE
CHECKED:	APPROVED:				3-6
DATE: 4/2012	DATE: 4/2012				

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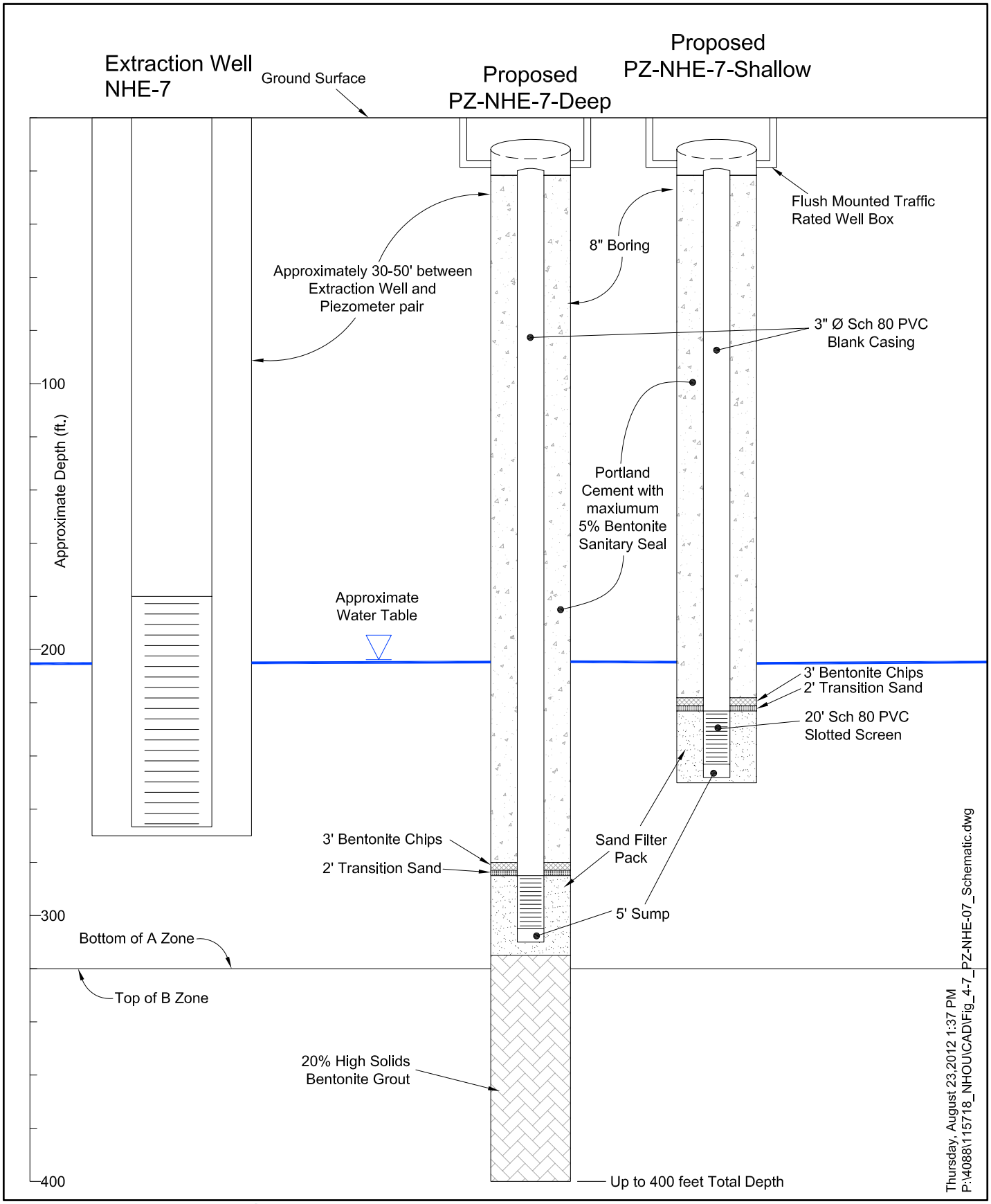

Proposed PZ-NHE-7 Schematic Diagram

Phase 1 Pre-Design Investigation Work Plan
North Hollywood Operable Unit
North Hollywood, California

FIGURE
3-7

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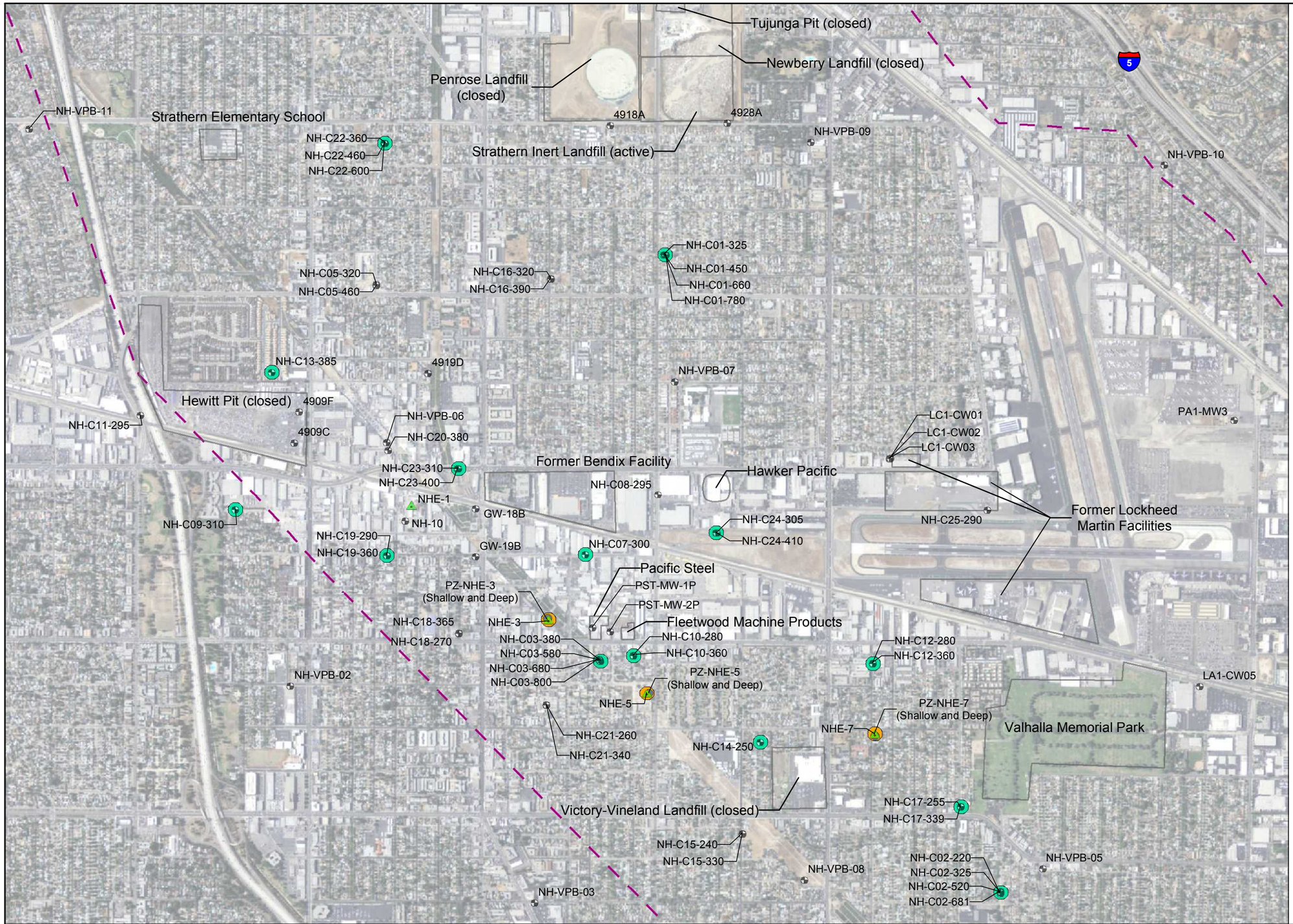
PCB	4088115718	DH	4/2012	MDT	4/2012



EXPLANATION

- Proposed Piezometer Couplet (Phase 1)
- NHOU Extraction Well
- Monitoring Wells
- Slug Test Location
- Aquifer Test Location
- Approximate Boundary San Fernando Valley Investigation Area 1

DRAWN: TJH	PROJECT NO: 4088115718	amec	Phase I Pre-Design Investigation Work Plan North Hollywood Operable Unit Second Interim Remedy Groundwater Remediation System Design
REV:	SCALE: AS SHOWN		Aquifer Test Locations
CHECKED:	APPROVED:		FIGURE 3-8
DATE: 4/2012	DATE: 4/2012		

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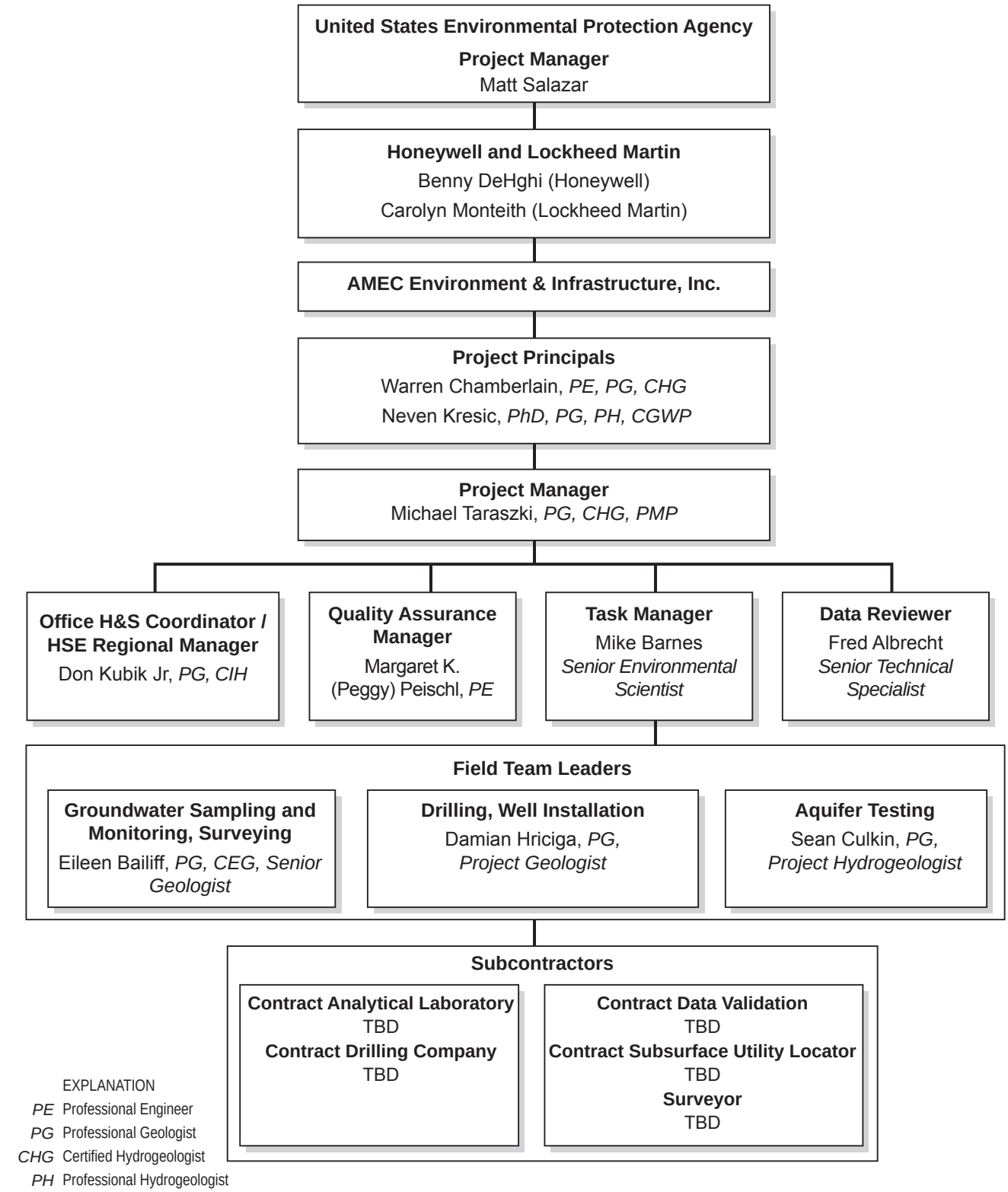

EXPLANATION

PE	Professional Engineer
PG	Professional Geologist
CHG	Certified Hydrogeologist
PH	Professional Hydrogeologist
CGWP	Certified Groundwater Professional
PMP	Professional Project Manager
CIH	Certified Industrial Hygienist

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amec

2101 Webster Street, 12th Floor
Oakland, California 94612-3066

DRAWN BY	JC
DATE	4/2012
REVIEWED BY	MSB
REVIEWED DATE	4/2012
APPROVED BY	MDT
APPROVED DATE	4/2012

PROJECT ORGANIZATIONAL CHART
PHASE I PRE-DESIGN INVESTIGATION
WORK PLAN
North Hollywood Operable Unit
Second Interim Remedy
Groundwater Remediation System Design

FIGURE
5-1

PROJECT NO.
4088115718.4100

APPENDIX A

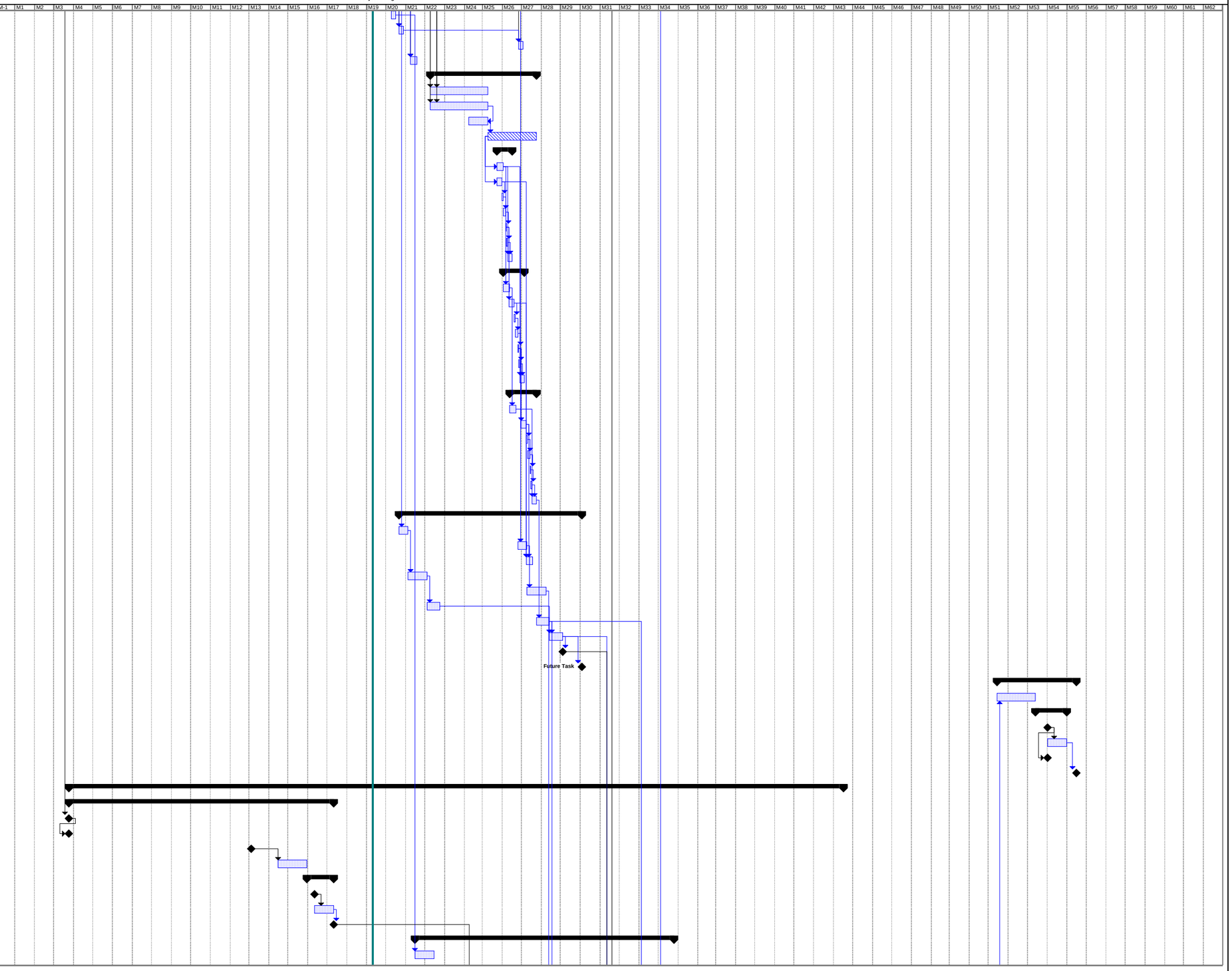
Revised Phase I Pre-Design Investigation Schedule

LOCKHEED MARTIN COPORATION AND HONEYWELL INTERNATIONAL INC.
NORTH HOLLYWOOD OPERABLE UNIT (NHOU) 2nd INTERIM REMEDY GROUNDWATER REMEDIATION SYSTEM DESIGN
Project Design Schedule

ID	Predecessors	Task Name	Duration
1		EPA APPROVAL OF SUPERVISING CONTRACTOR (NOTICE-TO-PROCEED)	0 days
2		TASK 1 - PROJECT MANAGEMENT	1264 days
3	1SS	Prepare Quality Management Plan	6 days
5	4	EPA Review	7 days
6	5	EPA Approves QMP	0 days
7		Prepare Remedial Design Work Plan, HASP, and RD QAPP	174 days
8		Review Process	174 days
14	13	Submit Draft RD Work Plan to EPA	0 days
15	14	EPA Review (30 days)	130 days
16	15	Submit Final RD Work Plan to EPA	0 days
17	16	EPA Review of Final RD Work Plan	15 days
18		Prepare RD QAPP per RD Work Plan	175 days
19	16FS+180 days	Draft RD QAPP	45 days
20		Review Process	100 days
24	23	Submit Draft RD QAPP to EPA	0 days
25	24	EPA Review (30 days)	88 days
26	25FS+30 days	Submit Final RD QAPP	0 days
27		Prepare Monthly Progress Reports and Annual Performance Evaluations	1107 days
70		Conduct Weekly and Monthly Teleconference Calls with LMC/HW Team and USEPA	979 days
213		TASK 2 - DATA AND DOCUMENT MANAGEMENT	270 days
214	6	Data Management	270 days
215		Geospatial Data Dissemination and Aggregation	180 days
216	6	e-Document Solution (SharePoint)	90 days
217		TASK 3 - GROUNDWATER CHARACTERIZATION	1586 days
218		Data Gap Analysis Report	306 days
219	14	Draft Data Gap Analysis Memorandum	170 days
220		Review Process	195 days
230	229FS+21 days	Submit Final Data Gap Analysis and revised project schedule to EPA	0 days
231		Groundwater Management Plan	996 days
232	230	EPA, LADWP, and Watermaster deliberations	270 days
233	232	Agreement to proceed among USEPA, LADWP, and ULARA Watermaster	0 days
234	233FS+180 days	USEPA, LADWP produce draft GMP	0 days
235	234	AMEC review of draft GMP	30 days
236	235	Submit comments on draft GMMP to EPA and LADWP	0 days
237	342FS+90 days	Collaboration Meeting #2 with USEPA, LADWP, ULARA W/M, CDPH, and RWQCB	0 days
238	237FS+180 days	Collaboration Meeting #3 with USEPA, LADWP, ULARA W/M, CDPH, and RWQCB	0 days
239	238FS+180 days	Collaboration Meeting #4 with USEPA, LADWP, CDPH, ULARA W/M, and RWQCB	0 days
240		Pre-Design Investigation - Phase 1	508 days
241		Sampling and Analysis Plan (SAP) and Work Plan	200 days
242	229	Develop Draft SAP (including QAPP) and HASP	28 days
243		Review Process	142 days
247	246	Submit Draft SAP + HASP to EPA	0 days
248	247	EPA Review (45 days)	130 days
249	248	EPA Approves SAP + HASP	0 days
250	249FS+30 days	Submit Final SAP + HASP	0 days
251	230	Develop Phase 1 Work Plan (including FSP)	14 days
252		Review Process	131 days
256	55,230FS+30 days	Submit Phase 1 Work Plan to EPA	0 days
257	256	EPA Review (45 days)	119 days
258	257	EPA Approves Phase 1 Work Plan	0 days
259	258FS+30 days	Submit Final Phase 1 Work Plan	0 days
260		Groundwater Elevation Measurements	338 days
261	258	Access agreements with well owners	60 days
262	261,258	First Quarterly Event	2 days
263	262FS+90 days	Second Quarterly Event	2 days
264	263FS+90 days	Third Quarterly Event	2 days
265	264FS+90 days	Fourth Quarterly Event	2 days
266		Depth-Discrete Groundwater Sampling	266 days
267	258	Access agreement with well owners	60 days
268	261,267	First Semi-annual event (A-Zone and B-Zone monitoring wells)	12 days
269	258,264	Second Semi-annual event (A-Zone and B-Zone monitoring wells)	12 days
270	61FS+10 days,258	Depth-discrete Sampling at and near NHE-1	5 days
271	61FS+15 days,258	Vertical Groundwater Quality Profiles	5 days

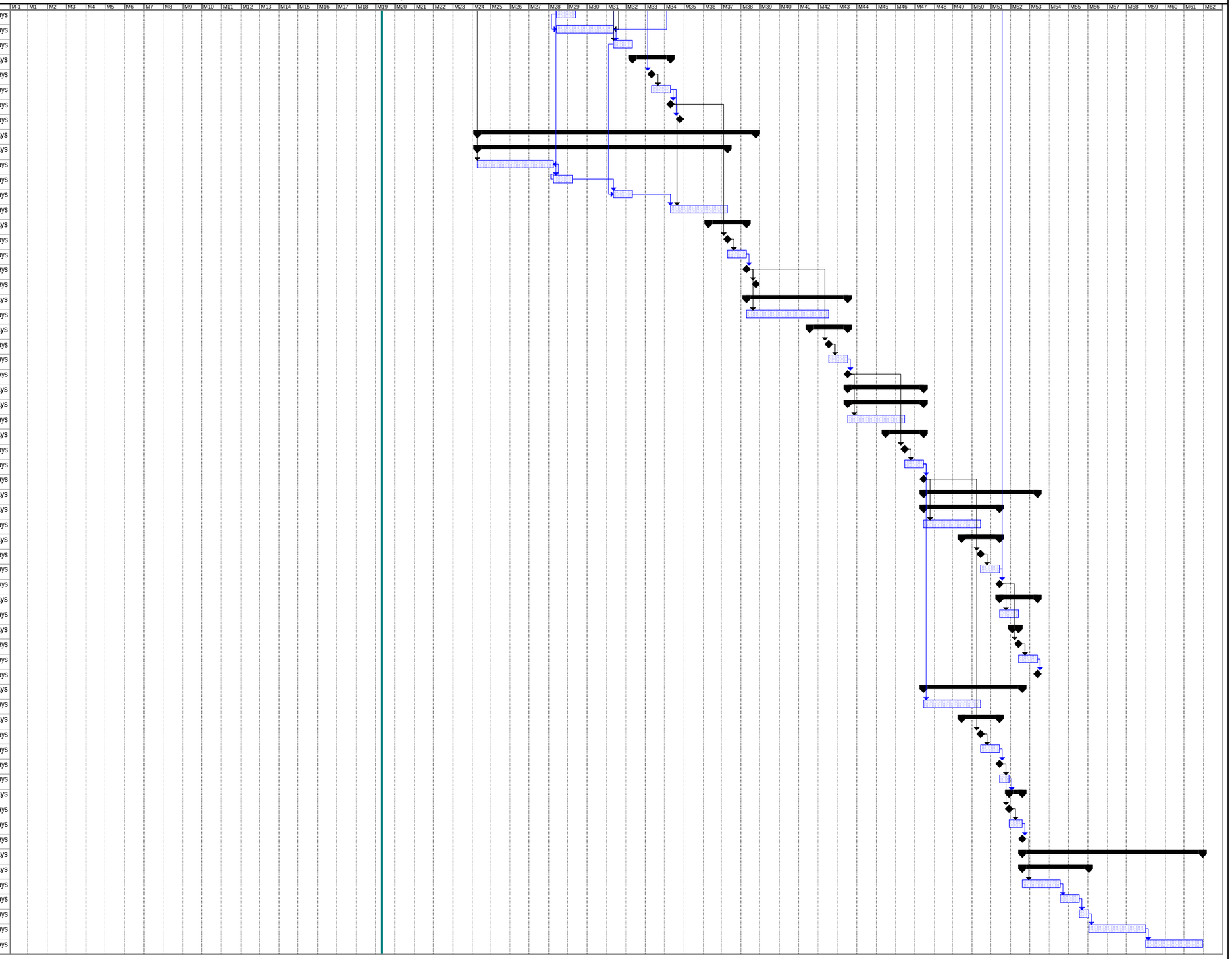
LOCKHEED MARTIN COPORATION AND HONEYWELL INTERNATIONAL INC.
NORTH HOLLYWOOD OPERABLE UNIT (NHOU) 2nd INTERIM REMEDY GROUNDWATER REMEDIATION SYSTEM DESIGN
Project Design Schedule

ID	Predecessors	Task Name	Duration
272	261,258	Surveying	7 days
273	58,262FS+10 days	First semiannual spinner logging event	7 days
274	8,273FS+180 days	Second semiannual spinner logging event	7 days
275	61FS+30 days,258	Slug Testing	10 days
276		NHE Piezometers/Aquifer Tests	166 days
277	258,233	LADPH well instllation permits (develop applications and obtain permits)	90 days
278	258,233	Access Agreements and LADWP Coordination (drilling, rehabilitation, and aquifer testing)	90 days
279	278FF	Communication planning with EPA	30 days
280	279	Execute Communication Plan	76 days
281		NHE-3 Location	24 days
282	280SS+14 days	Inspect/Rehabilitate NHE-3	10 days
283	280SS+14 days	Drill deep borehole/collect soil samples	8 days
284	283	Construct deep piezometer	2 days
285	284	Drill shallow borehole	4 days
286	285	Construct shallow piezometer	1 day
287	286	Develop shallow and deep piezometers	2 days
288	287,282	Perform NHE-3 Aquifer Test	7 days
289		NHE-5 Location	33 days
290	282	Inspect/Rehabilitate NHE-5	10 days
291	286FS+4 days	Drill deep borehole/collect soil samples	8 days
292	291	Construct deep piezometer	2 days
293	292	Drill shallow borehole	4 days
294	293	Construct shallow piezometer	1 day
295	294	Develop shallow and deep piezometers	2 days
296	295,282	Perform NHE-5 Aquifer Test (temporary pump)	7 days
297		NHE-7 Location	42 days
298	290	Inspect/Rehabilitate NHE-7	10 days
299	294FS+4 days	Drill deep borehole/collect soil samples	8 days
300	299	Construct deep piezometer	2 days
301	300	Drill shallow borehole	4 days
302	301	Construct shallow piezometer	1 day
303	302	Develop shallow and deep piezometers	2 days
304	303,298	Perform NHE-7 Aquifer Test	7 days
305		Pre-Design Investigation (Phase 1) Findings Memorandum	286 days
306	268	Laboratory Analysis (1st Semiannual Groundwater Samples)	14 days
307	269	Laboratory Analysis (2nd Semiannual Groundwater Samples	14 days
308	299,283,291	Laboratory Analysis (Soil Samples)	10 days
309	306	Third Party Analytical Data Validation (1st Semiannual Groundwater Samples)	30 days
310	307	Third Party Analytical Data Validation (2nd Semiannual Groundwater Samples)	30 days
311	309	Analytical Data Evaluation (1st Semiannual Groundwater Samples)	20 days
312	304	Geologic/Hydraulic Data Evaluation	20 days
313	312,311	Summarize Phase 1 Findings (Groundwater Modeling Memorandum Appendix)	21 days
314	313	Assess need for Phase 2	0 days
315	313FS+30 days	Meet with EPA to discuss Phase 1 Pre-Design Investigation and assessment findings	0 days
316		Groundwater Monitoring Plan and SAP	124 days
317	393	Final Design Update of Groundwater Monitoring Plan	60 days
318		Review Process	49 days
322	321	Submit Draft Groundwater Monitoring Plan and SAP to EPA	0 days
323	322	EPA Review	30 days
324	322	EPA Approves Groundwater Monitoring Plan and SAP	0 days
325	323FS+15 days	Submit Final Groundwater Monitoring Plan and SAP	0 days
326		TASK 4 - PRELIMINARY DESIGN	1211 days
327		Building Conditions Assessment	414 days
328	6FS+32 days	NHOU CTF Site Visit	0 days
329	328	Develop Draft Building Conditions Assessment Report	180 days
330		Submit LADWP Data Request	0 days
331	330FS+42 days	Finalize Draft Building Conditions Assessment Report	45 days
332		Review Process	42 days
336	335	Submit Draft Building Conditions Assessment to EPA	0 days
337	336	EPA Review	30 days
338	337	EPA Approves Building Conditions Assessment	0 days
339		Predesign Groundwater Modeling Memorandum (no Phase 2)	405 days
340	272FS+30 days	Refine SFB-FFS Model Structure	30 days



LOCKHEED MARTIN COPORATION AND HONEYWELL INTERNATIONAL INC.
NORTH HOLLYWOOD OPERABLE UNIT (NHOU) 2nd INTERIM REMEDY GROUNDWATER REMEDIATION SYSTEM DESIGN
Project Design Schedule

ID	Predecessors	Task Name	Duration
341	312	Refine Hydraulic Properties with AQT Findings	30 days
342	341SS,234FF	Site Model Simulations	90 days
343	13FS+30 days,314	Develop Administrative Draft Groundwater Modeling Memorandum	30 days
344		Review Process	60 days
348	47,312FS+60 days	Submit Draft Groundwater Modeling Memorandum to EPA	0 days
349	348	EPA Review	30 days
350	349	EPA Approves Pre-Design Groundwater Modeling Memorandum	0 days
351	349FS+15 days	Submit Final Groundwater Modeling Memorandum	0 days
352		Treatment Options Memorandum	440 days
353		Internal development	395 days
354	338,355SF	Evaluate potential treatment technologies	120 days
355	310	Analytical Data Evaluation (2nd Semiannual Groundwater Samples)	30 days
356	343SS,355	Evaluate potential NHOU extraction well scenarios (rates and concentraction ranges)	30 days
357	356,350	Develop draft Treatment Options Memorandum	90 days
358		Review Process	60 days
362	350FS+90 days	Submit Draft Treatment Options Memorandum to EPA	0 days
363	362	EPA Review	30 days
364	363	EPA Approves Treatment Option Memorandum	0 days
365	364FS+15 days	Submit Final Treatment Options Memorandum	0 days
366		Preliminary Design Report (30%)	160 days
367	364	Internal Development	130 days
368		Review Process	60 days
372	364FS+130 days	Submit Draft Preliminary Design Report to EPA	0 days
373	372	EPA Review	30 days
374	373	EPA Approves Preliminary Design Report	0 days
375		TASK 5 - INTERMEDIATE DESIGN (60%)	120 days
376		Intermediate Design Package	120 days
377	374	Internal Development	90 days
378		Review Process	60 days
382	374FS+90 days	Submit Intermediate Design Report to EPA	0 days
383	382	EPA Review	30 days
384	383	EPA Approves Intermediate Design Report	0 days
385		TASK 6 - PRE-FINAL AND FINAL DESIGN	180 days
386		Pre-Final Design Package (90%)	120 days
387	384	Internal Development	90 days
388		Review Process	60 days
392	384FS+90 days	Submit Pre-Final Design Report to EPA	0 days
393	392	EPA Review	30 days
394	393	EPA Approves Pre-Final Design Report	0 days
395		Final Design Package (100%)	60 days
396	394	Internal Development	30 days
397		Review Process	10 days
401	394FS+30 days	Submit Final Design Report to EPA	0 days
402	401	EPA Review	30 days
403	402	EPA Approves Final Design Report	0 days
404		Pre-Achievement O&M Plans	156 days
405	383	Draft Pre-Achievement O&M Plan	90 days
406		Review Process	60 days
410	384FS+90 days	Submit Draft Pre-Achievement O&M Plan to EPA	0 days
411	410	EPA Review	30 days
412	411	EPA Approves Draft Pre-Achievement O&M Plan	0 days
413	412	Develop Final Pre-Achievement O&M Plan	15 days
414	413	Review Process	21 days
418	412FS+15 days	Submit Final Pre-Achievement O&M Plan to EPA	0 days
419	418	EPA Review	21 days
420	419	EPA Approves Final Pre-Achievement O&M Plan	0 days
421		TASK 7 - ENGINEERING SERVICES DURING BIDDING AND CONSTRUCTION	285 days
422		Construction Management Plan	105 days
423	420	Draft	60 days
424	423	Review	30 days
425	424	Final	15 days
426	425	Office-based Services During Construction	90 days
427	426	Assist LMC/HI and Contractor with Start-up and Testing	90 days



APPENDIX B

Evaluation of Potential Impacts to NHOU Treatment Plant Chromium and 1,4-Dioxane Influent Concentrations During Pumping Tests of NHE-3, NHE-5, and NHE-7

APPENDIX B

EVALUATION OF POTENTIAL IMPACTS TO NHOU TREATMENT PLANT FROM CHROMIUM AND 1,4-DIOXANE INFLUENT CONCENTRATIONS DURING PUMPING TESTS OF NHE-3, NHE-5, AND NHE-7

AMEC has prepared calculations to illustrate potential impacts on influent concentrations of total chromium and 1,4-dioxane at the NHOU treatment facility due to variations in flow rates during proposed hydraulic testing of system extraction wells NHE-3, NHE-5, and NHE-7. The pumping tests are scheduled to include initial step tests followed by an up-to-72-hour constant rate pumping test. The test procedure is also expected to include a recovery period of likely no more than 24 hours.

Data used in this analysis included monthly individual and system-total flow rates for Water Year 2010-2011 as tabulated in the ULARA Watermaster's Annual (2012a) report, and flow rates for October 2011 through March 2012 as provided in the 2011-2016 Annual Pumping and Spreading Ground report (ULARA Watermaster, 2012b). Recent analytical data for active NHOU extraction wells were obtained from the ULARA Watermaster's Annual Groundwater Pumping and Spreading Ground Reports (ULARA Watermaster, 2011, 2012b). Our evaluation described requires that analytical data from NHE-5 be estimated because that extraction well has been inactive since 2008. In order to reasonably estimate influent groundwater quality data during the proposed aquifer testing activities (including pumping from NHE-5), the following assumptions and methods were applied:

- Median values of the monthly rates and concentrations were identified and used as basis of representative flow rates and concentrations.
- Only times when the wells were in operation were the flow rates averaged or medians determined. The entire system was shut off in March 2011 and NHE-4 was shut off from October 2010 through March 2011.
- Similarly, means and medians were determined for concentrations based only on the set of data that included actual sample results (some parameters were missing for some months). Minimum and maximum values over the water year were also used in the analysis.
- It has been assumed that concentrations of VOCs that may be present at NHE-5 will not significantly change the total VOC concentrations either current or in the past when the system has shown more than adequate capability and capacity to deal with greater flows and concentrations than at present. Hence no analysis was performed for typical VOCs, and only includes total or hexavalent chromium and 1,4-dioxane.
- To provide a flexible approach and to conservatively span a likely range of applied pumping rates during testing, three pumping rates have been assumed for calculating potential effects of pumping tests on NHOU treatment plant influent concentrations, specifically for total chromium and 1,4-dioxane. These are: 50, 100, and 150 gpm for NHE-3and NHE-5; and 150, 300, and 450 gpm for NHE-7. In addition, there will be a recovery period (rate = 0 gpm) for each test. These are estimated rates, and are based on an apparent increase in hydraulic conductivity in this sequence of wells and the respective typical flow rates that each well achieves. Actual rates applied in the field may

vary from these, but should be in the range given and certainly less than the maximum used in these calculations.

- A second approach was taken in which a flow weighted average formula was developed to provide an estimate of the concentrations on chromium and 1,4-dioxane that could be allowable at NHE-5 and still meet the performance criterion of 5 µg/L for hexavalent chromium and the current notification limit of 1 µg/L[1] for 1,4-dioxane, as a function of the pumping rate at NHE-5. A conservative range of flow rates was assumed, using the estimated total flow for the other wells (based on their median flow rates) and their computed flow weighted total chromium and 1,4-dioxane concentrations. Total chromium was conservatively assumed to be entirely hexavalent chromium.
- Methods used to estimate the expected influent concentrations include:
    1. Calculating the statistical measures, e.g., median flow rates and concentrations, maxima and minima (Table B-1)
    2. Using those data to calculate the flow-weighted estimates of concentrations that would be expected based on the current represented conditions and the flow rate conditions expected to be applied during hydraulic testing (Table B-2)
    3. A secondary approach was also considered by estimating the allowable concentrations at NHE-5 during testing that would still meet the performance criteria at the treatment plant (Table B-3).

As summarized in Table B-1 and discussed in the Final Data Gap Analysis (AMEC, March 13, 2012), total chromium and 1,4-dioxane concentrations generally decrease in a southeasterly direction and, as such, the median concentrations at NHE-4 are used to represent the likely current conditions at NHE-5. Assuming that groundwater conditions at NHE-4 reasonably represent groundwater quality conditions at NHE-5, median total chromium and 1,4-dioxane concentrations (4.1 and 1.13 µg/L, respectively) at NHE-4 are used to represent NHE-5 in the first approach (Table B-2). Results suggest that expected concentrations of total chromium at the treatment plant will likely be less than 4 µg/L and that of 1,4-dioxane will be approximately 1 µg/L or less during testing, and will not result in significant changes in treatment plant influent concentrations.

A second approach was taken to account for the possibility that groundwater quality conditions at NHE-4 are not representative of conditions at NHE-5 and to instead calculate the maximum likely concentrations of these COCs at NHE-5 that would still meet drinking water quality requirements in the NHOU Extraction and Treatment System effluent. As summarized in Table B-3. Results indicate that the concentrations of both hexavalent chromium and 1,4-dioxane could both exceed 20 µg/L without exceeding drinking water limits, assuming that NHE-5 is pumped at the expected rates and other NHOU extraction rates remain in operation during the test. As summarized on Table B-1, neither COC has been detected at these concentrations at nearby extraction wells and are thus unlikely to be encountered at NHE-5.

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[1] Note that ARARs were frozen at the time the ROD was signed, but off-site requirements, including requirements applicable to treated water delivered to the drinking water supply, must be met in order to comply with the Second Interim Remedy's selected end use regardless of whether those requirements change over time. As such, the current treatment requirement for 1,4-dioxane is 1 µg/L even though the performance standard remains at 3 µg/L.

We conclude that pumping NHE-5 at the proposed rates and duration will pose no significant effect on the NHOU Extraction and Treatment System regarding drinking water quality limitations of hexavalent chromium or 1,4-dioxane. However, AMEC will coordinate with LADWP to determine if and when additional samples may be collected from NHE-5 prior to initiating the proposed aquifer test.

APPENDIX B TABLES

Summary of Estimated Influent Concentrations
of Total Chromium and 1,4-Dioxane to the
NHOU Treatment Facility

TABLE B-1

Representative Pre-Testing Conditions

LADWP Well ID	Calculated Median Flow[1,2,3] (gpm)	Total Chromium µg/L			1,4-Dioxane µg/L		
		Minimum	Maximum	Median	Minimum	Maximum	Median
NHE-3	59.1	6.2	19.4	14.2	0	1.72	1.11
NHE-4	83.8	3.8	5	4.1	0	1.9	1.13
NHE-5[4]				4.1			1.13
NHE-6	252.2	1.8	3.7	3.3	0	0	0
NHE-7	251.5	0	1.5	1.3	0	1.66	1.37
NHE-8	272.1	1	1.3	1.14	0	1.3	1.05
Total	918.7			2.89			0.86

TABLE B-2

FIRST APPROACH

Estimated Influent Concentration at Treatment Facility During Aquifer Testing

LADWP Well ID	Pumping Rate (gpm)	Total Chromium µg/L	1,4-Dioxane µg/L
NHE-3	0	2.11	0.84
	100	3.37	0.87
	150	3.91	0.88
NHE-5[4,5,6]	50	2.95	0.87
	100	3.01	0.89
	150	3.06	0.90
NHE-7	0	3.49	0.67
	150	3.08	0.80
	300	2.81	0.89
	450	2.60	0.95

TABLE B-3
SECOND APPROACH
Allowable Concentration at NHE-5 During Testing and Still Meet Performance Criteria of
5 µg/L for Hexavalent Chromium and 1 µg/L for 1,4-Dioxane

LADWP Well ID	Pumping Rate (gpm)	Allowable Hexavalent Chromium (µg/L)	Allowable 1,4-Dioxane (µg/L)
NHE-5	50	43.8	3.57
	100	24.4	2.29
	150	17.9	1.86

Notes:

gpm = gallons per minute

µg/L = micrograms per liter

1. Median flow rate for NHE-4 includes only duration when on - i.e., April 2011 - March 2012.
2. Median rates for all other wells do not include March 2011 when the entire system was down.
3. Wells NHE-1 and NHE-5 are currently inactive; well NHE-2 is currently pumped directly to the sewer system.
4. Concentrations of total chromium and 1,4-dioxane anticipated at NHE-5 during testing are assumed to be similar or less than at NHE-4 .
5. Median concentration of 1,4-dioxane anticipated at NHE-5 during testing is assumed to be the maximum median concentration.
6. Assumptions regarding NHE-5 will be confirmed by sampling prior to hydraulic testing.

APPENDIX C

AMEC Responses to USEPA Comments to the Draft Work Plan,
Phase I Pre-Design Investigation (dated August 10, 2012)

10 September 2012

Mr. Matt Salazar
U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, CA 94105

Re: AMEC Responses to EPA Comments (dated August 10, 2012)
"Draft Work Plan, Phase I Pre-Design Investigation, North Hollywood Operable Unit, Second Interim Remedy" and the *"Remedial Design Quality Assurance Project Plan, North Hollywood Operable Unit, Second Interim Remedy Groundwater Remediation System Design"*

Dear Mr. Salazar:

This letter has been prepared to respond to final comments that USEPA provided to the following documents on August 10, 2012:

- *Draft Work Plan, Phase I Pre-Design Investigation, North Hollywood Operable Unit Second Interim Remedy, Groundwater Remediation System Design* (AMEC, April 13, 2012)
- *Draft Sampling and Analysis Plan, Phase I Pre-Design Investigation, North Hollywood Operable Unit Second Interim Remedy, Groundwater Remediation System Design* (AMEC, April 13, 2012)
- *Health and Safety Plan, North Hollywood Operable Unit Second Interim Remedy, Groundwater Remediation System Design* (AMEC, April 13, 2012)
- *Remedial Design Quality Assurance Project Plan, North Hollywood Operable Unit Second Interim Remedy, Groundwater Remediation System Design* (AMEC, May 14, 2012).

A response follows each comment provided by the USEPA and each document has been revised accordingly.

It is imperative to recognize that development of the Groundwater Management Plan, as a required Institutional Control in the ROD, remains a critical element of the Second Interim Remedy. All Phase I Pre-Design Investigation activities have been based on the expectation that the USEPA and LADWP will develop a Groundwater Management Plan that will not only be a notification of planned pumping, but also will provide a "decision-making process to address any potential conflicts between the LADWP's pumping plans and the performance of the remedy". The Groundwater Management Plan was included in the ROD as an Institutional Control to ensure that production well pumping does not negatively impact the performance of the Second Interim Remedy. The current schedule reflects the need for an agreement to proceed on the Groundwater Management Plan prior to the installation of the proposed piezometers under the Phase 1 Pre-Design Investigation and the preparation of the Groundwater Modeling Memo.

AMEC Environment & Infrastructure, Inc.
1330 Broadway, Suite 1702
Oakland, California 94612
Tel (510) 451-1001
Fax (510) 451-3465
amec.com

Should you have questions regarding our responses to EPA comments, please feel free to call me at (510) 663-3996 to discuss.

Sincerely,
AMEC Engineering & Infrastructure, Inc.

Michael Taraszki, PG, CHG, PMP
Project Manager

Robert Hartwell, PE
Engineering Manager

w/permission

Attachments:

Attachment A — USEPA Comments on the *Draft Work Plan, Phase I Pre-Design Investigation, North Hollywood Operable Unit Second Interim Remedy, Groundwater Remediation System Design* and the *Remedial Design Quality Assurance Project Plan, North Hollywood Operable Unit Second Interim Remedy, Groundwater Remediation System Design (August 10, 2012)*

WORK PLAN

1. **General comment:** The Work Plan is well written and indicates a comprehensive understanding of both the available site data and the data gaps in the NHOU. Conduct of the work proposed in the Work Plan (and SAP) will improve the conceptual site model for the NHOU and provide important hydrogeologic data required for RD of the Second Interim Remedy.

As stated in Section 2.4 of the Work Plan, "The overall objective of the Phase I Pre-Design Investigation is to fill critical data gaps identified as necessary for the Second Interim Remedy design to meet RAOs…" And Section 4 of the Work Plan states that a second phase of investigation would only be performed "if it is determined that insufficient data exist (at that time) to fill critical data gaps associated with the Second Interim Remedy and comply with RAOs and meet CDPH 97-005 requirements." However, actions that might fill some of the "critical data gaps" identified in the Final Data Gap Analysis report (pages 5-14 and 5-15) prepared by AMEC (dated March 14, 2012) are not proposed in this Work Plan. Specifically, critical data gaps 4, 5, 6, 8, and 9 listed on pages 5-14 and 5-15 of the Final Data Gap Analysis report seem to be unaddressed, or only partly addressed, by the activities listed in the Work Plan. It seems that either some of the data gaps identified in the Final Data Gap Analysis report are no longer deemed critical, or will simply not be addressed by the proposed Phase I investigation and will be addressed in some other manner. Please revise the Work Plan to provide more clarity regarding which of the critical data gaps are addressed by each proposed field activity, and which critical data gaps are not addressed in the proposed Phase I investigation (together with an explanation of why not, and how they will be addressed in the future). Our comments and/or recommendations for filling these data gaps are summarized below, but could be modified depending on additional information provided by the respondents:

- **Critical Data Gap 4** ("existing monitoring well network insufficient to characterize vadose zone and groundwater conditions beneath known and potential source areas"): The Work Plan should show critical areas for further investigation on a map, or at least describe how the need for further characterization in the vicinity of the "known and potential source areas" would be evaluated and conducted during a Phase II data gaps investigation. The area southwest of NHOU extraction wells NHE-2 and NHE-3, where high concentrations of VOCs and hexavalent chromium have been detected, but are poorly delineated, seems to be of primary concern. It is not clear how the data collection activities described in the Work Plan would fill this data gap or aid in further delineating contaminant concentrations in this particular area. We recommend that at least two new monitoring wells be installed in this area as part of the Phase I investigation.

  AMEC Response: As shown on Figure 6-1 in the Final Data Gap Analysis (AMEC, March, 14, 2012), two groundwater monitoring wells have been considered for installation in this area. However, as described in that document and in the Phase I Pre-Design Investigation Work Plan, additional monitoring wells (whether at the locations illustrated on Figure 6-1 or elsewhere) will be considered following the evaluation of data collected as part of Phase I sampling and testing. Depth-discrete analytical data and accurate groundwater elevations from existing monitoring wells are anticipated to be particularly useful in

supporting that assessment. Should it be determined that additional are needed, the number (if any) and location(s) of additional monitoring wells will be determined and installed and sampled as part of the Phase II Pre-Design Investigation.

- **Critical Data Gap 5** ("objective projections of pumping and recharge volumes, including beyond year 2015, are not yet available"): The Work Plan should state that addressing this data gap does not require field activity; rather, discussions are ongoing (presumably) with LADWP and the ULARA Watermaster to develop improved and updated projections of future pumping and recharge volumes.

  AMEC Response: Comment acknowledged. The ULARA Watermaster has affirmed that the projections included in his annual Pumping and Spreading reports have been provided by associated municipalities and are presumed to be accurate. AMEC anticipates that forthcoming discussions between the EPA and various stakeholders will clarify how these projections correspond with the 2007 Stipulated Agreement. Table 2-1 has been incorporated into the Final Work Plan to provide further clarification.

- **Critical Data Gap 6** ("performance monitoring wells have not been installed and monitored"): It is unclear whether the proposed piezometers in the Work Plan constitute some or all of the needed performance monitoring wells that comprise this critical data gap. The Work Plan should clarify whether the planned piezometers are expected to address this data gap by themselves, or if installation of additional performance monitoring wells is anticipated to be required in the future, to complete the RD. If so, then the Work Plan should describe how and when decisions about the need for additional performance monitoring wells will be made.

  AMEC Response: Proposed piezometers adjacent to NHE-3, NHE-5, and NHE-7 will provide empirical data that will be used to verify, calibrate, and refine the numerical groundwater flow model as needed to support the design of the Second Interim Remedy. It is not anticipated that additional piezometers will be needed to achieve this objective.

- **Critical Data Gap 8** ("available analytical data are insufficient to evaluate A-Zone and, potentially, B-Zone groundwater quality within the future NHOU capture zone to meet CDPH 97-005 requirements"): The Work Plan should define whether this is still considered to be a critical data gap, and describe how and when it will be addressed.

  AMEC Response: This remains a critical data gap; the Work Plan has been revised to specify that additional data beyond those included in the Phase I Pre-Design Investigation will be required to address CDPH 97-005 requirements. AMEC anticipates that specific groundwater samples (within the anticipated NHOU capture zone) will be collected after the groundwater flow model has been refined and calibrated such that the Second Interim Remedy capture area can be more accurately estimated and monitoring wells within that area (from the A-Zone and B-Zone) can be identified. This sampling activity would be integrated into the current NHOU sampling program, to the extent possible, and would not comprise a Phase II Pre-Design Investigation. Table 2-1 has been incorporated into the Final Work Plan to provide further clarification.

- **Critical Data Gap 9** ("vertical conduits throughout the NHOU study area have not been sufficiently evaluated"): The Work Plan includes investigative activities to evaluate existing monitoring wells as potential vertical conduits for contaminant migration; however, it does not include plans to evaluate existing inactive production wells. Inactive production wells appear to pose a greater threat of vertical contaminant migration, due to their number, long screens, and large diameter. The Work Plan should describe how and when this part of Critical Data Gap 9 will be addressed (e.g., will it be addressed as part of a future Phase II investigation, and are there any conditions on which such an investigation would depend).

  AMEC Response: Figure 4-3 of the Final Data Gap Analysis report shows the locations of probable and suspected vertical conduits at inactive and active municipal production wells. Inspection and/or elimination of vertical conduits at inactive production wells (in particular) is the responsibility of the well owner. This responsibility has been clarified in the additional table and text of the Work Plan (see our response to Comment #5); however, we cannot speculate as to exactly when this critical data gap may be addressed. Honeywell and Lockheed Martin expect that the USEPA will participate in activities required to get well owners, including LADWP, to address the issue of closing vertical conduits at inactive and active supply wells to facilitate the success of the Second Interim Remedy. Table 2-1 has been incorporated into the Final Work Plan to provide further clarification.

2. **Table of Contents page iii, Table, Figures, and Appendix sections:** The title provided in the table of contents for Table 3-1 is different from the title actually on Table 3-1. The titles for Figure 3-1 and Appendix A are similarly inconsistent with the titles given in the table of contents. Please make the titles listed in the table of contents consistent with the actual titles of the corresponding tables, figures, and appendices.

AMEC Response: Comment acknowledged. The table of contents has been revised to correctly match table and figure titles.

3. **Section 2.2, Project Background, page 2-3, first full paragraph:** This paragraph paraphrases the key remedial action objectives (RAOs) and relates them to the specific work scope items in the Agreement and Order on Consent (AOC). However, the second sentence in this paragraph focuses exclusively on the second RAO for the NHOU Second Interim Remedy. We recommend that this sentence be modified to also accommodate the fourth remedial action objective (RAO), which is to achieve improved hydraulic containment to inhibit horizontal and vertical contaminant migration in groundwater from the more highly contaminated areas and depths of the aquifer to the less contaminated areas and depths of the aquifer, including the southeast portion of the NHOU near the Erwin and Whitnall production well fields. We assume that this RAO influences the AOC work scope items, as well as the scope of work for the activities described in the Work Plan.

AMEC Response: The second sentence has been modified to acknowledge other production well fields as suggested. Otherwise, please note that the RAOs are represented in full on the previous page and that this paragraph, including the focus on the Rinaldi-Toluca well field, stems from the Record of Decision, Section 2.8, page 2-19.

4. **Section 2.3, Previous Investigations, page 2-4, fourth paragraph:** The second-to-last sentence in this paragraph states "However, it was concluded that existing data are

insufficient to proceed with a Second Interim Remedy…" We recommend that the sentence be modified to state which entity came to that conclusion, and provide a reference to a document where that conclusion is stated (perhaps the Draft or Final Data Gap Analysis report prepared by AMEC).

AMEC Response: This was the conclusion of AMEC as part of the Final Data Gap Analysis report and has been additionally referenced in the Work Plan for clarity.

5. **Section 2.4, Phase I Pre-Design Investigation Objectives, page 2-5, bullets 1 through 6:** It is difficult to directly compare these bulleted "specific objectives" of the Phase I Pre-Design Investigation to the "critical data gaps" listed in the Final Data Gaps Analysis report (prepared by AMEC, dated March 14, 2012, see pages 5-14 and 5-15). We recommend adding a table to the Work Plan that lists the critical data gaps provided in the Final Data Gaps Analysis report and then lists the corresponding specific objectives of the Phase I Pre-Design Investigation in an adjacent column. Such a table would allow easier comparison of critical data gaps to objectives of the upcoming investigation, and possibly aid in identification of redundancies or additional needs.

AMEC Response: AMEC has included Table 2-1 in the Work Plan to explicitly reference each task item to a data gap identified in the Final Data Gap Analysis report. This table describes how each data gap will be addressed by the tasks outlined in the Phase I Pre-Design Investigation, or if and when each may be addressed in a subsequent investigation.

6. **Section 2.4, Phase I Pre-Design Investigation Objectives, page 2-5, bullet 7:** This bullet states that a specific objective of the Phase I Pre-Design Investigation is to "Assess whether sufficient data exist to proceed with designing the Second Interim Remedy…" We recommend adding a discussion in this document or the SAP (and referencing such a location within bullet 7) that describes the process and people who will make such an assessment.

AMEC Response: Text comprising this bullet has been modified to include a reference to a section within the Work Plan that will outline the AMEC's decision processes regarding determining data sufficiency for the Second Interim Remedy design.

7. **Section 3.3.2, Aquifer Testing, page 3-5, first paragraph of section:** The second sentence of this paragraph states that "…the vertical extent of capture cannot be determined because pressure responses at depths below the existing NHOU extraction wells does not exist" (sic). We recommend revising this sentence to clarify that *measurements* of pressure responses at depths below the extraction wells do not exist.

AMEC Response: Comment acknowledged. Text has been revised as suggested.

8. **Section 3.3.2, Aquifer Testing, page 3-5:** During the planned aquifer testing, wells NHE-3, -5, and -7 will alternately be turned off and on, and pumped at different rates during the step-discharge tests. CDPH is concerned that these changes in the relative pumping rates at each extraction well will change the concentrations of contaminants entering the existing NHOU treatment system, particularly 1,4-dioxane and chromium, which are not removed by air stripping. Furthermore, well NHE-5 has not been pumped (or sampled) in several years, so there is substantial uncertainty regarding water quality at this well at present. An evaluation of estimated combined influent concentrations entering the NHOU treatment system during each distinct phase of the planned pumping tests should be provided, indicating the anticipated concentrations of chromium and 1,4-dioxane. This could be accomplished for wells NHE-3 and NHE-7 using a spreadsheet-

based mixing cell calculation, based on anticipated flow rates and recent concentration data. Well NHE-5 should be sampled in advance of the pumping tests to obtain more recent contaminant concentration data and overdue Title 22 monitoring data, in order to complete such an evaluation Results may indicate that treatment or an alternative disposal method is required to ensure that the water sent to the distribution system meets MCLs and NLs, since the NHOU treatment plant does not remove chromium and 1,4-dioxane. This evaluation should be included in the work plan or provided under separate cover at least six weeks before the aquifer testing commences, to provide adequate time for EPA and CDPH review.

AMEC Response: Anticipated influent water quality will be included in an Appendix B to the Work Plan to evaluate potential changes in hexavalent chromium and 1,4-dioxane concentrations as a result of pumping NHE-5, based on historical and recent NHE extraction well pumping performance and the anticipated pumping rate of NHE-5 during the 72-hour pumping test. Based on our preliminary calculations, increasing the influent hexavalent chromium concentration to above 5 µg/L would require concentrations at NHE-5 to exceed 20 µg/L, which is far higher than historical data at this well or nearby NHE wells. Similarly, increasing the influent 1,4-dioxane concentration to above 1 µg/L would require concentrations at NHE-5 to also exceed concentrations higher than historical data at this well or nearby NHE wells. This is consistent with the relatively low pumping rate expected from NHE-5 compared to the overall treatment system (approximately 10 percent).

As such, there appears to be little cause for concern regarding impacts to water quality as a result of pumping NHE-5. However, AMEC supports the concept of utilizing additional hexavalent chromium and 1,4-dioxane data from the NHOU extraction wells, as obtained by LADWP, to support the Phase I Pre-Design Investigation and the Second Interim Remedy design.

9. **Section 3.3.2.1, Monitoring Well Testing, page 3-6:** The second sentence of this paragraph states that "…the resulting hydraulic conductivity values (from slug testing) will be incorporated into the groundwater flow model…" We recommend revising this sentence to state that the resulting hydraulic conductivity values from slug testing will be used to guide development of the hydraulic conductivity matrix in the model. Forcing results of slug tests, which focus on local aquifer properties near the well or boring being tested, into the model may degrade numerical model representativeness of the physical system at the site, rather than improve it.

AMEC Response: Comment acknowledged. Text has been revised as suggested.

10. **Section 4, Data Management, Data Evaluation, and Reporting, page 4-2:** The last sentence of the first full paragraph on this page states that "This report (following the Phase I investigation) will evaluate Phase I data and will recommend that a Phase II Pre-Design Investigation be performed if it is determined that insufficient data exist to fill critical data gaps associated with the Second Interim Remedy and comply with RAOs and meet CDPH 97-005 requirements." As noted in Comment 1, above, some of the critical data gaps described in the Final Data Gap Analysis report are not addressed by the activities proposed in the Work Plan. Therefore, it seems certain that insufficient data will exist to fill those critical data gaps. Please revise so the Work Plan provides a better explanation of why some previously "critical" data gaps may no longer need to be filled.

AMEC Response: See responses to previous comments and, in particular, our response to Comment #5.

SAMPLING AND ANALYSIS PLAN

1. **General comment:** The SAP directly incorporates components of a Quality Assurance Project Plan (QAPP); a stand-alone QAPP is not included. We have no objections to this approach. However, at several locations the SAP text, figures, and Field Sampling Plans (FSPs) refer to "the QAPP." We recommend that these document components refer to the SAP, rather than the non-existent (at the time of submittal) QAPP.

AMEC Response: Comment acknowledged. References to "the QAPP" have been revised to "the SAP" for consistency and clarity**.**

2. **Figures:** Figures within the SAP and FSPs do not have consistent title blocks. Some title blocks reference the QAPP, Work Plan, etc. We recommend updating the figure title blocks for consistency.

AMEC Response: Figures with inconsistent title blocks have been revised accordingly.

3. **Table 2-1:** Several discrepancies associated with this table are noted below, and need to be corrected. Similar corrections will also need to be made for Tables A-3 and B-2 located in the appropriate appendices:

> a) The table lists EPA Method 8260 as the analytical method to be used for analysis of volatile organic compounds. A more suitable method for analysis of potential drinking water is EPA Method 524.2. The SAP should provide an explanation (perhaps as part of development of data quality objectives) regarding why EPA Method 8260 analysis is appropriate for some or all samples to be obtained under this SAP.
>
> **AMEC Response:** Previous sampling of monitoring wells in the NHOU have been analyzed using EPA Test Method 8260 and this information will be incorporated into the SAP to justify the continued use of this method over EPA Test Method 524.2, unless lower method detection limits warrant the use of EPA Test Method 524.2 (e.g., 1,1,1-TCA).
>
> b) For perchlorate by EPA Method 331, the sample container is listed as "100 mL Sanitized," but no container type (e.g. polyethylene) is listed.
>
> **AMEC Response:** Comment acknowledged. The container type has been added.
>
> c) The column heading marked "MDL" lists a number of values related to each method. This heading implies that the values listed are the achievable method detection limits for each method. However, the values directly correlate with the performance standards listed in Section 2.3.2, page 2-7. Heading either needs to be changed to "Performance Standard," or the actual, achievable MDLs for each method need to be added instead.
>
> **AMEC Response:** Actual, achievable MDLs are lab-specific in most cases. AMEC has updated the SAP with the MDL values provided by the analytical laboratory selected to perform these analyses.

4. **Table 2-2:** Several discrepancies associated with this table are noted below, and need to be corrected. Similar corrections will also need to be made for Table A-2 located in the appropriate appendix:

a) The Acceptance Criteria listed for the Temperature blank (under Accuracy, Field) is less than 4 degrees centigrade. However, Table 2-1 lists the appropriate temperature preservation for each method as 4 ± 2 degrees centigrade.

AMEC Response: To be consistent with Table 2-1 and the National Guideline, the Acceptance Criteria listed for the Temperature blank (under Accuracy, Field) has been revised to "4 ± 2 degrees centigrade".

b) The Acceptance Criteria for Method blanks (under Accuracy, Laboratory) is listed as "No compounds should be detected in the laboratory method blanks." Does this statement imply that all compounds should be detected below the laboratory's MDL, or below the laboratory's reporting limit?

AMEC Response: This statement means that no compound should be detected above its respective Reporting limit in the Method blanks.

c) The Acceptance Criterion for Preparation blanks (under Accuracy, Laboratory) is listed as "%R less than compound specific limit". This criterion is better suited for Laboratory Control Samples (LCS) than the blanks. The similar criteria listed for Method blanks should be used for Preparation blanks.

AMEC Response: Comment acknowledged. Text has been revised as suggested.

5. **Acronyms**: Many acronyms were: 1) not captured in the abbreviations and acronyms list, 2) not defined with the first time use, 3) defined multiple times throughout the SAP, or 4) not used after being defined. Please ensure that the SAP (and appendices) undergoes a comprehensive review to appropriately capture and correct all acronyms and callouts. In addition, the definition of the acronym COC should be determined and used consistently throughout the SAP (e.g. chemical of concern, contaminant of concern, constituent of concern). Finally, the definition of the acronym CSM should be determined and used consistently throughout the SAP (e.g. conceptual site model vs. site conceptual model).

AMEC Response: Comment acknowledged. Acronyms and abbreviations have been properly defined and introduced throughout the revised documents.

6. **Emerging Chemicals:** The SAP is inconsistent when referencing and listing what is considered an emerging chemical (e.g. hexavalent chromium, 1,4-dioxane, 1, 2, 3-trichloropropane, perchlorate, and n-nitrosodimethylamine). In addition, the term "emerging chemical" should replace the term "new chemical" when used within the SAP.

AMEC Response: Text has been revised to be consistent with Attachment 4 in Appendix A (Scope of Work) of the Administrative Settlement Agreement and Order on Consent for Remedial Design (AOC; EPA, 2011).

7. **Section 1.0 Introduction, page 1-1:** In the first paragraph, please add the reference USEPA, 2011, after the AOC callout.

AMEC Response: The citation has been included as suggested.

8. **Section 2.0 Project Management, page 2-1:** A "Project Method Performance Objectives" bullet should be added after the "Project Data Quality Objectives (DQOs) and criteria for measurement of data" bullet for consistency of summarizing the subsections within Section 2.0.

AMEC Response: A new fifth bullet titled "Method Performance Objectives has been included as suggested

9. **Section 2.1.3.5 Role/Responsibility of Data Reviewer, page 2-2:** One of the roles listed for the Data Reviewer is performing data validation according to the National Functional Guidelines. However, later in this same section, and in Section 5.1, paragraph 3, the SAP indicates that data validation will be performed by a qualified third party data validator, independent from AMEC. Will the Data Reviewer perform some portion of the data validation, or will all of the validation be performed by third party? Some additional clarification is needed to better describe the role of the Data Reviewer in regards to data validation.

AMEC Response: As specified in the AOC, a qualified third party will perform primary data validation. AMEC's Data Manger (as clarified in our response to Comment #15) will verify that data validation procedures were followed and completed. SAP text has been revised accordingly.

10. **Section 2.2, page 2-3:** What is the back-up plan if NHE 1 and 5 cannot be made operational?

AMEC Response: The context of this comment cannot be determined because there is no reference to NHE-1 and NHE-5 in this section or page of the SAP.

11. **Section 2.2.3 Impacts to NHOU Groundwater, page 2-4 and 2-5:** We recommend listing the eight NHOU extraction wells earlier in this section so that when reference is made to the shutdown of NHE-2 later in the section, the reader understands the well is affiliated with the NHOU Extraction and Treatment System.

AMEC Response: Comment acknowledged. Text has been modified accordingly.

12. **Section 2.2.3 Impacts to NHOU Groundwater, page 2-5:** Last paragraph, line 6; we recommend deleting the term "NHOU treatment system" and replacing with the term "NHOU Extraction and Treatment System". Consider making this a global change.

AMEC Response: Comment acknowledged. Text has been revised through the document as appropriate.

13. **Section 2.3.1 Potential Measurements, page 2-6:** In the second paragraph, line 2, 1,2,3-TCP should be added to the list of chemicals identified for analysis. In addition, this paragraph refers to total alkalinity while Table 2-1 makes reference to alkalinity. Finally, this paragraph refers to pH and specific conductance; however, Table 2-1 does not list these parameters for analysis. We recommend modifying the text to improve the consistency within this section and with Table 2-1.

AMEC Response: Comment acknowledged. Text has been revised accordingly.

14. **Section 2.3.2 Applicable Technical Quality Standards and Criteria, page 2-7:** We recommend replacing "TCP" with "1,2,3-TCP" for consistency and clarity, in this section and elsewhere in the document as appropriate to consistently abbreviate 1,2,3-trichloropropane.

AMEC Response: Comment acknowledged. Text has been revised accordingly.

15. **Section 2.7.2 Laboratory Records, page 2-14, third paragraph:** This paragraph indicates that the AMEC Data Manager will have the responsibility for obtaining and tracking GeoTracker deliverables. However, the AMEC Data Manager's roles and responsibilities are not outlined in Section 2.1.3.

AMEC Response: The "Data Reviewer" title in Section 2.1.3 has been revised to "Data Manager" and throughout this document.

16. **Section 3.2.1 Groundwater Sample Collection and Flow Monitoring, page 3-4:** In the first paragraph, line 8, we believe that 1,2,3-TCP should be added to the list of chemicals identified for analysis, consistent with Table 2-1.

AMEC Response: Comment acknowledged. Text has been revised accordingly.

17. **Section 3.2.1 Groundwater Sample Collection and Flow Monitoring, page 3-4:** The second and third paragraphs state that vertical flow logs and groundwater level measurements will be obtained from "select existing piezometers." The activities may be performed at monitoring wells, not piezometers, and if so, the text should be modified accordingly.

AMEC Response: Table C-1 lists the monitoring wells planned for vertical profiling. Text has been revised accordingly.

18. **Section 6.0 References, page 6-1:** The USEPA Guidance on Systematic Planning Using the Data Quality Objectives Process is listed twice, once as 2006 and the other as 2006a. We recommend that one of these duplicate references be deleted, and that corresponding references to this document within the body of the report be modified accordingly.

AMEC Response: Comment acknowledged. The "USEPA, 2006" reference listed in Section 6 has been deleted; citations within the text correctly refer to USEPA, 2006a.

19. **Appendix A, Table A-3:** If results of groundwater quality sampling are planned for use to support a CDPH policy 97-005 evaluation, the following analytical methods are recommended by CDPH as being more suitable for drinking water analysis than those listed in Table A-3:

a) 1,2,3-trichloropropane (TCP): CDPH SRL "low" method (http://www.cdph.ca.gov/certlic/drinkingwater/Pages/123TCPanalysis.aspx)

b) 1,4-dioxane: EPA Method 522

c) Nitrosodimethylamine: EPA method 521; in addition, CDPH recommends analyzing for all nitrosamines

d) Perchlorate: EPA method 314 (false positives can occur using this method—a backup analytical method using a mass-spectrometer-based analysis is recommended if positive results are detected in excess of the State MCL)

AMEC Response: As mentioned in our response to the Work Plan General Comment #1, additional samples separate from the Phase I Pre-Design Investigation are anticipated to be needed to address CDPH 97-005 requirements and proposed analytical methods are considered appropriate to address RAOs. However, AMEC has reviewed the methods recommended by CDPH and has incorporated them into the SAP tables as appropriate.

20. **Appendix A, Section A1.0 Introduction, page A1-1:** In the second paragraph, line 4, we recommend adding the term "Phase I" in front of the term "Pre-Design Investigation." This change can be carried into the introduction for Appendix B and C as well.

AMEC Response: Text has been revised accordingly.

21. **Appendix A, Section A1.3 Responsible Agency, page A1-1:** For consistency with Appendix B and C, we recommend adding "Region IX" to the end of the sentence.

AMEC Response: Text has been revised accordingly.

22. **Appendix A, Section A1.4 Project Organization, page A1-2:** Based on our understanding of the Work Plan, Eileen Bailiff is the Field Team Leader for Groundwater Sampling and Monitoring, rather than Sean Culkin. Please clarify.

AMEC Response: Comment acknowledged. Eileen Bailiff will be identified as the Field Team Leader in Appendix A as stated in the Work Plan.

23. **Appendix A, Section A1.5 Statement of the Specific Problem, page A1-2:** We recommend revising the first bullet to read as follows (bold text indicates new text for consideration): "Analytical data are insufficient to delineate the lateral and vertical distribution and temporal variability of COCs **in the NHOU study area with respect to the A-Zone and B-Zone** and to define the necessary target capture area." This change can also be made to Section A3.2, page A3-2 under "State the Problem".

AMEC Response: Text has been revised accordingly in Sections A1.5 and A3.2.

24. **Appendix A, Section A1.5 Statement of the Specific Problem, page A1-2:** We recommend updating the second bullet to read as follows (bold text indicates new text for consideration): "Groundwater elevation data are not surveyed to a common elevation datum to verify and clarify groundwater flow directions **and gradients in some locations**." This change can also be made to Section A3.2, page A3-2 under "State the Problem".

AMEC Response: Text has been revised accordingly.

25. **Appendix A, Section A2.1 Site or Sampling Area Description, page A2-1:** We recommend revising the first sentence within the second paragraph, as the description of the system is already provided in the operational history section, as follows: "The NHOU Extraction and Treatment System and associated well field network is located in the San Fernando groundwater basin." We don't believe the author intended to claim that the NHOU groundwater production well system consists of eight extraction wells, etc. This change can be carried into the same description within Appendix B and C as well.

AMEC Response: Text in Appendices A, B, and C has been revised accordingly.

26. **Appendix A, Section A2.2 Operational History, page A2-1:** We recommend revising the first sentence of this paragraph as follows: "The NHOU Extraction and Treatment System, which was constructed between 1987 and 1989, consists of eight groundwater extraction wells (NHE-1 through NHE-8), a collector line, and a central treatment system consisting of an air-stripping treatment system to remove VOCs from extracted groundwater, two activated carbon units to remove VOCs from the air stream, a chlorination system, and ancillary equipment." This change can be carried into the same description within Appendix B and C as well.

In addition, in the last sentence, we recommend deleting "(sans NHE-1)" and adding the following sentences to the end of the paragraph for consistency with Appendix B: "As of June 2011, six of the eight extraction wells remain in service. NHE-1 has never operated as part of the NHOU system and NHE-5 has not operated since 2008." This change can be carried into the same description within Appendix C as well.

AMEC Response: Text in Appendices A, B, and C has been revised accordingly.

27. **Appendix A, Section A2.3 Previous Investigations/Regulatory Involvement, page A2-2:** The reference to USEPA, 2009a is not found in the reference list. Please add the correct reference.

AMEC Response: The Second Interim Remedy Record of Decision has been included in Section 6.0 and the citation here has been revised to "USEPA, 2009".

28. **Appendix A, Section A2.4 Geological and Hydrogeological Information, page A2-2:** We recommend including a reference for the Data Gap Analysis report (e.g. AMEC, 2012a). This change can be carried into the same section within Appendix B and C as well.

AMEC Response: Comment acknowledged. A citation has been inserted and Section 6.0 has been revised accordingly.

29. **Appendix A, Section A2.5 Environmental and/or Human Impact, page A2-2:** In line 8, we recommend adding "1,2,3-" in front of "TCP". This change can be carried into the same section within Appendix B and C as well.

AMEC Response: Text has been revised accordingly.

30. **Appendix A, Section A3.1 Project Task and Problem Definition, page A3-1:** We recommend adding the following text to the end of the fifth task: "and to further evaluate the potential utilization of the well (which has never operated as part of the NHOU Extraction and Treatment System) as part of the Second Interim Remedy."

In addition, is a seventh task justified for addition to the SAP related to NH-10, per the Work Plan (i.e. "At least two depth-discrete samples will be collected from the upper perforation zones of production well NH-10 during a single monitoring event to evaluate groundwater quality in the A-Zone and B-Zones at that location.")?

AMEC Response: Groundwater samples proposed to be collected from NHE-1 are intended to assess groundwater quality at this location and will not pertain to the evaluation of whether this well could be utilized as an extraction well as part of the Second Interim Remedy. The need for an extraction well at this location will be based, in part, on analytical results from the proposed samples and from numerical model simulation results that will be presented and discussed in the Groundwater Modeling Memorandum.

Similarly, there is no need for a seventh task because the fifth task was specifically written to account for sampling at NH-10 (i.e., "…obtain…groundwater quality samples and groundwater elevation measurement near the NHE-1 extraction well…"). NH-10 is near NHE-1 and, although not specifically mentioned, proposed sampling activities at that location are accounted for in Table A-1, as the comment acknowledges.

31. **Appendix A, Section A3.2 Data Quality Objectives (DQOs), page A3-3:** Step 6, Item "a", we recommend including a reference for the Data Gap Analysis report (i.e. AMEC, 2012a).

AMEC Response: Comment acknowledged. A citation has been inserted and Section 6.0 has been revised accordingly.

32. **Appendix A, Section A5.1 Analyses** Narrative**, page A5-1:** Table A-1 lists 29 monitoring wells that will be sampled semiannually. Reference to 30 monitoring wells in this paragraph should be updated.

AMEC Response: Section A5.1 intentionally refers to "approximately 30 wells" to acknowledge potential problems associated with accessing proposed monitoring wells. Text has not been revised.

33. **Appendix A, Section A8.0 Disposal of Residual Materials, page A8-1:** We recommend that AMEC verify whether the reference to Appendix A-2 in the third paragraph should actually be to Appendix A-1, and that this be corrected if necessary.

AMEC Response: Text has been revised accordingly.

34. **Appendix A, Section A8.0 Disposal of Residual Materials, page A8-2:** The bullets under the statement "The following steps will be followed for document retention:" do not correspond with the same bullets in Appendix B, Section B8.3 Waste Profiling and Documentation with respect to who sends, signs, and receives the profiles and manifests. We recommend revising Appendix A or B, as appropriate.

AMEC Response: Comment acknowledged. Section B8.3 has been updated to include Lockheed Martin in the profiling and manifesting process.

35. **Appendix A, Section A9.1.1 Daily Field Records, page 9-1:** We recommend that the first paragraph add reference to Appendix A-1 at the end of the second sentence.

AMEC Response: Text has been revised accordingly.

36. **Appendix A, Section A9.1.1 Daily Field Records, page 9-1:** We recommend that the sixth bullet be updated to read as follows: "Sample media (e.g., groundwater) **and depth of collection.**"

AMEC Response: This information will be recorded on either the Daily Field Record or activity-specific data form as listed near the bottom of page 9-1. Text has not been revised.

37. **Appendix A, Section A9.1.2 Activity-Specific Forms, page A9-2 and Section A9.3 Sample Chain-of-Custody Forms, page A9-3:** Please provide a sample chain of custody form in Appendix A-1.

AMEC Response: A sample chain-of-custody form was inadvertently omitted from the draft SAP and has been included in the revised SAP**.**

38. **Appendix A, Section A11.0 Field Variances, page A11-1:** Please add the following text after the second sentence for consistency with Appendix B: "The AMEC Project Manager will notify the USEPA of major modifications or variances to the field program." Please modify the text in Appendix B to the previous statement. The same change can be made to this section in Appendix C.

AMEC Response: Text has been revised accordingly.

39. **Appendix A, Section A13.0 References, page A13-1:** We recommend updating the reference list and/or deleting those references that are not used within Appendix A.

AMEC Response: Comment acknowledged. Unused citations have been deleted as appropriate.

40. **Appendix B, Section B1.5, page B1-2:** We recommend updating the first bullet to read as follows (bold text indicates new text for your consideration): "Performance monitoring well **and piezometers** have not been installed and monitored to demonstrate the size and shape of the existing NHOU extraction well capture area, **specifically with regard to the A-Zone and B-Zone.**"

AMEC Response: Text has been revised accordingly.

41. **Appendix B, Section B1.6 Schedule, page B1-2:** In the second line, we recommend deleting the word "sampling" and replacing with the phrase "drilling and piezometer installation". It is hard to tell whether this Field Sampling Plan is supposed to cover drilling, sampling, or both.

AMEC Response: Text has been revised accordingly.

42. **Appendix B, Section B2.1 Site Description, page B2-1:** Second paragraph, in addition to listing Figure B-2, it would also be appropriate to list Figures B-4 and B-6.

AMEC Response: Text has been revised accordingly.

43. **Appendix B, Section B3.1 Project Task and Problem Definition, page B3-1:** Line 6, reference to Figures B-3, B-5, and B-7 should be corrected to reference Figures B-2, B-4, and B-6 instead. Line 8, reference to Figures B-4, B-6, and B-8 should be corrected to reference Figures B-3, B-5, and B-7 instead.

AMEC Response: Text has been revised accordingly.

44. **Appendix B, Section B3.2 Data Quality Objectives (DQOs), page B3-2:** We recommend adding an item to the second step: "h) Do the NHOU extraction wells need to be deepened to meet RAOs?"

AMEC Response: We respectfully disagree with the recommendation, which refers to an objective within the Second Interim Remedy Record of Decision. That objective does not pertain to the design and location of performance monitoring wells (or piezometers), which is the subject of Appendix B of the SAP. Whether or not NHOU extraction wells may need to be deepened will be one of several actions considered as part of the Groundwater Modeling Memorandum.

45. **Appendix B, Section B3.2 Data Quality Objectives (DQOs), page B3-3:** The following figure references should be corrected in the fourth step: Items a), c), and e) – Figure B-3 should be updated to call out Figure B-2 instead, and Figure B-8 should be updated to call out Figure B-7 instead.

AMEC Response: Text has been revised accordingly.

46. **Appendix B, Section B3.2 Data Quality Objectives (DQOs), page B3-3:** Sixth step, item "a", should include reference to the Data Gap Analysis report (e.g. AMEC, 2012a).

AMEC Response: Text has been revised accordingly.

47. **Appendix B, Section B3.5 Data Management and Assessment Oversight, page B3-6:** Last paragraph, this section makes reference to a Data Usability Evaluation and Field QA/QC submittal. This submittal may need to be referenced in Appendix A as well.

AMEC Response: Text has been revised accordingly.

48. **Appendix B, Section B4 Sampling Rationale, page B4-1:** Second paragraph, line 7 – Reference to Table B-1 should be updated to reference Table B-2 instead.

AMEC Response: Text has been revised accordingly.

49. **Appendix B, Section B6.7 Piezometer Installation, page B6-4:** First paragraph, figure references in the first line on this page should be updated from B-4, B-6, and B-8 and corrected to reference Figures B-3, B-5, and B-7.

AMEC Response: Text has been revised accordingly.

50. **Appendix B, Section B6.8.2 Post-Development Groundwater Sampling, page B6-5:** Reference to Table B-3 should be updated to reference Table B-2 instead.

AMEC Response: Text has been revised accordingly.

51. **Appendix B, Section B9.3 Sample Chain-Of-Custody Forms, page B9-3:** First paragraph, consider changing reference from Appendix B-2 to Appendix B-1.

AMEC Response: Text has been revised accordingly.

52. **Appendix B, Section B13.0 References, page B13-1:** Suggest updating reference list and/or deleting those references that are not used within Appendix B.

AMEC Response: Comment acknowledged. Unused references have been deleted as appropriate.

53. **Appendix C, Section C1.6 Schedule, page C1-2:** In the first sentence, suggest deleting the phrase “in multiple sampling events” and replace with the word “testing”. In the second sentence, suggest deleting the word “sampling” and replacing with the word “testing”.

AMEC Response: Text has been revised accordingly.

54. **Appendix C, Section C2.1 Site or Sampling Area Description, page C2-1:** All references to Figures A-1 or A-2 should be updated to reference Figures C-1 or C-2, respectively.

AMEC Response: Text has been revised accordingly.

55. **Appendix C, Section C2.4 Geological and Hydrogeological Information, page C2-2:** Line 3, suggest adding the phrase “and testing” after the word “sampling”.

AMEC Response: Text has been revised accordingly.

56. **Appendix C, Section C3.1 Project Task and Problem Definition, page C3-1:** Suggest updating the first item to read as follows: “Slug tests will be performed at 12 monitoring wells screened primarily in either the A-Zone or B-Zone to estimate hydraulic parameters. These data will be used to estimate hydraulic conductivity values as simulated in the current groundwater flow model to define the NHOU extraction well capture zone.”

AMEC Response: The text and Table C-1 have been corrected to cite the 14 monitoring wells as are discussed in the Phase I Pre-Design Investigation Work Plan.

57. **Appendix C, Section C3.1 Project Task and Problem Definition, page C3-1:** Suggest updating the second item to read as follows (bold text indicates new text for

consideration): "Perform aquifer pumping tests at three NHE extraction wells (NHE-3, NHE-5, and NHE-7) **while monitoring the response to the pumping test in 10 observation wells** to estimate well efficiency and A-Zone hydraulic parameters.

AMEC Response: Text has been revised accordingly.

58. **Appendix C, Section C3.1 Project Task and Problem Definition, page C3-1:** In the third paragraph, suggest updating the first sentence to read as follows (bold text indicates new text for consideration): "Aquifer tests at NHE wells will consist of a step drawdown test **to evaluate extraction well performance** followed by a constant discharge test **with corresponding recovery tests**."

AMEC Response: Text has been revised accordingly.

59. **Appendix C, Section C3.2 Data Quality Objectives (DQOs), page C3-2:** In Step 2, suggest updating the lettering of the items. In Step 3, part "b", line 1, clarify which "NHE" well is referred to, and suggest adding "as well as other existing monitoring wells" to the end of the line (before "as listed in Table C-1").

AMEC Response: Text has been revised as appropriate in Steps 2 and 3.

60. **Appendix C, Section C3.2 Data Quality Objectives (DQOs), page C3-3:** In step 7, delete reference to analytical methodologies as sampling and analysis will not occur as part of this FSP.

AMEC Response: "Analytical methodologies" refers to the analytical methods that will used to evaluate the aquifer test drawdown data. The first sentence of step 7a) has been revised to state "Aquifer test locations, number of observation wells, and aquifer test evaluation methodologies are proposed herein."

61. **Appendix C, Section C6.4 Decontamination Procedures, page C6-12:** At the end of the first paragraph, suggest correcting the acronym FSA to the acronym FSP. At the end of this paragraph, suggest referencing Appendix A of the SAP.

AMEC Response: Text has been revised accordingly.

62. **Appendix C, Section C13.0 References, page C13-1:** Suggest updating reference list and/or deleting those references that are not used within Appendix C.

AMEC Response: Comment acknowledged. Unused references have been deleted as appropriate.

HEALTH AND SAFETY PLAN

1. **Section 1.5, Table in "Chemical Hazards," page C1-3:** The current Threshold Limit Value for TCE is 10 ppm; the table should be clarified or corrected accordingly.

AMEC Response: Text has been revised accordingly.

2. **Appendix E, Job Safety Analyses, Pre-ground Disturbance and Clearance Activities:** If saw cutting of concrete or asphalt, the Job Safety Analysis may not adequately address use of respiratory protection for dust, or physical controls for use of a chop saw. We recommend that the authors of the HASP consider expanding this discussion if saw cutting is anticipated.

AMEC Response: Text has been revised accordingly.

Remedial Design QUALITY ASSURANCE PROJECT PLAN

1. **Distribution List:** The name of Ms. Acharya (DTSC) appears to be misspelled, and the street address for Mr. Lindquist (CH2M HILL) should be 2525 Airpark Drive (not 2625). Other errors may be present that delay delivery of this or future documents in a timely manner. We recommend that AMEC review and, if necessary, update their distribution list.

AMEC Response: AMEC has reviewed the distribution list and made corrections to Ms. Acharya's name and Mr. Lindquist's street address. Ms. Acharya and Mr. Lindquist were correctly included on the e-mail notification regarding the report's availability for their review. All required document deliveries for this project have consistently been made in a timely manner to the distribution list specified in the AOC.

2. **Section 2.2, Project Delivery, page 2-4, first and second paragraphs:** It appears that the terms "design/bid/build" and "design/build" may have been inadvertently transposed in the first and second paragraphs. This is not a critical issue from a regulatory perspective, but may lead to confusion if the RD QAPP is forwarded to potential construction bidders in the future. We recommend that this potential transposition be checked and corrected, if appropriate.

AMEC Response: AMEC has reviewed the terms noted above and has determined that they were used correctly in the text describing project delivery methods. Text has been added to further clarify the difference in the two delivery methods to prevent future confusion.

3. **Section 4.3.8, Procedures for Records Retention, page 4-7, first paragraph:** This paragraph states that various records will be filed and retained, but does not state the period of retention nor that it is consistent with the Records Retention section of the AOC. We recommend that the RD QAPP include the duration for records retention and maintenance of files on a SharePoint site.

AMEC Response: AMEC has revised Section 4.3.8 to make it consistent with the records retention section of the AOC.

ATTACHMENT A

USEPA Comments on the *Draft Work Plan, Phase I Pre-Design Investigation, North Hollywood Operable Unit Second Interim Remedy, Groundwater Remediation System Design* and the *Remedial Design Quality Assurance Project Plan, North Hollywood Operable Unit Second Interim Remedy, Groundwater Remediation System Design (August 10, 2012)*

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 9
75 Hawthorne Street
San Francisco, California

August 10, 2012

Michael Taraszki
AMEC for Honeywell and Lockheed
1330 Broadway Street, Ste 1702
Oakland, CA 94612

RE: Comments on *"Draft Work Plan, Phase I Pre-Design Investigation, North Hollywood Operable Unit, Second Interim Remedy Groundwater Remediation System Design"* and the *" Remedial Design Quality Assurance Project Plan, North Hollywood Operable Unit, Second Interim Remedy Groundwater Remediation System Design"*

Dear Mr. Taraszki:

EPA has reviewed the above-referenced document, and provides the following comments in the attached file. These comments should be addressed and resubmitted with the final drafts of the above referenced documents, which are due **thirty days** from the date of this letter.

The attached comments are comprehensive, and the following agencies/firms commented or had an opportunity to comment, in addition to EPA:

- the Los Angeles Department of Water and Power (LADWP)
- the Upper Los Angeles River Area (ULARA) Watermaster
- the Los Angeles Regional Water Quality Control Board (Regional Board)
- CH2M HILL, consultant to EPA

Please include a separate letter which addresses each of the general and major comments specifically, and indicates how the responses to the comments have been incorporated into the final.

Please let me know if you have any questions.

Sincerely,

Matt Salazar
EPA Project Manager

The review focused on significant technical issues; we have not commented on typographical or grammatical errors except where such errors may lead to confusion on technical issues. Following are our comments on these submittals.

Work Plan

1. **General comment:** The Work Plan is well written and indicates a comprehensive understanding of both the available site data and the data gaps in the NHOU. Conduct of the work proposed in the Work Plan (and SAP) will improve the conceptual site model for the NHOU and provide important hydrogeologic data required for RD of the Second Interim Remedy.

   As stated in Section 2.4 of the Work Plan, "The overall objective of the Phase 1 Pre-Design Investigation is to fill critical data gaps identified as necessary for the Second Interim Remedy design to meet RAOs…" And Section 4 of the Work Plan states that a second phase of investigation would only be performed "if it is determined that insufficient data exist (at that time) to fill critical data gaps associated with the Second Interim Remedy and comply with RAOs and meet CDPH 97-005 requirements." However, actions that might fill some of the "critical data gaps" identified in the Final Data Gap Analysis report (pages 5-14 and 5-15) prepared by AMEC (dated March 14, 2012) are not proposed in this Work Plan. Specifically, critical data gaps 4, 5, 6, 8, and 9 listed on pages 5-14 and 5-15 of the Final Data Gap Analysis report seem to be unaddressed, or only partly addressed, by the activities listed in the Work Plan. It seems that either some of the data gaps identified in the Final Data Gap Analysis report are no longer deemed critical, or will simply not be addressed by the proposed Phase 1 investigation and will be addressed in some other manner. Please revise the Work Plan to provide more clarity regarding which of the critical data gaps are addressed by each proposed field activity, and which critical data gaps are not addressed in the proposed Phase 1 investigation (together with an explanation of why not, and how they will be addressed in the future). Our comments and/or recommendations for filling these data gaps are summarized below, but could be modified depending on additional information provided by the respondents:

   - **Critical Data Gap 4** ("existing monitoring well network insufficient to characterize vadose zone and groundwater conditions beneath known and potential source areas"): The Work Plan should show critical areas for further investigation on a map, or at least describe how the need for further characterization in the vicinity of the "known and potential source areas" would be evaluated and conducted during a Phase II data gaps investigation. The area southwest of NHOU extraction wells NHE-2 and NHE-3, where high concentrations of VOCs and hexavalent chromium have been detected, but are poorly delineated, seems to be of primary concern. It is not clear how the data collection activities described in the Work Plan would fill this data gap or aid in further delineating contaminant concentrations in this particular area. We recommend that at least two new monitoring wells be installed in this area as part of the Phase 1 investigation.

   - **Critical Data Gap 5** ("objective projections of pumping and recharge volumes, including beyond year 2015, are not yet available"): The Work Plan should state that addressing this data gap does not require field activity; rather, discussions are ongoing (presumably) with LADWP and the ULARA Watermaster to develop improved and updated projections of future pumping and recharge volumes.

- **Critical Data Gap 6** ("performance monitoring wells have not been installed and monitored"): It is unclear whether the proposed piezometers in the Work Plan constitute some or all of the needed performance monitoring wells that comprise this critical data gap. The Work Plan should clarify whether the planned piezometers are expected to address this data gap by themselves, or if installation of additional performance monitoring wells is anticipated to be required in the future, to complete the RD. If so, then the Work Plan should describe how and when decisions about the need for additional performance monitoring wells will be made.
- **Critical Data Gap 8** ("available analytical data are insufficient to evaluate A-Zone and, potentially, B-Zone groundwater quality within the future NHOU capture zone to meet CDPH 97-005 requirements"): The Work Plan should define whether this is still considered to be a critical data gap, and describe how and when it will be addressed.
- **Critical Data Gap 9** ("vertical conduits throughout the NHOU study area have not been sufficiently evaluated"): The Work Plan includes investigative activities to evaluate existing monitoring wells as potential vertical conduits for contaminant migration; however, it does not include plans to evaluate existing inactive production wells. Inactive production wells appear to pose a greater threat of vertical contaminant migration, due to their number, long screens, and large diameter. The Work Plan should describe how and when this part of Critical Data Gap 9 will be addressed (e.g., will it be addressed as part of a future Phase II investigation, and are there any conditions on which such an investigation would depend).

2. **Table of Contents page iii, Table, Figures, and Appendix sections:** The title provided in the table of contents for Table 3-1 is different from the title actually on Table 3-1. The titles for Figure 3-1 and Appendix A are similarly inconsistent with the titles given in the table of contents. Please make the titles listed in the table of contents consistent with the actual titles of the corresponding tables, figures, and appendices.

3. **Section 2.2, Project Background, page 2-3, first full paragraph:** This paragraph paraphrases the key remedial action objectives (RAOs) and relates them to the specific work scope items in the Agreement and Order on Consent (AOC). However, the second sentence in this paragraph focuses exclusively on the second RAO for the NHOU Second Interim Remedy. We recommend that this sentence be modified to also accommodate the fourth remedial action objective (RAO), which is to achieve improved hydraulic containment to inhibit horizontal and vertical contaminant migration in groundwater from the more highly contaminated areas and depths of the aquifer to the less contaminated areas and depths of the aquifer, including the southeast portion of the NHOU near the Erwin and Whitnall production well fields. We assume that this RAO influences the AOC work scope items, as well as the scope of work for the activities described in the Work Plan.

4. **Section 2.3, Previous Investigations, page 2-4, fourth paragraph:** The second-to-last sentence in this paragraph states "However, it was concluded that existing data are insufficient to proceed with a Second Interim Remedy…" We recommend that the sentence be modified to state which entity came to that conclusion, and provide a reference to a document where that conclusion is stated (perhaps the Draft or Final Data Gap Analysis report prepared by AMEC).

5. **Section 2.4, Phase 1 Pre-Design Investigation Objectives, page 2-5, bullets 1 through 6:** It is difficult to directly compare these bulleted "specific objectives" of the Phase 1 Pre-Design Investigation to the "critical data gaps" listed in the Final Data Gaps Analysis report (prepared by AMEC, dated March 14, 2012, see pages 5-14 and 5-15). We recommend adding a table to the Work Plan that lists the critical data gaps provided in the Final Data Gaps Analysis report and then

lists the corresponding specific objectives of the Phase 1 Pre-Design Investigation in an adjacent column. Such a table would allow easier comparison of critical data gaps to objectives of the upcoming investigation, and possibly aid in identification of redundancies or additional needs.

6. **Section 2.4, Phase 1 Pre-Design Investigation Objectives, page 2-5, bullet 7:** This bullet states that a specific objective of the Phase 1 Pre-Design Investigation is to "Assess whether sufficient data exist to proceed with designing the Second Interim Remedy…" We recommend adding a discussion in this document or the SAP (and referencing such a location within bullet 7) that describes the process and people who will make such an assessment.

7. **Section 3.3.2, Aquifer Testing, page 3-5, first paragraph of section:** The second sentence of this paragraph states that "…the vertical extent of capture cannot be determined because pressure responses at depths below the existing NHOU extraction wells does not exist" (sic). We recommend revising this sentence to clarify that *measurements* of pressure responses at depths below the extraction wells do not exist.

8. **Section 3.3.2, Aquifer Testing, page 3-5:** During the planned aquifer testing, wells NHE-3, -5, and -7 will alternately be turned off and on, and pumped at different rates during the step-discharge tests. CDPH is concerned that these changes in the relative pumping rates at each extraction well will change the concentrations of contaminants entering the existing NHOU treatment system, particularly 1,4-dioxane and chromium, which are not removed by air stripping. Furthermore, well NHE-5 has not been pumped (or sampled) in several years, so there is substantial uncertainty regarding water quality at this well at present. An evaluation of estimated combined influent concentrations entering the NHOU treatment system during each distinct phase of the planned pumping tests should be provided, indicating the anticipated concentrations of chromium and 1,4-dioxane. This could be accomplished for wells NHE-3 and NHE-7 using a spreadsheet-based mixing cell calculation, based on anticipated flow rates and recent concentration data. Well NHE-5 should be sampled in advance of the pumping tests to obtain more recent contaminant concentration data and overdue Title 22 monitoring data, in order to complete such an evaluation Results may indicate that treatment or an alternative disposal method is required to ensure that the water sent to the distribution system meets MCLs and NLs, since the NHOU treatment plant does not remove chromium and 1,4-dioxane. This evaluation should be included in the work plan or provided under separate cover at least six weeks before the aquifer testing commences, to provide adequate time for EPA and CDPH review.

9. **Section 3.3.2.1, Monitoring Well Testing, page 3-6:** The second sentence of this paragraph states that "…the resulting hydraulic conductivity values (from slug testing) will be incorporated into the groundwater flow model…" We recommend revising this sentence to state that the resulting hydraulic conductivity values from slug testing will be used to guide development of the hydraulic conductivity matrix in the model. Forcing results of slug tests, which focus on local aquifer properties near the well or boring being tested, into the model may degrade numerical model representativeness of the physical system at the site, rather than improve it.

10. **Section 4, Data Management, Data Evaluation, and Reporting, page 4-2:** The last sentence of the first full paragraph on this page states that "This report (following the Phase 1 investigation) will evaluate Phase 1 data and will recommend that a Phase 2 Pre-Design Investigation be performed if it is determined that insufficient data exist to fill critical data gaps associated with the Second Interim Remedy and comply with RAOs and meet CDPH 97-005 requirements." As noted in Comment 1, above, some of the critical data gaps described in the Final Data Gap Analysis report are not addressed by the activities proposed in the Work Plan. Therefore, it seems certain that insufficient data will exist to fill those critical data gaps. Please revise so the Work Plan

provides a better explanation of why some previously "critical" data gaps may no longer need to be filled.

SAP

1. **General comment:** The SAP directly incorporates components of a Quality Assurance Project Plan (QAPP); a stand-alone QAPP is not included. We have no objections to this approach. However, at several locations the SAP text, figures, and Field Sampling Plans (FSPs) refer to "the QAPP." We recommend that these document components refer to the SAP, rather than the non-existent (at the time of submittal) QAPP.

2. **Figures:** Figures within the SAP and FSPs do not have consistent title blocks. Some title blocks reference the QAPP, Work Plan, etc. We recommend updating the figure title blocks for consistency.

3. **Table 2-1:** Several discrepancies associated with this table are noted below, and need to be corrected. Similar corrections will also need to be made for Tables A-3 and B-2 located in the appropriate appendices:

   a) The table lists EPA Method 8260 as the analytical method to be used for analysis of volatile organic compounds. A more suitable method for analysis of potential drinking water is EPA Method 524.2. The SAP should provide an explanation (perhaps as part of development of data quality objectives) regarding why EPA Method 8260 analysis is appropriate for some or all samples to be obtained under this SAP.

   b) For perchlorate by EPA Method 331, the sample container is listed as "100 mL Sanitized," but no container type (e.g. polyethylene) is listed.

   c) The column heading marked "MDL" lists a number of values related to each method. This heading implies that the values listed are the achievable method detection limits for each method. However, the values directly correlate with the performance standards listed in Section 2.3.2, page 2-7. Heading either needs to be changed to "Performance Standard," or the actual, achievable MDLs for each method need to be added instead.

4. **Table 2-2:** Several discrepancies associated with this table are noted below, and need to be corrected. Similar corrections will also need to be made for Table A-2 located in the appropriate appendix:

   a) The Acceptance Criteria listed for the Temperature blank (under Accuracy, Field) is less than 4 degrees centigrade. However, Table 2-1 lists the appropriate temperature preservation for each method as 4 ± 2 degrees centigrade.

   b) The Acceptance Criteria for Method blanks (under Accuracy, Laboratory) is listed as "No compounds should be detected in the laboratory method blanks." Does this statement imply that all compounds should be detected below the laboratory's MDL, or below the laboratory's reporting limit?

   c) The Acceptance Criterion for Preparation blanks (under Accuracy, Laboratory) is listed as "%R less than compound specific limit". This criterion is better suited for Laboratory Control

Samples (LCS) than the blanks. The similar criteria listed for Method blanks should be used for Preparation blanks.

5. **Acronyms**: Many acronyms were: 1) not captured in the abbreviations and acronyms list, 2) not defined with the first time use, 3) defined multiple times throughout the SAP, or 4) not used after being defined. Please ensure that the SAP (and appendices) undergoes a comprehensive review to appropriately capture and correct all acronyms and callouts. In addition, the definition of the acronym COC should be determined and used consistently throughout the SAP (e.g. chemical of concern, contaminant of concern, constituent of concern). Finally, the definition of the acronym CSM should be determined and used consistently throughout the SAP (e.g. conceptual site model vs. site conceptual model).

6. **Emerging Chemicals:** The SAP is inconsistent when referencing and listing what is considered an emerging chemical (e.g. hexavalent chromium, 1,4-dioxane, 1, 2, 3-trichloropropane, perchlorate, and n-nitrosodimethylamine). In addition, the term "emerging chemical" should replace the term "new chemical" when used within the SAP.

7. **Section 1.0 Introduction, page 1-1:** In the first paragraph, please add the reference USEPA, 2011, after the AOC callout.

8. **Section 2.0 Project Management, page 2-1:** A "Project Method Performance Objectives" bullet should be added after the "Project Data Quality Objectives (DQOs) and criteria for measurement of data" bullet for consistency of summarizing the subsections within Section 2.0.

9. **Section 2.1.3.5 Role/Responsibility of Data Reviewer, page 2-2:** One of the roles listed for the Data Reviewer is performing data validation according to the National Functional Guidelines. However, later in this same section, and in Section 5.1, paragraph 3, the SAP indicates that data validation will be performed by a qualified third party data validator, independent from AMEC. Will the Data Reviewer perform some portion of the data validation, or will all of the validation be performed by third party? Some additional clarification is needed to better describe the role of the Data Reviewer in regards to data validation.

10. **Section 2.2, page 2-3:** What is the back-up plan if NHE 1 and 5 cannot be made operational?

11. **Section 2.2.3 Impacts to NHOU Groundwater, page 2-4 and 2-5:** We recommend listing the eight NHOU extraction wells earlier in this section so that when reference is made to the shutdown of NHE-2 later in the section, the reader understands the well is affiliated with the NHOU Extraction and Treatment System.

12. **Section 2.2.3 Impacts to NHOU Groundwater, page 2-5:** Last paragraph, line 6; we recommend deleting the term "NHOU treatment system" and replacing with the term "NHOU Extraction and Treatment System". Consider making this a global change.

13. **Section 2.3.1 Potential Measurements, page 2-6:** In the second paragraph, line 2, 1,2,3-TCP should be added to the list of chemicals identified for analysis. In addition, this paragraph refers to total alkalinity while Table 2-1 makes reference to alkalinity. Finally, this paragraph refers to pH and specific conductance; however, Table 2-1 does not list these parameters for analysis. We recommend modifying the text to improve the consistency within this section and with Table 2-1.

14. **Section 2.3.2 Applicable Technical Quality Standards and Criteria, page 2-7:** We recommend replacing "TCP" with "1,2,3-TCP" for consistency and clarity, in this section and elsewhere in the document as appropriate to consistently abbreviate 1,2,3-trichloropropane.

15. **Section 2.7.2 Laboratory Records, page 2-14, third paragraph:** This paragraph indicates that the AMEC Data Manager will have the responsibility for obtaining and tracking GeoTracker deliverables. However, the AMEC Data Manager's roles and responsibilities are not outlined in Section 2.1.3.

16. **Section 3.2.1 Groundwater Sample Collection and Flow Monitoring, page 3-4:** In the first paragraph, line 8, we believe that 1,2,3-TCP should be added to the list of chemicals identified for analysis, consistent with Table 2-1.

17. **Section 3.2.1 Groundwater Sample Collection and Flow Monitoring, page 3-4:** The second and third paragraphs state that vertical flow logs and groundwater level measurements will be obtained from "select existing piezometers." The activities may be performed at monitoring wells, not piezometers, and if so, the text should be modified accordingly.

18. **Section 6.0 References, page 6-1:** The USEPA Guidance on Systematic Planning Using the Data Quality Objectives Process is listed twice, once as 2006 and the other as 2006a. We recommend that one of these duplicate references be deleted, and that corresponding references to this document within the body of the report be modified accordingly.

19. **Appendix A, Table A-3:** If results of groundwater quality sampling are planned for use to support a CDPH policy 97-005 evaluation, the following analytical methods are recommended by CDPH as being more suitable for drinking water analysis than those listed in Table A-3:

    a) 1 ,2,3-trichloropropane (TCP): CDPH SRL "low" method (http://www.cdph.ca.gov/certlic/drinkingwater/Pages/123TCPanalysis.aspx)

    b) 1,4-dioxane: EPA Method 522

    c) Nitrosodimethylamine: EPA method 521; in addition, CDPH recommends analyzing for all nitrosamines

    d) Perchlorate: EPA method 314 (false positives can occur using this method—a backup analytical method using a mass-spectrometer-based analysis is recommended if positive results are detected in excess of the State MCL)

20. **Appendix A, Section A1.0 Introduction, page A1-1:** In the second paragraph, line 4, we recommend adding the term "Phase 1" in front of the term "Pre-Design Investigation." This change can be carried into the introduction for Appendix B and C as well.

21. **Appendix A, Section A1.3 Responsible Agency, page A1-1:** For consistency with Appendix B and C, we recommend adding "Region IX" to the end of the sentence.

22. **Appendix A, Section A1.4 Project Organization, page A1-2:** Based on our understanding of the Work Plan, Eileen Bailiff is the Field Team Leader for Groundwater Sampling and Monitoring, rather than Sean Culkin. Please clarify.

23. **Appendix A, Section A1.5 Statement of the Specific Problem, page A1-2:** We recommend revising the first bullet to read as follows (bold text indicates new text for consideration): "Analytical data are insufficient to delineate the lateral and vertical distribution and temporal variability of COCs **in the NHOU study area with respect to the A-Zone and B-Zone** and to define the necessary target capture area." This change can also be made to Section A3.2, page A3-2 under "State the Problem".

24. **Appendix A, Section A1.5 Statement of the Specific Problem, page A1-2:** We recommend updating the second bullet to read as follows (bold text indicates new text for consideration):

"Groundwater elevation data are not surveyed to a common elevation datum to verify and clarify groundwater flow directions **and gradients in some locations**." This change can also be made to Section A3.2, page A3-2 under "State the Problem".

25. **Appendix A, Section A2.1 Site or Sampling Area Description, page A2-1:** We recommend revising the first sentence within the second paragraph, as the description of the system is already provided in the operational history section, as follows: "The NHOU Extraction and Treatment System and associated well field network is located in the San Fernando groundwater basin." We don't believe the author intended to claim that the NHOU groundwater production well system consists of eight extraction wells, etc. This change can be carried into the same description within Appendix B and C as well.

26. **Appendix A, Section A2.2 Operational History, page A2-1:** We recommend revising the first sentence of this paragraph as follows: "The NHOU Extraction and Treatment System, which was constructed between 1987 and 1989, consists of eight groundwater extraction wells (NHE-1 through NHE-8), a collector line, and a central treatment system consisting of an air-stripping treatment system to remove VOCs from extracted groundwater, two activated carbon units to remove VOCs from the air stream, a chlorination system, and ancillary equipment." This change can be carried into the same description within Appendix B and C as well.

    In addition, in the last sentence, we recommend deleting "(sans NHE-1)" and adding the following sentences to the end of the paragraph for consistency with Appendix B: "As of June 2011, six of the eight extraction wells remain in service. NHE-1 has never operated as part of the NHOU system and NHE-5 has not operated since 2008." This change can be carried into the same description within Appendix C as well.

27. **Appendix A, Section A2.3 Previous Investigations/Regulatory Involvement, page A2-2:** The reference to USEPA, 2009a is not found in the reference list. Please add the correct reference.

28. **Appendix A, Section A2.4 Geological and Hydrogeological Information, page A2-2:** We recommend including a reference for the Data Gap Analysis report (e.g. AMEC, 2012a). This change can be carried into the same section within Appendix B and C as well.

29. **Appendix A, Section A2.5 Environmental and/or Human Impact, page A2-2:** In line 8, we recommend adding "1,2,3-" in front of "TCP". This change can be carried into the same section within Appendix B and C as well.

30. **Appendix A, Section A3.1 Project Task and Problem Definition, page A3-1:** We recommend adding the following text to the end of the fifth task: "and to further evaluate the potential utilization of the well (which has never operated as part of the NHOU Extraction and Treatment System) as part of the Second Interim Remedy."

    In addition, is a seventh task justified for addition to the SAP related to NH-10, per the Work Plan (i.e. "At least two depth-discrete samples will be collected from the upper perforation zones of production well NH-10 during a single monitoring event to evaluate groundwater quality in the A-Zone and B-Zones at that location.")?

31. **Appendix A, Section A3.2 Data Quality Objectives (DQOs), page A3-3:** Step 6, Item "a", we recommend including a reference for the Data Gap Analysis report (i.e. AMEC, 2012a).

32. **Appendix A, Section A5.1 Analyses** Narrative**, page A5-1:** Table A-1 lists 29 monitoring wells that will be sampled semiannually. Reference to 30 monitoring wells in this paragraph should be updated.

33. **Appendix A, Section A8.0 Disposal of Residual Materials, page A8-1:** We recommend that AMEC verify whether the reference to Appendix A-2 in the third paragraph should actually be to Appendix A-1, and that this be corrected if necessary.

34. **Appendix A, Section A8.0 Disposal of Residual Materials, page A8-2:** The bullets under the statement "The following steps will be followed for document retention:" do not correspond with the same bullets in Appendix B, Section B8.3 Waste Profiling and Documentation with respect to who sends, signs, and receives the profiles and manifests. We recommend revising Appendix A or B, as appropriate.

35. **Appendix A, Section A9.1.1 Daily Field Records, page 9-1:** We recommend that the first paragraph add reference to Appendix A-1 at the end of the second sentence.

36. **Appendix A, Section A9.1.1 Daily Field Records, page 9-1:** We recommend that the sixth bullet be updated to read as follows: "Sample media (e.g., groundwater) **and depth of collection.**"

37. **Appendix A, Section A9.1.2 Activity-Specific Forms, page A9-2 and Section A9.3 Sample Chain-of-Custody Forms, page A9-3:** Please provide a sample chain of custody form in Appendix A-1.

38. **Appendix A, Section A11.0 Field Variances, page A11-1:** Please add the following text after the second sentence for consistency with Appendix B: "The AMEC Project Manager will notify the USEPA of major modifications or variances to the field program." Please modify the text in Appendix B to the previous statement. The same change can be made to this section in Appendix C.

39. **Appendix A, Section A13.0 References, page A13-1:** We recommend updating the reference list and/or deleting those references that are not used within Appendix A.

40. **Appendix B, Section B1.5, page B1-2:** We recommend updating the first bullet to read as follows (bold text indicates new text for your consideration): "Performance monitoring well **and piezometers** have not been installed and monitored to demonstrate the size and shape of the existing NHOU extraction well capture area, **specifically with regard to the A-Zone and B-Zone.**"

41. **Appendix B, Section B1.6 Schedule, page B1-2:** In the second line, we recommend deleting the word "sampling" and replacing with the phrase "drilling and piezometer installation". It is hard to tell whether this Field Sampling Plan is supposed to cover drilling, sampling, or both.

42. **Appendix B, Section B2.1 Site Description, page B2-1:** Second paragraph, in addition to listing Figure B-2, it would also be appropriate to list Figures B-4 and B-6.

43. **Appendix B, Section B3.1 Project Task and Problem Definition, page B3-1:** Line 6, reference to Figures B-3, B-5, and B-7 should be corrected to reference Figures B-2, B-4, and B-6 instead. Line 8, reference to Figures B-4, B-6, and B-8 should be corrected to reference Figures B-3, B-5, and B-7 instead.

44. **Appendix B, Section B3.2 Data Quality Objectives (DQOs), page B3-2:** We recommend adding an item to the second step: "h) Do the NHOU extraction wells need to be deepened to meet RAOs?"

45. **Appendix B, Section B3.2 Data Quality Objectives (DQOs), page B3-3:** The following figure references should be corrected in the fourth step: Items a), c), and e) – Figure B-3 should be updated to call out Figure B-2 instead, and Figure B-8 should be updated to call out Figure B-7 instead.

46. **Appendix B, Section B3.2 Data Quality Objectives (DQOs), page B3-3:** Sixth step, item "a", should include reference to the Data Gap Analysis report (e.g. AMEC, 2012a).

47. **Appendix B, Section B3.5 Data Management and Assessment Oversight, page B3-6:** Last paragraph, this section makes reference to a Data Usability Evaluation and Field QA/QC submittal. This submittal may need to be referenced in Appendix A as well.

48. **Appendix B, Section B4 Sampling Rationale, page B4-1:** Second paragraph, line 7 – Reference to Table B-1 should be updated to reference Table B-2 instead.

49. **Appendix B, Section B6.7 Piezometer Installation, page B6-4:** First paragraph, figure references in the first line on this page should be updated from B-4, B-6, and B-8 and corrected to reference Figures B-3, B-5, and B-7.

50. **Appendix B, Section B6.8.2 Post-Development Groundwater Sampling, page B6-5:** Reference to Table B-3 should be updated to reference Table B-2 instead.

51. **Appendix B, Section B9.3 Sample Chain-Of-Custody Forms, page B9-3:** First paragraph, consider changing reference from Appendix B-2 to Appendix B-1.

52. **Appendix B, Section B13.0 References, page B13-1:** Suggest updating reference list and/or deleting those references that are not used within Appendix B.

53. **Appendix C, Section C1.6 Schedule, page C1-2:** In the first sentence, suggest deleting the phrase "in multiple sampling events" and replace with the word "testing". In the second sentence, suggest deleting the word "sampling" and replacing with the word "testing".

54. **Appendix C, Section C2.1 Site or Sampling Area Description, page C2-1:** All references to Figures A-1 or A-2 should be updated to reference Figures C-1 or C-2, respectively.

55. **Appendix C, Section C2.4 Geological and Hydrogeological Information, page C2-2:** Line 3, suggest adding the phrase "and testing" after the word "sampling".

56. **Appendix C, Section C3.1 Project Task and Problem Definition, page C3-1:** Suggest updating the first item to read as follows: "Slug tests will be performed at 12 monitoring wells screened primarily in either the A-Zone or B-Zone to estimate hydraulic parameters. These data will be used to estimate hydraulic conductivity values as simulated in the current groundwater flow model to define the NHOU extraction well capture zone."

57. **Appendix C, Section C3.1 Project Task and Problem Definition, page C3-1:** Suggest updating the second item to read as follows (bold text indicates new text for consideration): "Perform aquifer pumping tests at three NHE extraction wells (NHE-3, NHE-5, and NHE-7) **while monitoring the response to the pumping test in 10 observation wells** to estimate well efficiency and A-Zone hydraulic parameters.

58. **Appendix C, Section C3.1 Project Task and Problem Definition, page C3-1:** In the third paragraph, suggest updating the first sentence to read as follows (bold text indicates new text for consideration): "Aquifer tests at NHE wells will consist of a step drawdown test **to evaluate extraction well performance** followed by a constant discharge test **with corresponding recovery tests**."

59. **Appendix C, Section C3.2 Data Quality Objectives (DQOs), page C3-2:** In Step 2, suggest updating the lettering of the items. In Step 3, part "b", line 1, clarify which "NHE" well is referred to, and suggest adding "as well as other existing monitoring wells" to the end of the line (before "as listed in Table C-1").

60. **Appendix C, Section C3.2 Data Quality Objectives (DQOs), page C3-3:** In step 7, delete reference to analytical methodologies as sampling and analysis will not occur as part of this FSP.

61. **Appendix C, Section C6.4 Decontamination Procedures, page C6-12:** At the end of the first paragraph, suggest correcting the acronym FSA to the acronym FSP. At the end of this paragraph, suggest referencing Appendix A of the SAP.

62. **Appendix C, Section C13.0 References, page C13-1:** Suggest updating reference list and/or deleting those references that are not used within Appendix C.

HASP

1. **Section 1.5, Table in "Chemical Hazards," page C1-3:** The current Threshold Limit Value for TCE is 10 ppm; the table should be clarified or corrected accordingly.

2. **Appendix E, Job Safety Analyses, Pre-ground Disturbance and Clearance Activities:** If saw cutting of concrete or asphalt, the Job Safety Analysis may not adequately address use of respiratory protection for dust, or physical controls for use of a chop saw. We recommend that the authors of the HASP consider expanding this discussion if saw cutting is anticipated.

Remedial Design QAPP

1. **Distribution List:** The name of Ms. Acharya (DTSC) appears to be misspelled, and the street address for Mr. Lindquist (CH2M HILL) should be 2525 Airpark Drive (not 2625). Other errors may be present that delay delivery of this or future documents in a timely manner. We recommend that AMEC review and, if necessary, update their distribution list.

2. **Section 2.2, Project Delivery, page 2-4, first and second paragraphs:** It appears that the terms "design/bid/build" and "design/build" may have been inadvertently transposed in the first and second paragraphs. This is not a critical issue from a regulatory perspective, but may lead to confusion if the RD QAPP is forwarded to potential construction bidders in the future. We recommend that this potential transposition be checked and corrected, if appropriate.

3. **Section 4.3.8, Procedures for Records Retention, page 4-7, first paragraph:** This paragraph states that various records will be filed and retained, but does not state the period of retention nor that it is consistent with the Records Retention section of the AOC. We recommend that the RD QAPP include the duration for records retention and maintenance of files on a SharePoint site