NAVFAC SW CONTRACT NO. N62473-06-D-2201
CTO NO. 0010

FINAL

COMPREHENSIVE PERFORMANCE MONITORING REPORT (OCTOBER 2005 THROUGH MAY 2010)

March 8, 2011

FULL-SCALE ENHANCED IN SITU BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS
INSTALLATION RESTORATION PROGRAM SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

DCN: ECSD-2201-0010-0007

Naval Facilities Engineering Command Southwest
Contracts Department
1220 Pacific Highway, Building 127, Room 112
San Diego, California 92132-5190

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DCN: ECSD-2201-0010-0007

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EXECUTIVE SUMMARY

This report summarizes the operational status and results of the remedial action for chlorinated ethenes (CEs), including tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE), and vinyl chloride (VC) in groundwater at Installation Restoration Program (IRP) Site 40. These compounds constitute the chemicals of concern (COCs) at this site. IRP Site 40 is the Concrete Pit and Gravel Area located at Naval Weapons Station Seal Beach in Seal Beach, California.

The objective of this report is to present a general summary of the project activities conducted from October 2005 through May 2010, and to update the current status of the enhanced in situ bioremediation (EISB) remedial action for treatment of the CEs in groundwater at IRP Site 40. Greater detail on project activities and monitoring results is provided in periodic summary reports, which were submitted to the regulatory agencies and are included in Attachment 1. An initial comprehensive performance monitoring report was produced in 2005, which summarized implementation and initial performance of the system, including data collected from March 2005 through September 2005.

The major field activities performed between October 2005 and May 2010 as part of the EISB remedial action are as follows:

- Periodic groundwater monitoring (water level measurement, groundwater sampling and analysis, soil gas sampling and analysis, and surface emissions monitoring). From 2006 on, periodic monitoring was conducted at quarterly or less frequent intervals (the number of well samples and sampling frequency were reduced with regulatory approval to streamline the program and eliminate collection of data that were not useful).
- Optimization evaluation. Over the course of the process monitoring, lactate distribution was observed to be adequate in some areas of the site, and the EISB process performed as expected at those locations. However, data indicated that lactate migration has been inconsistent across the site, and some areas did not receive adequate lactate. Thus, alternative approaches were considered for enhancing the current EISB system. Injection of Hydrogen Release Compound (HRC®) was selected to improve the delivery and distribution of lactate to the specific areas where cleanup is required and lactate migration has been limited.
- HRC injection, Round 1. The first application of HRC was conducted in April 2007. A total of 18,300 pounds of HRC was injected into the groundwater to address areas where the lactate distribution under the initial treatment scenario was not effective.
- Investigation Beneath Building 240. The potential for CE rebound was identified in the area immediately downgradient of Building 240, and was thus investigated via collection of groundwater samples at various depths from inside the locomotive maintenance shop to assess possible residual or potential source contamination. COC

concentrations were consistent with those reported elsewhere at the site, and thus there was no evidence of a major contaminant source.

- HRC Injection, Round 2. A final round of HRC injection was conducted during October and November 2008 to address residual contamination at the site. For this application, approximately 25,000 pounds of HRC was injected at 186 locations in the subsurface of the site. Of those, 22 locations were within Building 240 and the remaining 164 locations were outside the building.

The general evaluation of the EISB remedial action includes an overview of the major aspects of treatment, including assessment of the effects on groundwater (groundwater elevations, CE trends, geochemical parameters, and microbiological parameters) and soil gas (surface emissions monitoring and soil gas/vapor monitoring). As noted above, the evaluation is intended to be general in nature, focusing on overall trends of selected critical parameters in key monitoring wells and the plume delineations based on the most current data.

Groundwater level measurements indicated some minor variability in water levels initially, possibly due to the previous sodium lactate injections. However, following those injections, the levels were relatively stable, exhibiting a generally decreasing trend over time (consistent with drought conditions in Southern California during that period). Groundwater levels increased slightly in 2010, consistent with increased precipitation during the winter of 2010.

In terms of the contaminant evaluation, PCE and TCE have been degraded to levels below target cleanup goals (TCGs) in all wells. Residual low levels of cis-1,2-DCE and VC remain in excess of their TCGs, forming dilute plumes in the central and southwest portions of the site. The following table summarizes the most recent COC results for the May 2010 monitoring event:

Parameter	Maximum Concentration Detected (µg/L)	Target Cleanup Goal (µg/L)	Number of Wells with Concentration Exceeding TCG[1]
Tetrachloroethene	<1	5	0 of 19
Trichloroethene	4	5	0 of 19
cis-1,2-Dichloroethene	90	6	2 of 19
trans-1,2-Dichloroethene	0.44J	10	0 of 19
Vinyl chloride	37	0.5	12 of 19

Notes:

[1] A total of 19 wells were sampled during the May 2010 event, of which 10 were compliance wells and 9 were injections wells converted to monitoring wells.

Abbreviations and Acronyms:

µg/L – micrograms per liter
J – estimated concentration
TCG – target cleanup goal

In general, geochemical and microbiological data suggest that reducing conditions supportive of reductive dechlorination have been maintained throughout the contaminated area during this remedial action. In addition, general groundwater quality data indicate that significant long-term impacts are not imminent. Soil gas data suggest high concentrations of methane gas within the vadose zone at the site. However, methane gas concentrations have been deceasing from the high average concentrations of 79 percent in January 2006 to average concentrations of 67 percent in May 2010.

Overall, significant reductions in total CE concentrations have been observed in all monitoring wells over the life of the project. While microbiological and geochemical data suggest an environment favorable for continuing reductive dechlorination, the potential for enhanced bioremediation has likely reached its limit. Accordingly, slower, localized biodegradation, along with other natural attenuation processes, will likely dominate the further reduction of CE levels. The final round of HRC injection conducted in critical areas to reestablish conditions supportive of reductive dechlorination was successful in reducing residual CE concentrations and maximizing the extent of the EISB treatment. Concentrations of CEs are now very low, and it is unlikely that additional substrate additions will result in significant benefits relative to costs. As anticipated, monitored natural attenuation (MNA) will likely be sufficient to reach TCGs.

Thus, the following recommendations are made based on the data evaluation to date and the findings and conclusions:

1) Continue groundwater monitoring (annually, beginning May 2011) and assess natural attenuation for selected wells. These will include wells which currently do not meet the Record of Decision-specified criterion of not exceeding a TCG for over 1 year, and other strategically located wells deemed necessary to assess plume dynamics.

   During the annual monitoring period, wells for which all COCs fall below TCGs for two consecutive monitoring events may be removed from the program (with regulatory concurrence). Further, if an increasing trend is observed in a particular well, monitoring of the appropriate downgradient wells will be considered and evaluated. Finally, the analytical suite may be reduced (with regulatory concurrence) over time to eliminate analyses which are not providing useful data.

2) As part of the annual monitoring, conduct soil gas and surface emissions testing:

   a) Conduct field testing for methane, carbon dioxide, carbon monoxide, oxygen, and hydrogen sulfide at select soil gas monitoring wells and probes within the plume.

   b) Conduct surface emissions monitoring (methane) for all areas within IRP Site 40, inside Buildings 240 and 239, and inside of the manholes located within the site.

   c) Conduct soil gas sampling (volatile organic compounds [VOCs] and methane) for select vapor monitoring wells and probes.

3) Address the residual (relatively high concentration) DCE and VC in the area around MW-40-37, and DCE in the area around MW-40-08 via oxidative treatment.

4) Evaluate the data in terms of COC concentrations and MNA parameters. If all COC concentrations have been below TCGs for 1 year, "no further action" would be recommended. If COC concentrations exceed TCGs in one or more cases, or have not been below TCGs for 1 year, explore one or more of the following options:

   a) Extend the monitoring period for 1 or more years to assess whether natural attenuation processes will lower residual COC concentrations to below TCGs.

   b) Consider conducting a supplemental risk analysis to assess whether residual COCs pose risks to human or environmental receptors.

   c) Consider further treatment of residual contaminants, if necessary.

5) Consider evaluating the concentrations and, if necessary, conduct active venting of the vadose zone to remove VOC contaminants.

6) The long-term monitoring program would remain in effect until monitoring data show contamination levels are below remediation goals.

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Attachment 1	Summaries of Field Activities and Data Reports (on CD only)

ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
μg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BNI	Bechtel National Inc.
CE	chlorinated ethene
cells/L	cells per liter
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-1,2-DCE	cis-1,2-dichloroethene
Cl^-	chloride ion
Cl	chlorine
CO_2	carbon dioxide
COC	chemical of concern
COD	chemical oxygen demand
CPT	cone penetrometer testing
CVOC	chlorinated volatile organic compound
DCE	dichloroethene
DHC	*Dehalococcoides ethenogenes* spp.
DNA	deoxyribonucleic acid
DO	dissolved oxygen
DON	Department of the Navy
EISB	enhanced in situ bioremediation
EOS	emulsfied oil substrate
EPA	U.S. Environmental Protection Agency
ERSE	Extended Removal Site Evaluation
FS	Feasibility Study
FSI	Focused Site Inspection
GC	gas chromatography
gpm	gallons per minute

ABBREVIATIONS AND ACRONYMS
(Continued)

HRC®	Hydrogen Release Compound
H_2S	hydrogen sulfide
IRP	Installation Restoration Program
J	estimated value
JEG	Jacobs Engineering Group Inc.
LUC	land-use control
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
MNA	monitored natural attenuation
MSL	mean sea level
mV	millivolt
NAVFAC SW	Naval Facilities Engineering Command Southwest
NAVWPNSTA	Naval Weapons Station
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ORP	oxidation/reduction potential
PCE	tetrachloroethene
PLFA	phospholipid fatty acid
ppbv	parts per billion by volume
ppm	parts per million
ppmv	parts per million by volume
RAO	remedial action objective
ROD	Record of Decision
SBNWR	Seal Beach National Wildlife Refuge
SI	Site Inspection
trans-1,2-DCE	trans-1,2-dichloroethene
TCE	trichloroethene
TCG	target cleanup goal
TDS	total dissolved solids
TOC	total organic carbon
TtEC	Tetra Tech EC, Inc.

ABBREVIATIONS AND ACRONYMS
(Continued)

VC	vinyl chloride
VFA	volatile fatty acid
VOC	volatile organic compound
ZVI	zero-valent iron

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1.0 INTRODUCTION

This report summarizes the operational status and results of the remedial action for chlorinated ethenes (CEs) in groundwater at Installation Restoration Program (IRP) Site 40 (Concrete Pit and Gravel Area) located at Naval Weapons Station (NAVWPNSTA) Seal Beach, Seal Beach, California (Figures 1-1 and 1-2). CEs of interest include tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE),and vinyl chloride (VC), which constitute the chemicals of concern (COCs) at this site. This report covers the past 5 years from October 2005 through May 2010. Tetra Tech EC, Inc. (TtEC) prepared this document for Naval Facilities Engineering Command Southwest (NAVFAC SW) under Contract Task Order 0010 of the Remedial Action Contract Program, Contract No. N62473-06-D-2201.

The Department of the Navy (DON), NAVFAC SW, directs this remedial action in accordance with requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Upon review of the site's operational history and site-specific groundwater investigative data, the DON determined that this site contained elevated concentrations of PCE and TCE in groundwater, thus requiring a response action. This decision is documented in the Record of Decision (ROD) (DON 2004). The DON initiated the remedial action for the impacted groundwater at IRP Site 40 to reduce any potential threats to human health and the surrounding environment. The remedial action was determined to be enhanced in situ bioremediation (EISB) and performance monitoring, monitored natural attenuation (MNA), and land-use controls (LUCs).

1.1 OBJECTIVE

The objective of this report is to summarize project activities conducted from October 2005 through May 2010, and to update the current status of the remedial action for treatment of CEs in groundwater at IRP Site 40. A previous comprehensive performance monitoring report was produced in 2005, which summarized implementation and initial performance of the system, including data collected from March through September 2005 (TtEC 2006a).

This report is intended to summarize all activities since that initial report. In addition, periodic summary reports were prepared and submitted to the agencies over the life of the project, which described the actions taken and analyzed the monitoring results in detail. Accordingly, this comprehensive performance report presents a general summary of the data and major site activities, and refers to the Summary of Field Activities and Data Reports (Attachment 1) for further detail.

1.2 SCOPE

The scope of this report includes 1) introductory material; 2) background information about the site, initial remedy selection, and testing that was conducted; 3) a summary of activities that have been conducted since the inception of the full-scale project (with the focus on actions conducted since September 2005); 4) an overall evaluation of remedial action performance; 5) summary and conclusions; and 6) recommendations.

1.3 REGULATORY OVERVIEW

Groundwater remediation at IRP Site 40 is being conducted as part of the IRP. The program identifies, assesses, characterizes, and cleans up or controls pollutants from past hazardous waste disposal operations and spills. The program was established to comply with federal requirements for cleanup of hazardous waste sites. These federal requirements are outlined in CERCLA, as amended by the Superfund Amendments and Reauthorization Act. The DON, under the Defense Environmental Restoration Program, follows the U.S. Environmental Protection Agency (EPA) protocols.

The primary objective of the remedial action is to protect human health and the environment. Accordingly, remedial action objectives (RAOs) and target cleanup goals (TCGs) were developed to provide objectives used to define and evaluate remedial action alternatives. Potential applicable or relevant and appropriate requirements (ARARs) were initially identified and evaluated to assist in determining RAOs and recommended TCGs. ARARs were discussed in detail in the Work Plan (TtEC 2005). RAOs and recommended TCGs are summarized in the following subsections.

1.3.1 Remedial Action Objectives

The following RAOs were developed for IRP Site 40 groundwater cleanup (DON 2004):

- Consistent with policies and regulations of EPA; State Water Resources Control Board, California Environmental Protection Agency; and California Regional Water Quality Control Board, Santa Ana Region: protect existing beneficial uses of the shallow aquifer underlying NAVWPNSTA Seal Beach to the extent practical while preventing or minimizing migration of the volatile organic compounds (VOCs) at concentrations exceeding site remediation goals beyond the current NAVWPNSTA Seal Beach boundaries.
- Protect human health by preventing extraction of VOC-impacted shallow groundwater for domestic use until site remediation goals are achieved.

1.3.2 Target Cleanup Goals

Two CEs, PCE and TCE, were the initial primary COCs for IRP Site 40 groundwater. However, since the biological degradation of PCE and TCE results in the formation of dichloroethene (DCE) and VC, these chemicals are also considered COCs.

The TCGs for IRP Site 40 groundwater were developed based on an analysis of ARARs (DON 2004) and are listed in Table 1-1. These TCGs support the RAO of restoring the shallow aquifer underlying NAVWPNSTA Seal Beach as a potential drinking water supply to the extent practical. The values listed in Table 1-1 are federal Maximum Contaminant Levels (MCLs) for drinking water promulgated by EPA and California MCLs established by the Department of Health Services, as documented in the ROD (DON 2004).

The attainment area for this remedial action is defined as the footprint of the PCE plume at IRP Site 40 at the beginning of the project as shown on Figure 1-3. The DON does not intend to establish a point of compliance for this remedial action (DON 2004).

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2.0 BACKGROUND INFORMATION

Descriptions of the facility and site, information on previous investigations, and pertinent site details and conditions are presented in this section.

2.1 FACILITY AND SITE DESCRIPTION

Descriptions of NAVWPNSTA Seal Beach and IRP Site 40 are presented in this section.

2.1.1 NAVWPNSTA Seal Beach

NAVWPNSTA Seal Beach is located about 30 miles south of the Los Angeles urban center. NAVWPNSTA Seal Beach consists of approximately 5,000 acres of land along the Pacific Coast within the city of Seal Beach in Orange County, California (Figure 1-1). NAVWPNSTA Seal Beach is bordered on the southwest by Anaheim Bay, on the north by Interstate 405 (San Diego Freeway), on the east by Bolsa Chica Road, on the west by Seal Beach Boulevard, and on the southeast by a flood control channel. Originally commissioned in 1944, NAVWPNSTA Seal Beach is part of the Navy Region Southwest. NAVWPNSTA Seal Beach provides fleet combatants with ready-for-use ordnance. Because of its geographic location, the NAVWPNSTA serves as a supply point for the operating forces of the DON and United States Marine Corps forces in the Southern California region. Figure 1-2 shows a map of NAVWPNSTA Seal Beach, including the location of IRP Site 40.

2.1.2 IRP Site 40

IRP Site 40 (Figure 1-3) includes a concrete pit located in the Locomotive Shop (Building 240) and a gravel area located north of, and adjacent to, the building. The concrete pit formerly provided a collection point for oil and solvents spilled during locomotive maintenance activities. Until 1978, oil that collected in the pit discharged into the gravel area through a drainpipe. The pipe was plugged in 1978. Currently, the area north of Building 240 is paved and the area northwest of Building 240 is unpaved. Four railroad spurs terminate in Building 240 and provide locomotive access to the repair shop.

2.2 PHYSICAL SETTING AND CLIMATE

NAVWPNSTA Seal Beach is situated at latitude 33° 45′ 27″ and longitude 118° 4′ 22″, San Bernardino Baseline and Meridian. NAVWPNSTA Seal Beach is located within the Los Angeles-Orange County coastal plain. This northwest-trending structural basin is approximately 50 miles long and 20 miles wide with deposits as much as 20,000 feet thick. Basin morphology was developed through the mechanisms of folding, faulting, erosion, and fluctuating sea levels (JEG 1994).

Most of NAVWPNSTA Seal Beach lies on predominantly flat alluvial deposits in the southeastern portion of the Los Angeles Basin. The Los Angeles Basin is bounded on the north by the Santa Monica Mountains; on the northeast by the Repetto and Puente Hills; on the east and southeast by the Santa Ana Mountains and the San Joaquin Hills; and on the south, southwest, and west by the Palos Verdes Hills and the Pacific Ocean. The land at NAVWPNSTA Seal Beach slopes evenly from approximately 20 feet above sea level in the northwestern part of NAVWPNSTA Seal Beach to sea level in the tidal flats of the Seal Beach National Wildlife Refuge (SBNWR) in the southeast (Figure 1-2). The most pronounced topographic feature at NAVWPNSTA is part of Landing Hill on the southwest. Landing Hill reaches a maximum elevation of about 50 feet (JEG 1994).

The area climate is classified as a marine-influenced Southern California coastal region with mild winters that average 52 degrees Fahrenheit (°F) and summers that average 68 F. Temperature ranges from winter lows in the 30s °F to summer highs in the 90s °F. Annual precipitation averages 12.5 inches, with approximately 90 percent occurring between the months of November and April. Although precipitation is low, a high humidity level is sustained because of the proximity of the Pacific Ocean (JEG 1994). Prevailing winds average 3.8 miles per hour from the west. Occasional strong, dry winds from the northeast, known as the "Santa Anas," occur in the fall, winter, and early spring (JEG 1994).

2.3 REGIONAL GEOLOGY/HYDROLOGY/HYDROGEOLOGY

Regional geology and hydrogeology are summarized in the remainder of this subsection.

2.3.1 Regional Geology

Affected substrate at NAVWPNSTA Seal Beach is primarily Recent Age (Holocene) alluvial deposits within the Los Angeles Basin. Sources for this alluvium were the ancestral Los Angeles, San Gabriel and Santa Ana Rivers, and Upper Pleistocene sand and clay deposits. The ancestral rivers cut trenches through the rising Newport-Inglewood uplift to depths from 120 to 180 feet below mean sea level (MSL). Soils at NAVWPNSTA Seal Beach contain abundant clay and silt and are poorly drained. Six soil types have been identified. The Bolsa series (SCS 1978) covers approximately two-thirds of NAVWPNSTA Seal Beach including IRP Site 40 (JEG 1995). These soils are somewhat poorly drained, moderately alkaline, and calcareous and have developed from largely flat alluvial and coastal deposits. The soils extend to approximately 49 inches below ground surface (bgs) and are moderately to slowly permeable.

Stratigraphic sequence underlying NAVWPNSTA Seal Beach, from youngest to oldest, is:

- Recent alluvium
- Upper Pleistocene Lakewood Formation

- Lower Pleistocene San Pedro Formation
- Pleistocene Pico Formation

Maximum thickness of recent deposits in the region is approximately 80 to 100 feet. The upper 50 feet of this unit consists of fine sands, silty clays, and clays, while the lower unit consists of alluvial sands and gravels, silty sands, silty clays, and clays. Transitional, shallow marine, and fluvial deposits of great variability are part of the Upper Pleistocene sand and clay deposits, starting at approximately 80 to 100 feet. Units are discontinuous and contain zones of high and low permeability. The maximum thickness of the Lakewood Formation is approximately 350 feet in the city of Lakewood (DWR 1961).

2.3.2 Hydrogeology

NAVWPNSTA Seal Beach is located at the southwestern corner of the Orange County Basin of the Los Angeles Groundwater Basin. The Orange County Basin contains the Artesia, Gage, Hollydale, Jefferson, Lynwood, and Silverado aquifers. The Lynwood and Silverado aquifers are merged across most of the NAVWPNSTA (JEG 1994).

There are four general aquifer zones (JEG 1994):

- A semiperched, unconfined zone within the upper recent alluvial deposits
- A confined fresh groundwater zone contained in lower recent alluvial deposits
- Late and Early Pleistocene deposits of the Lakewood and San Pedro Formations, respectively, and deposits of the Late Pliocene Pico Formation in some parts
- A confined zone of saline water underlying the freshwater zone

The principal freshwater body tapped to supply NAVWPNSTA Seal Beach is a large confined aquifer occupying two zones. The first zone is about 75 to 200 feet deep and saline; and it is no longer used for water supply. The second zone is approximately 250 to 1,000 feet deep. This aquifer is the primary water supply source both to the NAVWPNSTA and neighboring cities (JEG 1994).

The groundwater underlying the NAVWPNSTA is within the Lower Santa Ana River Groundwater Basin (Santa Ana Pressure Sub-basin) (RWQCB 1995). Beneficial uses of groundwater within the Santa Ana Pressure Sub-basin include municipal and domestic supply, agricultural, industrial service supply, and industrial process supply. Currently, shallow groundwater underlying IRP Site 40 does not serve as a water source for any of the beneficial uses designated in the Water Quality Control Plan, Santa Ana River Basin (Basin Plan) (RWQCB 1995).

Groundwater levels in the principal freshwater zone fluctuate from year to year because of variations in pumping, infiltration, and recharge. Recharge to this aquifer is primarily from unconfined upgradient areas, and from unlined rivers that are hydraulically connected to the aquifer. Seasonal variations occur with highs in the wet winter months and with lows in the dry summer months when large quantities of water are used for irrigation (JEG 1994).

2.4 SITE CONDITIONS

This section presents general information on site conditions at IRP Site 40, including observed geologic units, conceptual model, aquifer test results, groundwater flow, general groundwater chemistry, nature and extent of contamination, and contaminant fate and transport. See the Feasibility Study (FS) (BEI 2000) for more details.

IRP Site 40 is contaminated primarily with CEs. The site has a region of soil contamination and a groundwater contaminant plume extending to approximately 66 feet bgs. The lateral and vertical extent of the plume has been delineated. The groundwater gradient is relatively flat, and movement of the plume in groundwater is relatively slow. The sediments span a wide range of lithologies and grain sizes (see the cross sections in the FS [BEI 2000]).

2.4.1 Geologic Units

The geologic units observed at IRP Site 40 are as follows (BNI 1999):

- Surficial soils – Silty sands and clayey sands, as well as sandy clay and clays, with considerable lithological variation laterally
- First sand unit – Sands to silty sands within a few feet of the water table extending to 7.5 to 10 feet bgs
- Second sand unit – Saturated sands to silty sands at 9 to 21 feet bgs, extending to 28 to 41 feet
- Third sand unit – Saturated sands to silty sands at 38 to 52 feet bgs, depending on the location

Lower permeability intervals containing clay, silty clay, and silt separate the coarser-grained units noted above.

2.4.2 Conceptual Model

The site physical conceptual model (Figure 2-1) generally represents the location and assumed lateral continuity of the hydrostratigraphic units beneath the IRP Site 40 vicinity. The model incorporates the uppermost soil layer, approximately 80 feet bgs, which includes Late Pleistocene sediments of the Lakewood Formation. The model was developed during the Extended Removal Site Evaluation (ERSE) (BNI 1999).

2.4.3 Aquifer Tests/Groundwater Flow

The hydraulic conductivities of screened intervals in selected ERSE groundwater monitoring wells were determined on the basis of aquifer (slug) tests (BNI 1999). Hydraulic conductivity values, highest for the shallowest well and lowest for the deep interval wells, were as follows:

- Shallow depth (9.5 to 20.5 feet bgs), 91.01 to 103.53 feet per day
- Intermediate depth (20.0 to 30.3 feet bgs), 28.56 to 54.13 feet per day
- Deeper zone (45 to 55 feet bgs), 2.96 to 20.20 feet per day

All of these hydraulic conductivity values are typical of published values for unconsolidated silty sands to sands (Freeze and Cherry 1979).

Based on a tidal influence study from the ERSE, water levels are locally tidally influenced (BNI 1999). The data indicated that the water table occurred at an approximate depth of 8 to 9 feet bgs. There are no continuous shallow confining layers evident at IRP Site 40.

The varying effects of tidal lag time and head differences are seasonal. In October 1997, head difference between well pairs ranged from 0.04 to 0.08 foot. Pressure response from tidal fluctuations varied from 0.1 to 0.2 foot in wells. Groundwater-level contours for intermediate-depth monitoring wells showed the hydraulic gradient direction is to the southeast, toward the tidal marsh. The average gradient magnitude is approximately 0.0002. Groundwater-level contours for deeper monitoring wells indicate that the overall hydraulic gradient direction is to the southeast, toward the tidal marsh; however, the gradient direction between individual wells varies. The average gradient magnitude was also approximately 0.0002. Head differences of -0.02 to -0.14 foot between well pairs indicate a downward vertical gradient. Seasonal influences appear to change the groundwater surface levels in all three zones, although the direction does not change, and the gradient changes relatively little.

2.4.4 Nature and Extent of Contamination

Previous investigations identified the potential sources of contamination at IRP Site 40. In 1995, Jacobs Engineering Group Inc. (JEG) conducted a Site Inspection (SI) of 16 sites within Operable Unit 4, including IRP Site 40 (JEG 1995). The SI identified a release to groundwater of the chemicals of potential concern (COPCs) carbon tetrachloride and PCE (JEG 1995). The SI recommended conducting a Focused Site Inspection (FSI). The FSI report concluded that a chlorinated hydrocarbon plume containing PCE, TCE, and cis-1,2-DCE at levels exceeding MCLs exists beneath the site (JEG 1996). The FSI delineated the lateral extent of the plume in the shallow groundwater as approximately 270 feet by 200 feet, but did not determine a vadose-zone source.

Bechtel National, Inc. further investigated soil contamination at IRP Site 40 during the ERSE (BNI 1999). The ERSE concluded that the potential for continued leaching of soil COPCs to groundwater is low to negligible. Releases of chlorinated compounds migrated through the soil, resulting in a groundwater plume containing primarily PCE with lesser concentrations of TCE, cis-l,2-DCE, trans-1,2-DCE, and chloroform. However, concentrations of these compounds in the vadose-zone soil indicate most of the original releases have already leached to groundwater or volatilized to the atmosphere (BNI 1999). The ERSE concluded that the potential for transport of soil COPCs through runoff is low to negligible. The ERSE further concluded that human-health risk for soils is below the NCP-defined departure point, and site development should not adversely impact ecological receptors (BNI 1999).

The lateral and vertical extent of the groundwater contaminant plume was delineated (BNI 1999). The main contaminant, PCE, was present at depth intervals of less than 20 feet, 20 to 45 feet, and greater than 45 feet bgs. See the FS (BEI 2000) for more details.

2.4.5 Contaminant Fate and Transport

The ERSE (BNI 1999) concluded the following:

- The potential for continued leaching of CEs from soil to groundwater is low to negligible.
- There is a negligible potential for CEs to have migrated deeper than that determined by the ERSE sampling. Downward migration of CEs apparently has been limited to approximately 66 feet bgs (BNI 1999).
- A slight downward gradient was indicated by the typical head difference of 0.1 to 0.2 foot at well pairs in October 1997; thus the potential for downward migration exists. Based on the absence of significant concentrations of CEs below the second interbedded unit, the slight downward gradient has not caused an impact at lower intervals.
- Significant biodegradation of PCE has occurred, and conditions are conducive to continued degradation; therefore, natural attenuation will continue to reduce existing CE concentrations.
- The potential for the CE plume to reach the SBNWR boundary at concentrations exceeding acceptable levels is low because of lithologic controls on groundwater flow and the apparent degradation taking place.

The FS (BEI 2000) further discusses the fate and transport characteristics of contaminants at IRP Site 40.

2.4.6 Summary of Risk Analysis

The ERSE concluded that no complete exposure pathway exists between chemicals in groundwater and ecological receptors at IRP Sites 40. Thus, chemicals reported in groundwater were not evaluated further for ecological risk. For the human-health screening risk assessment, COPCs were screened by comparing their maximum reported concentrations in soil and groundwater with concentrations representing a level of acceptable risk. The basic tenet of this approach is that the risk presented by a given concentration of a chemical is acceptable when it does not exceed the concentration established by regulatory agencies. Detailed results for the human-health screening risk assessment are presented in the FS (BEI 2000) and summarized as follows for IRP Site 40.

The human-health risk screening for IRP Site 40 groundwater estimated a total cancer risk of 4.1×10^{-3} and a hazard index of 85, resulting primarily from PCE and TCE. Approximately 88 percent of the total cancer risk is from PCE, and 85 percent of the total hazard index is from PCE and TCE.

2.5 SUMMARY OF PREVIOUS STUDIES AND INVESTIGATIONS

A number of studies and investigations have been conducted at NAVWPNSTA Seal Beach. These previous investigations and information relevant to IRP Site 40 are summarized in the remainder of the following subsections.

2.5.1 Remedial Investigations

The SI conducted by JEG in 1995, found that two COPCs, carbon tetrachloride and PCE, had been released to the groundwater at this site. The SI report also recommended a FSI to evaluate the nature and extent of chlorinated hydrocarbons in the groundwater. An FSI was conducted at IRP Site 40 in conjunction with further investigations at seven additional sites in OUs 4 and 5 (JEG 1996). The FSI concluded that a plume of chlorinated hydrocarbons containing PCE, TCE, and cis-1,2-DCE was present in groundwater beneath IRP Site 40. The study delineated the lateral extent of the plume in the shallow water-bearing zone as approximately 270 by 200 feet. Because PCE, TCE, and cis-1,2-DCE were reported at levels exceeding state and federal MCLs, further action was recommended.

In 1998, an ERSE was conducted to supplement data from previous investigations at IRP Site 40 (BNI 1999). The ERSE included soil and groundwater sampling, and the findings enabled the DON to support a decision for a no further action, removal action, or further evaluation. Although no immediate threat to human health or the environment from groundwater was indicated, the ERSE Report recommended a response action to address groundwater at IRP Site 40 because the cumulative human health risk exceeded the generally acceptable range as defined in the NCP. The DON determined that the ERSE for IRP Site 40 substantially complied

with the requirements of a remedial investigation under CERCLA and that it was appropriate to proceed directly to an FS.

2.5.2 Feasibility Study

An FS Report for groundwater cleanup at IRP Site 40 (Concrete Pit/Gravel Area) was developed (BEI 2000). The FS Report did not identify or recommend a preferred remedial alternative for IRP Site 40, but EISB was evaluated. It was noted that EISB offers the possibility of significantly accelerating the overall cleanup time frame. A consideration was that intermediate by-products can be formed that may be more toxic and hazardous than the primary COCs. The technology must, therefore, be implemented in a manner that completes the anaerobic biodegradation of the CEs to harmless by-products. Because limited data existed on the technology, bench-scale and pilot-scale testing was recommended in the FS Report (BEI 2000).

2.5.3 Bench-scale Test

The bench-scale test was performed from May to October 2000. Samples of groundwater and soil were collected from the saturated zone at IRP Site 40 in April 2000. Basically, microcosms were constructed using 800 milliliters of groundwater and 100 grams of soil, supplemented with lactate, and actively monitored for 5 months.

The overall goal of the laboratory test was to verify the presence of a complete anaerobic degradation pathway with a reaction rate that could enhance the remediation time frame. The study showed that indigenous microbes capable of lactate fermentation and sulfate reduction were present in the samples obtained from IRP Site 40. Dechlorination was not reported during the bench test; however, the presence of dechlorination daughter products (cis-1,2-DCE and TCE) provided evidence that microorganisms capable of reductive dechlorination were present at the site, although they were not apparent in the bench test (BEI 2004). It was concluded that there was a good potential for stimulating reductive dechlorination at the site, but that a lag period may be expected before complete dechlorination could be observed in the field.

2.5.4 Pilot Test

Based on the results of the bench-scale test, a pilot-scale test was designed and implemented by the DON to generate the critical performance and cost data necessary for remedy evaluation and selection, and to verify that the process could meet the site's cleanup criteria (BEI 2004). Specifically, the goal of the pilot-scale test was to verify the effectiveness of EISB on PCE and its natural degradation products (TCE, DCE, VC, and ethene) at IRP Site 40.

The pilot-scale test was conducted in two phases. Phase I (conducted from July 2001 to April 2002) involved biostimulation of indigenous bacteria with sodium lactate. During Phase II (conducted from March to December 2003), bioaugmentation was conducted using a commercially available bacterial culture that was not indigenous to the site.

Reductive dechlorination was confirmed during Phase I, but the reaction process was incomplete. PCE was reduced to DCE, but DCE was not reduced further to VC or ethene. It was reasoned that an appropriate microbial consortium for complete reductive dechlorination was not present at the site. Bacterial characterization using deoxyribonucleic acid (DNA) testing indicated the absence of *Dehalococcoides* organisms, which are considered necessary for complete dechlorination from PCE to ethene to occur.

Phase II involved adding a bacterial culture (bioaugmentation) that has been shown to completely dechlorinate PCE to ethene in other aquifers. Additional sodium lactate injections were performed over a 5-month period. In the second month, a bioaugmentation was conducted using a commercially available bacterial culture capable of carrying out complete reductive dechlorination. Effects were monitored over an 8-month period using groundwater and soil gas wells. Results indicated that the bioaugmented culture was able to bring about complete dechlorination to ethene. Based on the results of the pilot-scale test, the DON believed that sufficient information was generated to select EISB with bioaugmentation, followed by MNA, as the preferred remedial alternative for IRP Site 40 (BEI 2004).

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3.0 FULL-SCALE ENHANCED IN SITU BIOREMEDIATION ACTIVITIES

The selected remedy for groundwater at IRP Site 40 is EISB, MNA, and LUCs. EISB involves stimulation of biological reductive dechlorination by addition of a suitable substrate – initially an aqueous solution of sodium lactate. Detailed explanations of the process and mechanisms are provided in the Remedial Action Work Plan (TtEC 2005) and the prior EISB performance monitoring report (TtEC 2006a). Based on pilot test results, the remedy also included bioaugmentation using KB-1, a commercially available CE-respiring bacterial culture (containing *Dehalococcoides* spp. [DHC]). In addition, the remedy was optimized using a slow release lactate-based substrate to help in treating areas where delivery of the sodium lactate solution proved problematic. Activities conducted as part of the EISB process are described below in Sections 3.1 and 3.2.

3.1 INITIAL ACTIVITIES CONDUCTED THROUGH SEPTEMBER 2005

The following is a list of the major field activities performed through September 2005 as part of the EISB remedial action:

- Installation of groundwater monitoring and injection wells, and soil gas/vapor monitoring wells and probes
- Baseline sampling and analysis of groundwater samples
- Biostimulation (sodium lactate injection) Round 1
- Biweekly and monthly field testing and monthly sampling and laboratory analysis of groundwater samples
- Bioaugmentation Round 1 (recirculation of DHC-laden water from a well which had been bioaugmented previously)
- Biostimulation Round 2 (sodium lactate injection)
- Bioaugmentation Round 2 (injection of KB-1)

These actions are summarized in the following subsections as a point of reference; details are provided in the prior EISB performance monitoring report (TtEC 2006a) and in the Summary of Field Activities and Data Reports (Attachment 1). Activities conducted since the above-listed actions (the subject of this report) are discussed in more detail in Section 3.2. An overall assessment of EISB performance to date is provided in Section 4.0.

3.1.1 Installation of Wells

The well network is shown on Figure 1-3, and well details are presented in Table 3-1. Sixteen injection wells, eight groundwater monitoring wells, and four soil gas/vapor monitoring wells were installed at IRP Site 40 between February 23 and March 11, 2005. Two additional injection wells (IW-18 and IW-19) were installed on August 19 and September 10, 2005, respectively, for a total of 18 injection wells installed. A monitoring well installed during the pilot test study (MW-40-27) was used as an injection well (IW-5). The injection wells were used for injecting sodium lactate, while the 8 new monitoring wells were used in conjunction with the 13 existing wells (installed during the previous investigations) to assess the effectiveness of the EISB. In addition, a nested probe for monitoring soil gas concentrations was installed in each of the injection and groundwater monitoring well boreholes. These probes are used for field monitoring of the soil gas concentrations, including methane and hydrogen sulfide (H_2S), and for collecting soil gas samples for laboratory analysis. For further details, refer to the EISB performance monitoring report (TtEC 2006a).

3.1.2 Baseline Analysis

Following well installation and prior to sodium lactate injection, baseline sampling was conducted from March 21 to March 25, 2005. Baseline sampling and monitoring included taking water level measurements, field testing, and collecting groundwater samples for laboratory analysis. Baseline soil gas/vapor sampling was conducted on March 28, 2005. Groundwater samples were collected from 10 newly installed (MW-40-30 through -39) and 14 previously installed monitoring wells (MW-40-01, -02, -06, -07, -08, -10, -11, -13, -14, -15, -17, -19, -20, and -22).

The baseline event included analysis for chemical and biological parameters including VOCs, dissolved gases, total dissolved solids (TDS), major anions and cations, alkalinity, chemical oxygen demand (COD), DNA, volatile fatty acids (VFA), phospholipid fatty acid (PLFA), total organic carbon (TOC), and H_2S. Field parameters included dissolved oxygen (DO), oxidation/reduction potential (ORP), specific conductivity, pH, ferrous iron, and temperature. The baseline field testing and laboratory analysis provided information on the status of the groundwater prior to implementing EISB activities and established baseline concentrations, against which subsequent measurements could be compared and assessed. For further details, refer to the EISB performance monitoring report (TtEC 2006a) and the April 2005 Summary of Field Activities and Data Report (Attachment 1).

3.1.3 Sodium Lactate Injection, Round 1

An initial round of sodium lactate injection commenced on March 28, 2005, and was concluded on May 27, 2005. The injections were conducted by groups of wells as follows. Approximately

472,000 gallons of water mixed with approximately 21,600 gallons of 60 percent sodium lactate (3 percent lactate solution) was delivered over 9 weekly cycles to 17 injection wells. The target dosing rate for all wells was 4 gallons per minute (gpm), based on the rates achieved in a single well used during the pilot test. Data showed that injection rates were reasonably consistent with the target rate. For a few of the wells the injection rates were slightly less than the target rate, varying from 1.5 to 4.6 gpm due to low-flow and low-pressure rates at the tap-water sources. However, the daily injection durations were extended slightly as needed to maintain the desired daily dosing amounts. For further details, refer to the EISB performance monitoring report (TtEC 2006a) and the April 29, 2005, and May 2005 Summary of Field Activities and Data Reports (Attachment 1).

3.1.4 Periodic Monitoring

Periodic monitoring included the following:

3.1.4.1 Biweekly Field Testing

Biweekly field testing was conducted during the initial 6 months, including during the active remediation (lactate injection) period. Field testing included testing for nitrate, sulfate, ferrous iron, carbon dioxide (CO_2), alkalinity, COD, pH, temperature, conductivity, ORP, and DO.

3.1.4.2 Monthly Monitoring

Monthly monitoring consisted of field testing and collecting samples from monitoring wells for laboratory analysis. Laboratory analyses consisted of the parameters listed above in Section 3.1.2.

3.1.4.3 Additional Monitoring and Testing

Some additional testing of the injection wells and monitoring wells was also performed on an as-needed basis for various parameters and, in several cases, to investigate several aspects of the system. During the lactate injection period, groundwater samples were collected from select monitoring wells for field testing of COD to assess migration of lactate. In addition, water levels were also measured during this time. COD and water level measurements were collected more frequently at the beginning of the EISB.

Groundwater samples were collected mainly from specified monitoring wells, but in limited instances, samples were collected from other monitoring points, including HydroPunch® locations and injection wells, to provide additional data where deemed necessary. Also, in addition to the above-listed monitoring, groundwater levels were also measured. Periodic surface emissions monitoring and soil gas/vapor monitoring were conducted as well. For additional

details, refer to the EISB performance monitoring report (TtEC 2006a) for initial assessments and the Summary of Field Activities and Data Reports (Attachment 1).

3.1.5 Bioaugmentation Round 1 (Recirculation of DHC-Laden Water from IW-5)

From the end of the pilot test to the beginning of the full-scale project, Bechtel Environmental, Inc., had been administering periodic lactate injections into well MW-40-27 (injection well IW-05), which had previously received injections of the KB-1 bioaugmentation culture (containing DHC) during the pilot study. This was done to maintain cell concentrations and viability for possible use for bioaugmenting during the full-scale project. COD and DHC were assessed in groundwater samples from IW-5 during the prior month; the cell concentration in the sample was 2.04E+08 cells per liter (cells/L), and the COD was greater than 9,000 milligrams per liter (mg/L). Accordingly, the DHC-laden groundwater from IW-05 was redistributed into the new injection wells (May 16 through May 27, 2005). Approximately 4 gpm was pumped from IW-05 and distributed evenly into two injection wells per day. Subsequent analysis was conducted during the next month to determine the success of the DHC redistribution efforts; however, results indicate that DHC counts did not increase. For further details, refer to the EISB performance monitoring report (TtEC 2006a) and the May 2005 Summary of Field Activities and Data Report (Attachment 1).

3.1.6 Sodium Lactate Injection, Round 2

A second round of lactate injections commenced on August 1, 2005. Lactate was injected into the existing injection wells (IW-1 through IW-16) and into an additional well, IW-18, which was installed in the general vicinity of monitoring well MW-40-07 (Figure 1-3). Injections were conducted 3 days per week, and each well was injected 1 day per week at 4 gpm for 8 hours. A total of approximately 1,900 gallons of 3 percent sodium lactate solution was injected into each well per day, and the total volume injected was 217,000 gallons. The bulk of the lactate injections continued until October 11, 2005, but additional injections were conducted intermittently through December 16, 2005. For further details, refer to the EISB performance monitoring report (TtEC 2006a) and the August 2005 through December 2005 Summary of Field Activities and Data Reports (Attachment 1).

3.1.7 Bioaugmentation Round 2 (Injection of KB-1)

Following the Round 2 sodium lactate injection, it became apparent that 1) reductive dechlorination of PCE and TCE to DCE continued to occur to varying degrees, 2) key geochemical data suggested that the site was substantially reduced, and 3) some, but no clear evidence of reduction beyond DCE had been obtained. Therefore, the decision was made to proceed with bioaugmentation, as specified in the Work Plan (TtEC 2005).

Site Recovery and Management (a subconsultant to TtEC) performed the bioaugmentation with the KB-1 during the week of September 19. A total of 10 injection wells were bioaugmented, including IW-3, -6, -7, -8, -9, -10, -12, -13, -14, and -15. Each well received between 12.5 and 21 L of the KB-1 culture. During the 2 weeks following the injection of the KB-1 culture, none of the inoculated wells were stimulated with sodium lactate. Injections of sodium lactate into the bioaugmented wells resumed on October 5, 2005, at a rate of 4 gpm, 8 hours per day and once a week.

The migration of the KB-1 culture during the pilot test was estimated at 17 feet downgradient over 4 months. Based on these results, it was estimated that the effects of the bioaugmented strain (KB-1) would become evident approximately 4 to 6 months after bioaugmentation occurred. The March 2006 monitoring data (collected approximately 6 months after bioaugmentation) suggested increases in DHC levels in several wells, but did not appear to suggest clear, overall increases at that time that may be attributable to the bioaugmentation action. In addition, the COC concentrations did not initially suggest clear effects of bioaugmentation, however the pathway for complete dechlorination was later observed to be present in all wells. For further details, refer to the January-March 2006 Summary of Field Activities and Data Report (Attachment 1).

3.2 MAJOR SITE ACTIONS CONDUCTED AFTER SEPTEMBER 2005

The following are the major field activities performed between October 2005 and May 2010 as part of the EISB remedial action:

- Periodic monitoring of groundwater (water level measurement, groundwater sampling and analysis, soil gas sampling and analysis, and surface emissions monitoring)
- Optimization evaluation
- Hydrogen Release Compound (HRC®) injection (Round 1)
- Investigation beneath Building 240
- HRC injection, Round 2

These actions are discussed in the following subsections. Discussions are brief for actions that are described in the Summary of Field Activities and Data Reports (Attachment 1), and more detail is provided for actions that were not fully documented therein. Section 4.0 presents an overall assessment of EISB performance. A composite of the COC concentration contours based on September 2005 data is shown on Figure 3-1. Figure 3-1 will be used for comparison with the data collected in May 2010 and presented on Figure 4-5 to demonstrate the effectiveness of site remediation.

3.2.1 Periodic Monitoring

Monitoring consisted of field testing and collecting samples from various monitoring points for laboratory analysis. Laboratory analyses generally consisted of the parameters listed in Section 3.1.2. As with the pre-2006 sampling, groundwater samples were collected mainly from specified monitoring wells. However, in limited instances, samples were collected from other monitoring points, including HydroPunch locations and injection wells, to provide additional data where deemed necessary. Also, in addition to the above-listed monitoring, groundwater levels were measured. Surface emissions monitoring and soil gas/vapor monitoring were conducted as well. For details on wells/points sampled and results, refer to the January 2006 through May 2009 Summary Reports (Attachment 1).

3.2.2 Optimization Evaluation

Over the course of the process monitoring, it was observed that lactate distribution was adequate in some areas of the site, and the EISB process performed as expected at those locations. However, data indicated that lactate migration has been inconsistent across the site, and some areas did not receive adequate lactate. Specifically, for the shallow interval groundwater monitoring wells, CE treatment had not been effective in the central portion of the site as evidenced by minimal reduction in CE levels in groundwater monitoring wells MW-40-30, -32, -36, and -37 (Figure 1-3) (TtEC 2006b). Thus, alternative approaches were considered for enhancing the current EISB system, including improving the delivery and distribution of lactate (and potentially KB-1) to the specific areas where cleanup is required and lactate migration has been limited.

3.2.2.1 Summary of Additional Investigation

Investigations were conducted in the central portion of the site to aid in assessing options for optimizing remediation at IRP Site 40 (TtEC 2006b). These investigations focused on assessing 1) lithologic variation within the areas where lactate transport was not optimal; 2) COC distributions, based on both monitoring well and injection well data; and 3) lateral and vertical extent of lactate (as reflected by measurement of COD). The results of the investigations were presented to the agencies on August 23, 2006 (TtEC 2006c), and the findings are summarized below:

- The shallow aquifer in the central portion of the site (where the highest concentrations of COCs are present) was characterized as primarily silty sand with generally increasing sand content (and associated inferred increasing permeability) with depth.
- Significant concentrations of all COCs remained, with the highest concentrations generally in the vicinity of groundwater monitoring wells MW-40-30, -32, -36, and -37 (Figure 1-3).

- Degradation of DCE was only clearly evident in groundwater samples collected from the area where the previous pilot test was conducted, from middle interval monitoring wells where lactate migration was efficient, and from injection wells that had been inoculated with KB-1.
- Lateral plume migration appeared to be occurring to a limited degree in the shallow and mid-shallow intervals.
- While remediation did appear to have been effective in the injection well areas, the actual radius of remediation in the shallow interval in the central portion of the site appeared to be relatively small (less than 10 feet), with significant concentrations of COCs reported between "clean" injection wells and the nearest monitoring wells.
- COD data suggested a general radius of influence on the order of 10 feet or less in the shallow interval under the current injection scheme, rather than the 25-foot radius of influence observed in the pilot test.
- The overall low concentrations of COD near injection wells (generally below 100 mg/L) in the shallow part of the aquifer, and the presence of COD at concentrations over 2,000 mg/L in the mid-shallow monitoring wells located over 200 feet downgradient from the nearest injection well, indicated that lactate was readily migrating downward (vertically) and downgradient from the injection wells.
- The silt and silty sands/sandy silts present in the upper part of the aquifer in the center of the study area favored downward migration of lactate and inhibited the horizontal migration of lactate in the shallow part of the aquifer.
- Complete degradation was evident in samples collected from the area where the previous pilot test was conducted, from middle interval wells where lactate migration was efficient, and from injection wells that had been inoculated with KB-1.
- Overall, it appeared that if substrate could be distributed, complete reductive dechlorination would likely occur, and KB-1 had the potential to enhance the process.

Based on these findings and past monitoring data, optimization options were screened and the preferred option was selected (TtEC 2006b), as summarized in the following section.

3.2.2.2 Rationale for Selection of HRC for Optimizing Treatment

The selection process was streamlined by considering only approaches that were reasonably amenable and potentially cost-effective with respect to this site (a fairly dilute, nonmobile, dispersed plume). Hence, approaches such as electrical resistance heating and pump and treat, which are generally considered expensive and/or cumbersome, were not considered. In addition, since reducing conditions were established at the site and bioaugmentation had already taken place, approaches that were potentially applicable but incompatible with a highly reduced subsurface environment and MNA (e.g., in situ chemical oxidation and air sparging/soil vapor extraction) were initially considered but eliminated during a preliminary screening (TtEC

2006c). Based on the analysis, the following options were considered applicable for optimizing treatment of CEs at the site:

- Variations on the current in situ biological reductive dechlorination approach
  - Enhancements to the current lactate injection system
  - Enhancing lactate distribution via recirculation
  - Application of more persistent electron donor options (emulsfied oil substrate [EOS], Newman Zone, and HRC)
- Zero-valent iron (ZVI) treatment

Of these, application of HRC was selected as the preferred option for enhancing the system. The rationale was as follows:

- HRC is a slow-release substrate that does not require a high-volume injection method. HRC is injected in a high-viscosity, high-concentration state directly into the groundwater. No dilution is performed. The other more persistent substrates considered, EOS and Newman Zone, are injected on a diluted basis ranging from 2 to 10 percent substrate to water basis. The total injected volume for HRC would be approximately 2,500 gallons versus 100,000+ gallons for EOS and Newman Zone.
- Cone penetrometer testing (CPT) data showed poor lateral distribution of lactate via direct hydraulic pumping of lactate solution (less than 10 feet in tested areas). EOS and Newman Zone substrates, which are also injected with high volumes of water, can be expected to follow the same hydraulic distribution pattern as the lactate solution, and thus it is likely that poor lateral distribution would also be experienced with these other substrates.
- HRC can be laterally distributed most effectively by diffusion compared to the other substrates. Diffusion is mostly a function of concentration, and not soil type. Therefore, the high concentration of emplaced HRC will drive diffusive transport of the substrate in fine-grained soils at a higher rate than the other substrates, injected at lower concentrations (due to dilution with water). HRC is suited for achieving lateral distribution of substrate in the shallow groundwater zone due to the diffusion mechanism, and allows for the dosing of shallow groundwater not previously dosed via direct hydraulic pumping.
- HRC most likely has the longest residence time in the groundwater compared to the other substrates (EOS, Newman Zone, and lactate).
- Recirculation is not likely to enhance the process due to unfavorable geology. As indicated in the CPT logs, progressively sandier soils with depth will cause the same transport problems in a recirculation system as were encountered during direct pumping of the lactate solution into the subsurface. Vertical transport through coarser soils will be the preferred path of extracted and reinjected groundwater rather than horizontal transport through the shallower finer soils, and thus a crossgradient flow

will not be favored. Furthermore, unlike the lithology in the pilot test area, there is no confining clay layer in the full-scale treatment area to limit transport in the vertical direction and to promote the formation of groundwater circulation cells during pumping.

- ZVI technologies may have several technical advantages over bioremediation (potentially faster, more predictable reactions). However, ZVI technologies are not cost-competitive at this phase of the project. It would be more cost-effective to continue to optimize the biological approach rather than to implement a new approach.

3.2.3 HRC Injection, Round 1

The first application of HRC was conducted in April 2007. A total of 18,300 pounds of HRC material was procured from Regenesis Bioremediation Products located in San Clemente, California. The material was injected into the groundwater at 109 locations (at 95 locations in the central portion of the plume between Buildings 240 and 239, at 7 locations around well MW-40-07, and at 7 locations around well MW-40-34) to address areas where the lactate distribution under the initial treatment scenario was not effective. The injection field in the central portion of the plume consisted of an array of 9 by 11 injection points, covering an area of approximately 90 feet by 110 feet. The injection points had a spacing of approximately 10 feet, and each row was offset 5 feet from the next row to optimize coverage of the area. Round 1 HRC injection locations are depicted on Figure 3-2. For further detail, refer to the April 2007 Summary Report (Attachment 1) and the Work Plan (TtEC 2005).

3.2.4 Investigation Beneath Building 240

Following the initial HRC injection, it was concluded based on subsequent groundwater monitoring data that: 1) EISB has been very effective in reducing COC levels in groundwater, 2) reduction of residual COCs could be expected to continue, although probably at a reduced rate, and 3) the site was approaching a point where (as planned) MNA would likely be sufficient for COCs in groundwater to reach TCGs. However, there was some uncertainty about the time frame to reach TCGs and the potential for contaminant rebound to occur (as potentially suggested by increased COC levels reported in sample results from monitoring well MW-40-14).

The potential for further COC rebound in the vicinity of MW-40-14 was thus investigated by collecting groundwater samples at various depths from inside the locomotive maintenance shop (Building 240; refer to Figure 3-3) to assess possible residual or source contamination. These samples were also analyzed for COD, and one sample was analyzed for DHC. Direct-push technology using a CPT rig was used for collecting the samples. CPT and groundwater sampling was conducted in accordance with the procedures described in the final Addendum 2 of the final Sampling and Analysis Plan (TtEC 2008).

The sampling analysis data essentially indicated low concentrations of PCE, TCE, DCE, and VC in the samples, generally at the shallower sampling depths. The concentrations were consistent with those reported elsewhere at the site, and thus there was no evidence of a major contaminant source. Results are presented and discussed in the November 2008 Summary of Field Activities and Data Report (Attachment 1). Additional details on the rationale for the investigation can be found in the April 2008 and August 2008 Summary of Field Activities and Data Reports (Attachment 1).

3.2.5 HRC Injection, Round 2

A final round of HRC injection (Round 2) was conducted during October 23 and November 17, 2008, to address the area downgradient of Building 240 and other residual contamination at the site. To the extent practicable, this was expected to: 1) maximize (increase the rate and extent of) the treatment processes, which were likely substrate limited at the time, 2) reduce the time frame for MNA to act to meet TCGs, and 3) help guard against future contaminant rebound. For this application, approximately 25,000 pounds of HRC was injected at 186 locations in the subsurface within the site. Of those, 22 were located within Building 240, and the remaining 164 locations were outside the building. Round 2 HRC injection locations are shown on Figure 3-3.

The HRC application was conducted as specified in the August 2008 Summary of Field Activities and Data Report (Attachment 1). The application is discussed in more detail in the November 2008 Summary of Field Activities and Data Report (Attachment 1). Additional details on the rationale can be found in the April 2008 and August 2008 Summary of Field Activities and Data Reports (Attachment 1).

Assessment of the effects of the HRC application is discussed in the May 2009 Summary of Field Activities and Data Report (Attachment 1). In general, the HRC was effectively distributed within areas where residual COCs were present; however, some variability in COD data suggested that the HRC distribution was not uniform, which is consistent with results from past efforts to achieve substrate distribution at this site. Overall, the final round of HRC injection was considered successful in reestablishing conditions supportive of reductive dechlorination in critical areas, and in reducing residual COC concentrations and maximizing the extent of the EISB treatment. It was further concluded that, given the low COC concentrations remaining, it was unlikely that further addition of substrate would be beneficial.

4.0 OVERALL REMEDIAL ACTION PERFORMANCE EVALUATION

This section is an overall evaluation of the EISB remedial action based on data collected to date (May 2010). The evaluation consists of an overview of the major aspects of treatment, including assessment of the effects on 1) groundwater (groundwater elevations, COCs, geochemical parameters, and microbiological parameters) and 2) soil gas (surface emissions monitoring and soil gas/vapor monitoring). This evaluation is intended to be general in nature, focusing on overall trends of selected critical monitored parameters in key monitoring wells and the plume delineations based on the most current data. The monitoring well selection was based on location within or adjacent to the treatment area and on prior history of COC detections (i.e., wells not providing data indicative of treatment effectiveness and current plume configurations are not discussed herein).

As noted above, periodic status reports were prepared during the implementation, monitoring, and optimization phases, which documented details and critical aspects of ongoing site activities. (Attachment 1). These reports provide a more detailed history of project planning, execution, and performance over the past 5 years. For a complete list of monitoring parameters, field procedures, and analytical methods, refer to the Work Plan (TtEC 2005).

4.1 GROUNDWATER ASSESSMENT

The following subsections document major trends and current groundwater conditions in key monitoring wells based on monitoring well data collected from October 2005 through May 2010.

4.1.1 Groundwater Level Measurements

Groundwater level measurements were collected monthly from all wells during the initial bioremediation phase from March 2005 through March 2006. After that, through October 2008, groundwater levels were measured quarterly. Subsequently, in May 2009 and May 2010 groundwater level measurements were collected.

Appendix A of the final report will include groundwater contour maps (Figures A-1 through A-4) for the four quarters (January, April, July, and October) in 2008 (the last year that monitoring was conducted quarterly) using data from wells screened at similar intervals. The 2008 data show minor seasonal variations in groundwater levels. Based on the contour maps, the groundwater flow direction is generally towards the southeast. The calculated flow gradients for the four quarters (January, April, July, and October) in 2008 were 0.0037, 0.0064, 0.0035, and 0.0027 foot/foot, respectively. Figure 4-1 shows measured groundwater levels in several key groundwater monitoring wells at the site. Groundwater level measurement data

collected from November 2005 through May 2010 for key monitoring wells are presented in Table 4-1 and shown on Figure 4-1.

The May 2010 groundwater contour map (Figure 4-2) uses the same wells used to construct the groundwater contour maps in Figures A-1 through A-4. The groundwater flow direction in May 2010 was very similar to the flow direction depicted on Figures A-1 to A-4 for 2008 monitoring results.

Groundwater level measurements for all wells at the site are provided in Table A-1 in Appendix A. Groundwater level measurements were collected using a Solinst water-level meter. The water level was measured from the top of the casing to the top of the water to the nearest 0.01 foot. All measurements were recorded in the field on appropriate forms. As shown on Figure 4-1, some minor variability in water levels was observed initially, possibly due to the sodium lactate injections (injections were conducted intermittently through December 2005 – refer to Section 3.1). However, following that time, the levels were relatively stable, exhibiting a general decreasing trend through 2007, 2008, and 2009 (consistent with drought conditions in Southern California during that period), and increasing in 2010, consistent with increased precipitation in the winter of 2010. However, groundwater elevation trends since the start of the project (March 2005) show an overall general declining trend in groundwater level at the site. Groundwater levels ranged from approximately 1.5 to 2.5 feet above MSL in November 2005 to about 1.0 to 2.0 feet above MSL in May 2010, with an average decline of approximately 5 inches.

Groundwater levels measured during the most recent monitoring event (May 2010) are contoured on Figure 4-2.

Groundwater level measurements were collected during the May 3, 2010 annual monitoring event. During that event, groundwater elevations in the 43 site wells ranged from 0.40 foot below MSL in IW-5 to 2.08 feet above MSL in MW-40-34. In general, water level measurements collected in May 2010 indicate an average elevation increase of approximately 5.5 inches across the site, compared with groundwater levels measured during the previous monitoring event in May 2009.

4.1.2 Dechlorination Assessment/General Performance Assessment

The major mechanism for biodegradation of CEs is reductive dechlorination, whereby CEs serve as terminal electron acceptors during anaerobic respiration (in the presence of a suitable substrate). In this process, chlorine (Cl) atoms are removed from the respective parent compounds, forming less chlorinated metabolites and the chloride ion (Cl^-). The generalized pathway for destruction of CEs can be represented as follows:

$$PCE \Rightarrow TCE+Cl^- \Rightarrow DCE+Cl^- \Rightarrow VC+Cl^- \Rightarrow ethene \Rightarrow ethane \Rightarrow CO_2 \text{ and } H_2O$$

Ethene and ethane are innocuous and are easily degraded aerobically or microaerophilically.

The dechlorination process is assessed by interpreting the degradation of parent compounds (PCE and TCE) and formation and subsequent degradation of daughter compounds (DCE and VC) over time. In a complete reductive dechlorination process, PCE disappearance will lead to an increase in TCE, which will gradually decrease as DCE is formed, which gradually decreases to form VC and so forth as shown in the above equation. In some cases, DCE is not degraded but accumulates in groundwater. This is a process known as "DCE stall," and has been attributed to a lack of DCE-dechlorinating bacteria, specifically DHC.

The pilot test data suggested that native DHC organisms were not present at IRP Site 40 and that bioaugmentation was needed to avert DCE stall. While what is believed to be a native DHC strain has since been detected, the stall was observed in several wells early on in the full-scale project. Hence bioaugmentation was conducted using KB-1 (refer to Section 3.1).

A summary of dechlorination in groundwater is presented below. More details are available in the Summary of Field Activities and Data Reports (Attachment 1).

4.1.2.1 COC Concentration Trends

COC results from October 2005 through May 2010 are presented in Table 4-3 and are shown spatially on Figures 4-3, 4-4, and 4-5. Refer to Table 1-1 for a list of TCGs. Based on the data presented on Figure 4-4, it is notable that the cis-1,2-DCE concentration measured in well MW-40-08 was considerably higher in May 2010 than the concentration measured during the prior event (May 2009). The elevated cis-1,2-DCE concentration measured in May 2010 is not consistent with historical contaminant levels, however it is likely due to the degradation of PCE from this area or from upgradient areas.

4.1.2.2 Molar Basis

COCs trends (molar basis) are shown graphically for each well on Figure 4-6. In most cases, the characteristic pattern of parent compound complete degradation and disappearance followed by daughter product generation and subsequent degradation was generally observed. However, in all cases, equimolar production of daughter products was not evident, and loss of contaminant mass via processes other than biodegradation (i.e., natural mechanisms such as advection, dispersion, volatilization, and dilution) likely occurred to some extent. In a closed system, the total amount of the CE would be expected remain relatively constant on a molar basis; however, but this is not necessarily expected in this case, as it is an open system.

4.1.3 Current Plume Assessment

This subsection provides a summary of data collected in May 2010 followed by key observations regarding COC concentrations in the selected groundwater monitoring wells sampled during the May 2010 event. Note that for the following discussions, a concentration followed by the letter "J" indicates that the concentration is an estimated (trace) value.

Included in this assessment are monitoring wells MW-40-08, -13, -14, -22, -31, -35, and -39; and injection wells IW-1, -4, -6, -12, -14, and -16 (used for sodium lactate injection during the initial injection phase). COD has been measured over the duration of the project to evaluate lactate presence and to assess the migration and persistence of HRC near these wells. VFAs, including acetic acid, propionic acid, and butyric acid, have been measured as well in samples from monitoring wells MW-40-07, -30, -34, and -37 and injection well IW-6. These compounds are breakdown products of substrate injection, and their presence indicates that microbial activity is occurring as microbes degrade the substrate.

Using data from the most recent monitoring event (May 2010), the extents of the composite plumes were delineated for COC compounds exceeding TCGs. Summary of the groundwater analytical results for May 2010 sampling event are presented on Table 4-2. At this time, only cis-1,2-DCE and VC are present at concentrations exceeding TCGs. The estimated cis-1,2-DCE and VC plume boundaries are depicted on Figure 4-5. The data indicate that a low level residual VC plume is present beneath the central portion of the site. In addition, a smaller, residual cis-1,2-DCE plume is present to the southeast of the contaminant source area and downgradient of Building 240.

4.1.3.1 COC Concentrations

Figures 4-3 and 4-4 present historical COC concentrations over the life of the project through May 2010 for the shallow and mid-shallow wells. Appendix B presents a summary of all analytical data including the COC concentrations for all wells sampled for this reporting period (October 2005 through May 2010). Figure 4-5 shows only the concentrations from the May 2010 event and interpreted plume delineations based on the May 2010 data.

During the May 2010 sampling event, a combination of 19 wells (13 monitoring wells and 6 previously injection wells) were sampled. COC concentrations are discussed below:

- PCE was reported at a concentration of 0.49 J micrograms per liter (µg/L) in monitoring well MW-40-39. Concentrations of PCE in all other remaining wells were reported as not detected.

- TCE was reported as not detected in seven wells (IW-1, IW-14, MW-40-13, -31, -32, -34, and -39). TCE concentrations in the remaining 12 wells ranged from 0.26 J μg/L (MW-40-35) to 4.1 J μg/L (MW-40-37). All TCE concentrations were below the TCG of 5 μg/L.
- cis-1,2-DCE was reported as not detected in four wells (IW-14, MW-40-13, -34, and -39). Concentrations of cis-1,2-DCE reported in the remaining 15 wells ranged from 0.40 J μg/L (in the samples collected from IW-1 and IW-4) to 90 μg/L (MW-40-37). Samples from 17 of 19 wells had cis-1,2-DCE concentrations below the TCG of 6 μg/L. Only samples collected from wells MW-40-08 and -37 had cis-1,2-DCE concentrations of 27 and 90 μg/L, respectively, which exceeded the TCG of 6 μg/L.
- VC was reported from not detected to 42 μg/L (in a sample from well MW-40-37). Samples from 8 of 19 wells had VC concentrations below the TCG of 0.5 μg/L. Samples from 10 of the 19 wells had VC concentrations above the TCG of 0.5 μg/L but below 10 times the TCG.

A notable COC increase was observed in monitoring well MW-40-37 (DCE from 46 to 90 μg/L; VC from 13 to 37 μg/L).

Notable COC decreases versus prior results were also observed in MW-40-14 (PCE from 8.7 μg/L to not detected, TCE from 36 to 0.92 J μg/L, DCE from 19 to 1.3 μg/L, and VC from 23 to 3.1 μg/L).

Appendix C includes chains of custody and laboratory analytical results for samples collected in May 2010, and Appendix D includes the groundwater sampling field data for the May 2010 sampling event.

The decreases in concentrations of COCs in the majority of the wells could potentially be attributed to biodegradation and other attenuation mechanisms over time. For the few instances where increases are observed, these increases may be due to desorption/migration of transient pockets of contamination, which is common at sites such as this and others with similar characteristics.

4.1.3.2 COD and VFAs

COD and VFA data are presented in Table 4-4 and discussed below:

- COD levels were generally variable, but were high in the following plume wells (where contamination had been persistent in the past): IW-14 (2,580 mg/L), and IW-6 (2,070 mg/L). The COD concentrations in IW-14 and IW-6 are significantly elevated over concentrations measured during the prior (May 2009) event (45 and 94.4 mg/L, respectively). This indicates the continued presence of HRC in the areas of these wells.

- Relatively high COD concentrations were also reported in MW-40-35 (502 mg/L), and IW-12 (406 mg/L). However, COD in MW-40-35 had decreased from the elevated level measured in this well during the prior (May 2009) event (1,300 mg/L).
- COD levels in other locations were variable, ranging from 19.5 mg/L (MW-40-39) to 79.6 mg/L (MW-40-30).
- VFAs were measured in wells MW-40-07, -30, -34, and -37. As shown in Table 4-4, one or more VFAs were reported in wells MW-40-07, and MW-40-30, where COD concentrations were 51.6 mg/L (MW-40-07) and 79.6 mg/L (MW-40-30). VFAs were not reported in wells MW-40-34 and MW-40-37, both of which had a COD concentration of 29.5 mg/L. VFAs were also detected in well IW-6, which had a COD concentration of 2,070 mg/L (IW-6). Thus, the presence of VFAs in areas where COD was elevated indicates continued microbial activity in those areas.
- It is possible, as in the case of MW-40-37, for contaminant concentrations to decrease with no apparent increase in COD or VFAs. Because this is an open system, this could be a result of treated groundwater migrating from upgradient treatment areas.

4.1.3.3 Plume Interpretations

Interpretations of the current plume are discussed below:

- As shown on Figure 4-5, PCE and TCE in all samples collected during the May 2010 monitoring event were below their TCGs (5 μg/L for both COCs) Monitoring well MW-40-14, which was the only well with PCE, TCE, and DCE exceeding their TCGs during the prior event in May 2009, had reported not detected, 0.92 J, and 1.3 μg/L concentrations, respectively, in May 2010. These reductions in COCs concentrations are likely due to the high COD level (resulting from the second round of HRC injection) measured in this well during the May 2009 monitoring event (3,350 mg/L). The COD concentration in this well has since decreased to 43.6 mg/L in May 2010. VC concentrations in this well also decreased significantly from 23 to 3.1 μg/L, respectively, from May 2009 to May 2010 likely due to microbial activity.
- DCE exceeds its TCG (6 μg/L) only in two small localized areas in MW-40-08 (27 μg/L) and MW-40-37 (90 μg/L). DCE concentrations increased in these two wells since the previous monitoring event in May 2009 from 5 and 46 μg/L, respectively. This may be due to contaminant desorption resulting from the HRC injection and further breakdown of PCE and TCE to DCE in this area.
- Low concentrations of VC, generally in the 0.6 to 4.6 μg/L range, form a residual plume in the central portion of the site. The only two wells with VC exceeding 10 times the TCG (0.5 μg/L) were MW-40-08 (27 μg/L) and MW-40-37 (37 μg/L). VC concentrations increased in these two wells since the previous monitoring event in May 2009 from not detected and 13 μg/L, respectively.

It is clear that substantial reductions in COCs have been achieved following the two rounds of HRC injections in the central area of the site (April 2007 and November 2008), PCE and TCE concentrations are below their TCGs, and in most cases DCE concentrations are below the TCG. VC concentrations in 8 of 19 wells are below the TCG, and in 9 of 19 are near TCGs and decreasing. While increases in DCE and VC levels in MW-40-08 and MW-40-37 were noted during the May 2010 event, the next annual event should help determine whether or not this trend is transitory.

4.1.3.4 Status with Respect to Achieving Remediation Goals

Major reductions in contaminant concentrations have been observed in all key monitoring wells. As can be seen in Table 4-3, PCE and TCE have been reduced below their TCGs (5 μg/L for both compounds), and concentrations have been below TCGs for over a year in all wells except MW-40-14 (PCE and TCE concentrations exceeded TCGs in MW-40-14 during the prior [May 2009] monitoring event). PCE concentrations in MW-40-14 showed a rebound since the April 14, 2008, sampling event. Similarly, TCE concentrations in MW-40-14 have fluctuated since the remedial action was first implemented (Table 4-3). The only COCs currently exceeding respective TCGs are cis-1,2-DCE (MW-40-08 [27 μg/L] and MW-40-37 [90 μg/L]) and VC (4 μg/L or less in MW-40-07, -14, -30, -31, -32, and -36, and a higher concentration of 37 μg/L in MW-40-37). The TCGs for cis-1,2-DCE and VC are 6 and 0.5 μg/L, respectively.

4.1.4 Substrate Indicator Parameters – Chemical Oxygen Demand and Volatile Fatty Acids

COD was measured in monitoring wells to track the presence of the substrate (sodium lactate or HRC), and to track its area of influence. In addition, lactate (either as sodium lactate or HRC) is biodegraded to form VFAs, which generally include acetic acid, butyric acid, propionic acid, and pyruvic acid. Accordingly, VFAs were also measured periodically to establish and/or to assess whether or not the substrate was being metabolized as expected. Data for COD and VFAs are presented in Table 4-4 and shown graphically over time on Figure 4-7. As with the other data, detailed periodic descriptions of lactate injections and results of COD and VFA measurements are provided in Attachment 1 (refer to Sections 3-1 and 3-2), and a general assessment is provided below.

4.1.4.1 Chemical Oxygen Demand

Sodium lactate injections ceased in September 2005 (refer to Section 3.1). COD data collected during October 2005 suggest that residual substrate was present in several wells, notably MW-40-07, -14, -31, and -35. However concentrations were generally decreasing at that time or thereafter, and substrate levels (denoted by COD) were low in other wells. By the end of 2006, substrate levels were low (near background, in most cases) in all wells except MW-40-35.

The first HRC injection was conducted in April 2007. This appears to have led to variable COD increases in wells MW-40-7, -32, -34, and -36. The second HRC injection was conducted during October to November 2008. Overall, this action appears to have had less of an effect in terms of distributing measurable substrate than the initial HRC application, as reflected by generally stable COD levels following the application (Table 4-4, Figure 4-7).

TOC, which is an additional parameter used to track organic amendments in EISB, was also measured in several wells to supplement COD readings in assessing HRC migration. Results are presented in Appendix B1. TOC concentrations ranged from 3.41 mg/L (MW-40-34) to 705 mg/L (IW-6). A significant decrease in TOC concentrations was observed in May 2010 in MW-40-14 and MW-40-30 (3.65 and 14.6 mg/L, respectively) compared to May 2009 results for the same wells (1,170 and 376 mg/L, respectively). Also, there was a significant increase in TOC concentration in well IW-6 (705 mg/L) in May 2010, compared to May 2009 (17.6 mg/L). TOC and COD measurements in May 2010 correlated well, with the highest TOC concentration in well IW-6 (707 mg/L), which also had the highest COD concentration (2,070 mg/L).

4.1.4.2 Volatile Fatty Acids

VFA data are presented in Table 4-4 and included on Figure 4-7. VFAs were sporadically detected, with acetic acid, butyric acid, and propionic acid being the main species present. As shown on Figure 4-7, VFA detections tracked reasonably well with elevated COD, thus indicating that where substrate delivery was achieved, microbial activity was stimulated.

4.1.5 Select Geochemical Parameters

Geochemical parameters were measured in monitoring wells in support of process assessment through field and laboratory analyses. A number of geochemical parameters were monitored during the project; however, some were eliminated because they were not providing useful information. Detailed assessment and explanation of geochemical analysis are provided in the Summary of Field Activities and Data Reports (Attachment 1). The discussions below focus on several key parameters, including DO, ORP, nitrate, sulfate, biogenic gases (methane and ethane), pH, and sodium.

4.1.5.1 Terminal Electron Acceptors

A variety of terminal electron acceptors can be used sequentially by soil microorganisms, in conjunction with biological oxidation of a substrate (lactate). The preferred electron acceptor for facultative bacteria (capable of aerobic or anaerobic respiration) is oxygen, which provides the greatest amount of energy for growth. When oxygen becomes depleted, alternate electron acceptors, including nitrate and sulfate, are preferentially used. Thus, lactate-driven biological

activity should be reflected by depressed levels of electron acceptors DO, nitrate, and sulfate. This generates a strongly reducing environment, which is favorable for reductive dechlorination.

ORP measurements provide an additional means for assessing the subsurface oxidation/reduction environment. In general, positive ORP values represent an oxidized system (not favorable for reductive dechlorination), and negative ORP values generally represent a reduced system, which is favorable for reductive dechlorination. Further, the more negative the ORP values are (to approximately -250 millivolts [mV]), the more favorable the system would be for reductive dechlorination.

Dissolved Oxygen and Oxidation/Reduction Potential

DO and ORP data are provided in Table 4-5 and trends are depicted on Figure 4-8. DO was present only at very low concentrations at all monitoring locations during all monitoring events, indicating that the system was anaerobic throughout the period of interest. Based on the May 2010 readings, DO concentrations in the monitoring wells ranged from as low as 0.06 mg/L to 0.39 mg/L, with one anomalous reading of 1.14 mg/L in injection well IW-4 (given limitations associated with measuring DO in the field, DO readings of less than 0.5 mg/L essentially suggest that oxygen is not present). The 2010 DO measurements were similar to May 2009 measurements.

ORP data on Figure 4-8 show that ORP values were generally positive or slightly negative during the period preceding the HRC injections (April 2007 and before). However, after the HRC injections, decreases in ORP were observed in most wells, and the system remained strongly reduced throughout most of 2007 and 2008. More recent ORP data collected in 2009 and 2010 reflect general increases in ORP values, which indicate that the HRC is likely being exhausted. ORP values measured during the May 2010 event were negative for all 19 monitoring points, ranging from -42 mV in MW-40-39 (a downgradient well) to -259 mV in IW-16. While ORP values below -100 mV are considered optimal, values in the negative range generally reflect reducing conditions favorable for reductive dechlorination.

Nitrate and Sulfate

Nitrate and sulfate data are provided in Table 4-5, and trends are depicted on Figure 4-9. Nitrate was present at very low levels initially, mainly at 1 to 2 mg/L or less. Over time, however, even low-level nitrate concentrations decreased to not detected or trace levels in all wells from which samples were analyzed, indicating the active reducing nature of the subsurface system. Sulfate was initially present in highly variable but significant concentrations prior to the HRC injections. However, following the first HRC injection (April 2007), decreases were observed in many of the wells in which it was consistently measured, indicating optimal conditions for reductive dechlorination. Nitrate was either not detected or detected at very low concentrations in samples

collected during the May 2010 annual monitoring event, and sulfate levels ranged from 0.88 mg/L (MW-40-32) to 238 mg/L (MW-40-37), which have DCE and VC concentrations of 90 and 37 μg/L, respectively.

Total Dissolved Solids

TDS were measured only in wells IW-1, MW-40-07, -08, -22, and -39 during the May 2010 event to help in assessing secondary groundwater effects due to the injections. The highest TDS level was measured in downgradient well MW-40-39 (2,080 mg/L), which is an increase from the May 2009 reported concentration of 1,050 mg/L. The TDS concentrations in upgradient well IW-1 was 1,140 mg/L, significantly lower than the May 2009 concentration of 4,210 mg/L. The COD level in this well was only 53.6 mg/L (a significant decrease from the May 2009 COD concentration of 6,420 mg/L).

The TDS concentrations in upgradient well MW-40-22 was 2,060 mg/L and very similar to the May 2009 concentration of 2,020 mg/L. The COD level in this well was 23.5 mg/L. Another TDS result from a sample collected from MW-40-07 (in the downgradient portions of the site) was 1,900 mg/L. The lowest TDS level was measured in crossgradient well MW-40-08 (1,110 mg/L). COD levels in these wells ranged from 19.5 to 53.6 mg/L.

For comparison, baseline (March 2005) TDS levels for the monitoring wells were: 1,360 mg/L for MW-40-07; 1,050 mg/L for MW-40-08; 2,230 mg/L for MW-40-22; and 2,120 mg/L for MW-40-39 (TtEC 2006a). Thus, it can be observed that the current TDS concentrations are relatively consistent with baseline concentrations.

4.1.5.2 Biogenic Gases

Gaseous by-products of various biological processes (biogenic gases) discussed briefly herein include methane and ethane (Table 4-5 and Figure 4-10). Methane is produced when carbon dioxide is used as a terminal electron acceptor under strongly reducing conditions, and indicates favorable conditions for reductive dechlorination. As the data on Figure 4-10 show, methane was present in relatively high levels near the latter part of 2005, likely resulting from the lactate injections that were performed during the latter part of that year (refer to Section 3.1). While trends are not clear in all cases, in general, methane concentrations were the highest following the latter part of 2007 and 2008, which corresponds with the time frame for HRC injections. This provides another indication of the effectiveness of the HRC injections.

Ethane is an eventual by-product of PCE reduction (results from the reduction of ethene); however, ethane detections were very sporadic and were generally at or near the detection limit. The lack of dissolved ethane is likely due to the high volatility of ethane, which also tends to partition into air.

4.1.5.3 pH

The pH values measured in monitoring wells over the course of the project generally remained within the range of 6.5 to 7.5, which is considered optimal for bioprocesses to occur (Figure 4-11). The pH readings recorded for the May 2010 annual monitoring event ranged from 5.21 to 7.08 standard pH units. All but seven of the values fell between 6.50 and 7.08 standard pH units, which are within 6.5 to 8.5, a range that is generally accepted as favorable for bioremediation. The values not falling within this range were 5.21 (IW-14), 6.30 (IW-6), 6.36 (IW-12), 6.38 (MW-40-34), 6.38 (MW-40-36), 6.40 (IW-1), and 6.46 (MW-40-14). These are not optimal (notably IW-14), but can still be considered acceptable because site-wide pH levels are generally increasing (refer to Section 4.1.7 below).

4.1.5.4 Summary of Oxidation-Reduction Environment

In general, reducing conditions supportive of reductive dechlorination have been achieved and maintained throughout the contaminated area during this remedial action. This is consistent with the fact that significant contaminant reductions have been realized, and only low concentrations of daughter products cis-1,2-DCE and VC remain above respective TCGs. Changes in some of the indicator parameters, notably ORP, sulfate, and methane, appear to track well with the timing of the HRC injections, thus providing evidence for the general success of the HRC applications in maximizing the extent of the biotreatment approach.

4.1.6 Microbiological Parameters

Microbial assessment included 1) PLFA analysis, mainly as a measure of overall microbial biomass, and 2) DNA analysis for enumeration of the specific reductive dechlorinating organism DHC, which is considered integral in the reductive dechlorination process (mainly the reduction of DCE), and was previously found to be absent from the site. The microbial analysis data are presented in Table 4-5 and shown graphically on Figure 4-12. Microbial results are discussed in the Summary of Field Activities and Data reports provided as Attachment 1, and a brief overview is presented below.

Data from the May 2010 event from selected monitoring wells reflecting concentrations of DHC organisms, which are critical to the reductive dechlorination process, and total biomass (a measure of total viable bacteria) are included in Table 4-6. DO levels and ORP provide additional indication of microbial metabolism of the HRC (effectiveness in generating/ maintaining reducing conditions) which were discussed earlier.

Key observations regarding microbiological parameters are as follows (refer to Table 4-6):

- Total biomass counts for May 2010 ranged from 4.83×10^8 to 1.62×10^9 cells/L and were generally similar to those measured during the May 2009 event (4.36×10^8 to 5.87×10^9 cells/L).
- DHC levels ranged from 2.63×10^4 to 1.14×10^7 cells/L, and were generally similar to those measured during the May 2009 event (1.77×10^4 to 9.19×10^6 cells/L) Because DHC organisms are obligate chloroethene respirers (require chloroethenes to survive), it is expected that DHC populations would decline as COC concentrations are reduced.

Overall microbial biomass numbers were consistently in the range of 10^8 to 10^9 cells/L. This can be considered in the high range, and reflects the stimulation of microbial growth due to the added substrate. DHC population numbers varied widely but were mostly in the range of 10^3 to 10^6 cells/L. It is not known whether these numbers mostly reflect a native strain, which was detected over most of the site at low levels during the baseline analysis, or bioaugmented organisms. However, it is clear that a relatively robust DHC population was generated that carried out complete reduction of PCE and TCE, and significant "DCE stall" was generally not observed. (It is noted that MW-40-37 still has relatively high concentrations of DCE and this may be a possible exception. However, DHC as well as VC and ethene have been detected in samples from this well, indicating that the pathway for complete reductive dechlorination is present. It is likely that the DCE will degrade, but in light of the fact that donor transport has been limited in this area, more time would be required).

4.1.7 General Aquifer Quality

A general assessment of aquifer quality is provided herein based on the persistence of COD (a measurement of the added substrate), pH, and sodium (a component of the initial sodium lactate substrate). Baseline (March 2005) COD levels in the wells of interest ranged from not detected to 107 mg/L (MW-40-35) (TtEC 2006a). As is evident from the data on Figure 4-7, COD levels were significantly elevated over baseline levels for most wells either in late 2005/early 2006 (due to initial COD injections) or during mid-2007/early 2008 (due to the HRC injections). However, as can be seen in Table 4-4 and on Figure 4-7, as of May 2010, COD levels are now approaching background levels. It is noted that the COD level remains elevated in MW-40-35 (502 mg/L), which received a disproportionately high amount of lactate during the initial injections. However, as seen on Figure 4-7, a clear decreasing trend is noted. COD levels in all other wells were at or below 79.6 mg/L (Table 4-4), indicating that the added substrate has largely been degraded and current impacts to water quality are minimal.

Microbial addition of electron donor in groundwater produces organic acids, which can result in pH decreases. Baseline pH values ranged from 7.09 (MW-40-31) to 8.09 (MW-40-34), indicating neutral to slightly alkaline conditions (TtEC 2006a). As expected, pH values decreased in most cases during active treatment and values of approximately 6 (sometimes slightly below) were frequently detected (Table 4-5). However, as can be seen on Figure 4-11, pH levels are generally increasing, and currently (May 2010) range from 6.38 (MW-40-34 and -36) to 7.08 (MW-40-35) (Table 4-5). These data suggest that, while the pH did decrease during treatment, changes were relatively minor. Further, generally increasing trends suggest that the natural buffering of the system will serve to restore the system to background levels.

Cation data are of interest mainly to track the persistence of sodium, a component of the originally injected electron donor (sodium lactate). Added sodium from the initial lactate injection was also tracked. Baseline sodium values varied significantly and ranged from 186 mg/L (MW-40-32) to 1,130 mg/L (MW-40-31) (TtEC 2006a). As can be seen on Figure 4-11, general increases in sodium were observed in various wells during the treatment process. Interestingly, apparent sodium spikes were observed in several wells (including MW-40-30, -32, and -34) during the HRC treatment period (mid-2007/early 2008) (Figure 4-11). This appears anomalous, as HRC does not contain sodium, and may be due to migration of sodium from the initial lactate injections. Nonetheless, currently decreasing trends are evident in essentially all wells (Figure 4-11). While levels still exceed background, the general trends indicate that natural attenuation mechanisms such as dilution and dispersion are acting to decrease sodium levels. Sodium levels remain significantly elevated in MW-40-31 and -35 (as measured in January 2008, which is the most recent measurement for these wells) (Table 4-5). This is likely due to the high lactate delivery that was achieved in these wells. While decreasing sodium trends are evident in these wells, due to the high loading, it will take longer for background conditions to be restored in these areas.

Concentrations of sodium in the monitoring wells in which it was measured during the May 2010 event ranged from 153 to 537 mg/L. These concentrations are comparable with those measured in monitoring wells during the May 2009 event (216 to 586 mg/L). These measurements suggest that sodium concentrations continue to approach the baseline levels measured during March 2005, which ranged from 211 to 288 mg/L. Sodium concentrations measured in injection wells IW-6 and MW-40-14 were 537 and 360 mg/L, respectively. These values are somewhat higher, and likely reflect residual sodium from the original sodium lactate that was injected directly into these wells.

The May 2010 microbiological and geochemical data generally indicate the presence of sufficient microorganisms and maintenance of reducing conditions supportive of continued reductive dechlorination in most areas. Substrate levels (as indicated by the COD data) were

generally low and somewhat variable, but there may be enough electron donor present within the subsurface in some areas to support limited reductive dechlorination.

4.1.8 Summary of Overall Performance Assessment

Overall, the EISB system successfully generated strongly reducing conditions over the contaminated area and successfully degraded all of the PCE and TCE, which were the primary contaminants. As expected, DCE and VC were generated and subsequently degraded to a point where only low levels of DCE and VC remain.

4.2 SURFACE EMISSIONS AND SOIL GAS MONITORING

This section describes surface gas emissions monitoring, and soil gas monitoring and sampling conducted at the site during this reporting period. Soil gas monitoring consisted of 1) field testing of the soil gas monitoring probes, 2) soil gas/vapor sampling and analysis, and 3) surface emissions monitoring. Soil gas/vapor monitoring and surface emissions monitoring were conducted during each quarterly monitoring event along with groundwater monitoring, with the last quarterly event conducted in October 2008. Afterwards, the monitoring schedule reverted to an annual frequency and monitoring events were conducted during June 2009 and May 2010. In addition, during each monitoring event soil vapor samples were collected from select probes for laboratory analysis of VOCs and fixed gasses in soil vapor samples. Prior to their use in the field, all sampling and testing instruments were calibrated according to the manufacturer's instructions using instrument-specific calibration gases. The following subsections discuss the field testing and sampling procedures.

4.2.1 Field Testing of the Soil Gas Monitoring Wells and Nested Probes

Soil gas monitoring was conducted to evaluate the presence of methane and H_2S gas in the vadose zone, and to monitor migration of the subsurface gases toward the nearby buildings. Methane is a flammable gas that poses a potential explosion hazard and is asphyxiating. H_2S gas is toxic and could become a safety hazard. VC is a human carcinogen. Field testing and monitoring of soil gas/vapor were conducted in all soil gas/vapor monitoring probes (VW-01 through -06) and all 24 nested probes (constructed with ½-inch-diameter polyvinyl chloride tubing) installed next to the 4-inch well casings in each of the 16 injection wells (IW-1 through IW-4, and IW-6 through IW-17), and monitoring wells MW-40-30 through MW-40-39 (Figure 1-3).

Monitoring of the soil gas/vapor wells and probes included field measurement for methane, H_2S, oxygen, CO_2, carbon monoxide, and VOC concentrations. An explosive gas meter (Landtec Model GEM 2000) was used for measuring methane gas, CO_2, and oxygen concentrations in percent in air volume. In addition, an MSA Orion quad-gas-meter was used to detect H_2S concentrations in parts per million by volume (ppmv). A photoionization detector instrument was

used to detect VOC concentrations in parts per million (ppm). The instruments were equipped with pumps to allow samples to be drawn through a tube connected to the well sampling port. Field logs were used to record the time of monitoring and the gas concentrations detected by the instruments used. Soil gas monitoring data and results were presented in respective quarterly Summary of Field Activities and Data Reports (Attachment 1), and the quarterly soil gas monitoring data are presented in Appendix E.

Soil gas monitoring of probes was conducted on May 4, 2010. The results indicated that the 30 probes tested in the field had methane gas present at concentrations from 0.1 to 91.9 percent in air during the May 2010 monitoring event. The highest methane concentration was in the vapor monitoring well VW-40-02 located to the west of Building 240. The average methane concentration in all 30 wells was 60.2 percent in air. Hydrogen sulfide was reported in 10 of 30 probes with concentrations ranging from 1 to 19 ppm. The highest H_2S concentration was detected at 19 ppm in the vapor monitoring well VW-40-06 near the northwest corner of Building 239.

4.2.2 Soil Gas/Vapor Sampling and Analysis

In addition, during the May 2010 annual sampling event, soil gas samples were collected for laboratory analysis from vapor monitoring wells (VW-40-03, and VW-40-06) and a select number of soil gas monitoring probes that are installed in groundwater monitoring well MW-40-37, and injection wells IW-1 and -7. The samples were collected in 1 liter Tedlar™ bags using an oilless vacuum/pressure pump. Approximately 6 liters of gas was purged from the wells before sampling. The samples were shipped to Environmental Analytical Services, Inc. laboratories located in San Luis Obispo, California, for analysis. Tedlar bag samples were subjected to VOC analysis using EPA Method TO-15 full-scan gas chromatography (GC)/mass spectrometer analysis, and for fixed gas analysis using American Society for Testing and Materials 1946 GC/thermal conductivity detector analytical method. Fixed gasses included methane, CO_2, ethene, and ethane. A summary of the analytical results for the soil gas concentrations is presented in Table 4-7. These results are discussed below in comparison with baseline (March 2005) results (baseline concentrations were measured in each of these wells with the exception of MW-40-37).

VC was reported in all sampled wells at concentrations from 1,600 micrograms per cubic meter ($\mu g/m^3$) (or 610 parts per billion by volume [ppbv]) in the soil gas probe installed in vapor monitoring well VW-40-06 to 7,000 $\mu g/m^3$ (or 2,700 ppbv) in injection well IW-7. Results for baseline sampled wells ranged from below the detection limit (<220 $\mu g/m^3$) in VW-40-06 and IW-7 to 6,800 $\mu g/m^3$ in VW-40-03 (TtEC, 2006a). The baseline levels were generally lower, reflecting VC production via reductive dechlorination of parent chloroethenes.

DCE was reported in four of five sampled wells at concentrations from 370 $\mu g/m^3$ in vapor monitoring well VW-40-06 to 9,000 $\mu g/m^3$ in well VW-40-03. Baseline DCE concentrations for the sampled wells were comparable to the current levels, ranging from below the detection limit (<10 $\mu g/m^3$) in VW-40-03 to 11,000 $\mu g/m^3$ in IW-1 (TtEC 2006a).

PCE was reported in probes IW-7, VW-40-03, VW-40-06, and MW-40-37 at concentrations of 260 J, 180 J, 190 J, and 800 $\mu g/m^3$, respectively. PCE was not reported in the sample collected from the soil gas probe in injection well IW-1. Baseline PCE concentrations for the sampled wells were much higher, ranging from 9,000 $\mu g/m^3$ in IW-1 to 42,200 $\mu g/m^3$ in IW-7 (TtEC 2006a), reflecting removal of PCE from the groundwater via the EISB system.

TCE was reported in all samples (collected from IW-1, IW-7, VW-40-03, VW-40-06, and MW-40-37 at concentrations of 330, 260 J, 9,300, 640, and 1,300 $\mu g/m^3$, respectively. As with PCE, baseline TCE concentrations for IW-1, IW-7, VW-40-03, and VW-40-06 were generally higher (7,900, 3,100, 5,800, and 810 J $\mu g/m^3$, respectively), again reflecting removal of TCE from the groundwater via the EISB system.

Methane gas concentrations in samples collected in Tedlar™ bags from the soil gas monitoring probes and vapor monitoring wells, and analyzed in the laboratory, ranged from 63 percent in the soil gas probe in injection well IW-1 to 70.5 percent in the soil gas probe in injection well IW-7. Baseline methane concentrations for IW-1, IW-7, VW-40-03, and VW-40-06 were 58.9, 14.7, 60.5, and <0.001 percent, respectively. These are consistent with current levels in IW-1 and VW-40-03, however substantive increases in IW-7 and VW-40-06 are indicated.

Ethene and ethane were not reported in the samples collected during the May 2010 monitoring event from the soil gas wells and probes, nor were they detected in the baseline samples. CO_2 concentrations in the soil gas samples ranged from 19.3 to 27.9 percent in IW-1 and VW-40-06, respectively. Baseline CO_2 concentrations in the soil gas samples ranged from 0.6 to 16.9 percent in VW-40-06 and IW-1, respectively. CO_2 is a byproduct of biodegradation of lactate, thus the general increase in CO_2 concentrations reflects biodegradation of the added electron donor.

Field measurements of methane gas concentrations in soil gas probes were generally higher than the laboratory data for the same wells.

A summary of field testing results, including data for methane and H_2S, is presented in Table 4-8. A summary of the VOC analysis using EPA Method TO-15 is presented in Table 4-8. Monthly field soil gas monitoring data, including probe monitoring and surface emissions monitoring results, are provided in Appendices E and F, respectively.

4.2.3 Surface Emissions Monitoring

Methane gas emission was measured in and around Buildings 240 and 239. Particular attention was given to areas where methane gas could migrate into the building through cracks, utility penetrations, or other pathways in the floor slab. Measurements were also taken outside the buildings, in the work zones, at the EISB system area boundary, at cracks in the asphalt pavement, and at the sewer or other utility manhole covers near the injection areas. An explosive gas meter (Landtec Model GEM 500 or equivalent) was used for measuring methane gas concentrations in percent in air volume. The probe was placed at the crack or about an inch above the crack or the surfaces being monitored. The probe was held for at least 2 minutes or until the instrument showed steady readings. A site map was used to record the field measurements.

In general, surface emission monitoring results during the past 5 years (October 2005 through May 2010) indicate that methane gas was not detected at significant concentrations above the surface at the site, in the areas where monitoring was conducted inside Buildings 239 and 240, and in the vicinity of the site. For the most part, methane concentrations ranged from not detected to 0.2 percent, which is much lower than the lower explosive limit for methane of 5 percent in air.

Methane gas emissions were not detected within Buildings 239 or 240, or in the surrounding areas during the surface emissions monitoring performed on May 3, 2010.

Surface emission monitoring results are presented in the figures provided in Appendix F.

4.2.4 Land Use Controls

Specifically, the following policies were implemented during the LUCs for the IRP Site 40 groundwater plume and the aforementioned buffer zone:

- New groundwater extraction, injection, or drinking water wells were not installed within the IRP Site 40 groundwater plume or associated buffer zone without prior review and written concurrence from the DON, DTSC, and RWQCB.
- Injection and monitoring wells and associated piping and equipment that are included in the remedial action were not altered, disturbed, or removed without the prior review and written concurrence from the DON, DTSC, and RWQCB.

The DON considers that the LUCs have been protective of human health and the environment during and after implementation of the remedial action as required by Section 121(c) of CERCLA.

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5.0 SUMMARY AND CONCLUSIONS

The following subsections summarize the major findings and the conclusions from the past 5 years of EISB system operations and monitoring.

5.1 SUMMARY OF FINDINGS

The major findings are as follows:

- PCE and TCE, the original primary contaminants, have been degraded to levels below TCGs in all wells.
- Residual low levels of cis-1,2-DCE and VC remain in excess of TCGs, forming dilute plumes in the central and southeast portions of the site.
- In general, reducing conditions supportive of reductive dechlorination have been maintained throughout the contaminated area during this remedial action.
- Contaminant concentrations at the plume boundary are stable, and the plume has diminished significantly and does not pose an immediate threat to human or ecological receptors.
- General groundwater quality data indicate that future long-term impacts to groundwater quality are not likely.
- Soil gas data suggest high concentrations of methane gas persisting within the vadose zone at the site. Methane gas is a natural microbial by-product of substrate-enhanced anaerobic bioremediation. The accumulation of methane in the soil is likely because most of the area is paved, and therefore there is no pathway for release to the atmosphere. However, methane gas concentrations have been deceasing from the high average concentrations of 79 percent in January 2006 to average concentrations of 67 percent in May 2010. No methane gas emissions have been recorded throughout the project in Buildings 239 and 240 and the surrounding areas within the site. Nonetheless, high methane gas concentrations exceeding lower explosive levels in the vadose zone remain a health and safety concern for any subsurface and intrusive activities within the site.

5.2 CONCLUSIONS

Significant reductions in total COC concentrations have been observed in all monitoring wells over the life of the project. Also, microbiological and geochemical data suggest an environment favorable for reductive dechlorination to continue. However, while total biomass and DHC organisms are still present at reasonably high levels in key locations, COC concentrations have decreased to very low levels, which would limit biological reductive dechlorination (a total CE concentration of approximately 50 μg/L is required for vigorous growth of key dechlorinating organisms) (Cupples et al. 2004).

Therefore, the potential for enhanced reductive bioremediation has likely reached its limit at this point, and slower, localized biodegradation, along with other natural attenuation processes, will likely dominate the further reduction of COC levels. The final round of HRC injection conducted in critical areas to reestablish conditions supportive of reductive dechlorination was successful in reducing residual COCs concentrations and maximizing the extent of the EISB treatment. Concentrations of COCs are now very low (with the exception of MW-40-37 and possibly MW-40-08), and it is unlikely that more substrate additions will result in significant benefits relative to costs. As anticipated, MNA will likely be sufficient for residual low-level DCE and VC to reach TCGs over the majority of the site, however additional remedial activities may be advisable in the areas of MW-40-37 and MW-40-08.

6.0 RECOMMENDATIONS

The ROD (DON 2004) stipulates in Section 10.2 that, "when the subsurface benefits of enhanced bioremediation have been maximized, the remedy will revert to MNA on a site wide basis." Further, it is stipulated in Section 10.4 (DON 2004) that, "when the remediation goals for groundwater COCs have been achieved for 1 year of sampling, groundwater remediation will have been considered complete." As explained previously, the COC concentrations in the majority of wells are less than or close to the TCGs at this time, and additional efforts to stimulate reductive dechlorination would likely have a very limited effect. Thus, the following recommendations are made based on the data evaluation to date and the findings and conclusions described above in Section 5.0:

1) Continue groundwater monitoring (annually, beginning May 2011) and assess natural attenuation for selected wells. These will include wells which currently do not meet the ROD-specified criterion of not exceeding a TCG for over 1 year, and other strategically located wells deemed necessary to assess plume dynamics. These include the following wells: MW-40-07, -08, -13, -14, -22, -30, -31, -32, -34, -35, -36, and -37; and IW-2, and -4. Evaluation of wells and rationale for inclusion or rejection is presented in Table 6-1. Historic data used in the evaluation are shown in Figures 6-1 and 6-2, and the recommended well array is depicted on Figure 6-3.

   Analytical parameters will include:

   - VOCs
   - Field parameters (DO, ORP, pH, temperature, and electrical conductivity)
   - Geochemical parameters including anions, cations, TDS, COD, and TOC
   - Dissolved gasses
   - DHC

   During this monitoring period, wells for which all COCs fall below TCGs for two consecutive monitoring events may be removed from the program (with regulatory concurrence). Furthermore, if an increasing trend is observed in a particular well, monitoring of downgradient well or wells will be considered, as appropriate. Finally, the analytical suite may be reduced (with regulatory concurrence) over time to eliminate analyses which are not providing useful data.

2) As part of the monitoring program perform the following soil gas and surface emissions monitoring on an annual basis:

   a) Field testing for methane, CO_2, carbon monoxide, oxygen, and H_2S at all soil gas monitoring wells and probes within wells MW-40-30, -31, -32, -34, -35, -36, and -37; and IW-1, -3, -7, -10, and -18; and VW-40-01, -02, -03, -04, -05, and -06. (see Figure 6-3).

b) Surface emissions monitoring (methane) for all areas within IRP Site 40, inside Buildings 240 and 239, and inside of the manholes located within the site.

c) Soil gas sampling (VOCs and methane) for select vapor monitoring wells and probes (VW-40-02, -03, -04, and -06; IW-1, and -3; and MW-40-32, and -37).

3) Address the residual (relatively high concentrations) DCE and VC in the area around MW-40-37, and DCE in the area around MW-40-08 via treatment.

4) Evaluate the data in terms of COC concentrations and MNA parameters. If all COC concentrations have been below TCGs for 1 year, "no further action" would be recommended. If COC concentrations exceed TCGs in one or more cases, or have not been below TCGs for 1 year, explore one or more of the following options:

   a) Extend the monitoring period for 1 or more years to assess whether MNA processes will lower residual COC concentrations to below TCGs.

   b) Consider conducting a supplemental risk analysis to assess whether residual COCs pose risks to human or environmental receptors.

   c) Consider further treatment of residual contaminants, if necessary.

5) As noted in Section 4.2.2, concentrations of methane persist in vadose zone soils, which could potentially become problematic from a health and safety perspective in the event of subsurface activity (e.g., within utility manholes) and risks associated with vapor intrusion into nearby occupiable buildings. In addition, soil gas VOC results indicate the presence of CEs, mainly PCE, TCE, and VC. Consider evaluating the VOC concentrations in the vadose zone and, if necessary, conducting active venting of the vadose zone to remove these residual contaminants. This may be accomplished through soil vapor extraction with extracted vapors routed through granular activated carbon**.**

With respect to institutional controls and LUCs, the DON will continue maintaining the no-smoking signs at the site, and any activities at the site and within the established LUC boundaries would be coordinated with the NAVWPNSTA Seal Beach IRP Coordinator and implemented in accordance with the provisions stipulated in the ROD (DON 2001). LUCs would remain in effect until monitoring data show contamination levels are below remediation goals.

7.0 REFERENCES

BEI (Bechtel Environmental, Inc.). 2000. Final Groundwater Feasibility Study Report for Installation Restoration Sites 40 and 70, Naval Weapons Station Seal Beach, Seal Beach, California. June.

——————. 2004. Final Pilot Test Report for In Situ Enhanced Bioremediation at IRP Site 40, Naval Weapons Station Seal Beach, Seal Beach, California. November.

BNI (Bechtel National, Inc.). 1999. Final Extended Removal Site Evaluation Report, Installation Restoration Sites 40 and 70, Naval Weapons Station Seal Beach, Seal Beach, California. October.

Cupples, A.M., A.M. Spormann, and P.L. McCarty. 2004. Vinyl chloride and cis-dichloroethene dechlorination kinetics and microorganism growth under substrate limiting conditions. *Environ Sci Technol*. 2004 Feb 15;38(4):1102-7.

DON (Department of the Navy). 2004. Final Record of Decision/Remedial Action Plan, Operable Unit 4, IRP Site 40, Naval Weapons Station Seal Beach, Seal Beach, California. May.

DWR (California Department of Water Resources). 1961. Planned Utilization of the Ground Water Basins of the Coastal Plain of Los Angeles County. Bulletin 104, Appendix A. June.

Freeze and Cherry. 1979. *Groundwater*. Englewood Cliffs, New Jersey: Prentice-Hall.

JEG (Jacobs Engineering Group Inc.). 1994. Draft Preliminary Assessment (PA) Report for the Research, Testing and Evaluation Area, Naval Weapons Station, Seal Beach, California.

——————. 1995. Final Operable Unit 4 Site Inspection Report, Naval Weapons Station, Seal Beach, California. October.

——————. 1996. Draft Final Operable Units 4 and 5 Focused Site Inspection Report, Naval Weapons Station, Seal Beach, California. December 20.

RWQCB (California Regional Water Quality Control Board, Santa Ana Region). 1995. Water Quality Control Plan, Santa Ana River Basin.

SCS (Soil Conservation Service). 1978. Soil Survey of Orange County and Western Part of Riverside County, California. U.S. Department of Agriculture.

TtEC (Tetra Tech EC, Inc.). 2005. Final Remedial Design/Work Plan. Enhanced In Situ Bioremediation Installation Restoration Program Site 40 (Concrete Pit/Gravel Area), Naval Weapons Station Seal Beach, Seal Beach, California. February 24.

——————. 2006a. First Semiannual Performance Monitoring Report, Enhanced In Situ Bioremediation of Chlorinated Volatile Organic Compounds at IRP Site 40, Naval Weapons Station Seal Beach, Seal Beach, California. June 8.

——————. 2006b. Final Technical Memorandum Enhanced In Situ Bioremediation Remedial System Optimization Work Plan Enhanced In Situ Bioremediation Installation Restoration Program Site 40 (Concrete Pit/Gravel Area), Naval Weapons Station Seal Beach, Seal Beach, California. November 17.

——————. 2006c. PowerPoint Presentation. Remedial System Optimization Plan. Naval Weapons Station Seal Beach, Seal Beach, California. August 23.

——————. 2008. Final Addendum 2 to the Final Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan). Enhanced In Situ Bioremediation Installation Restoration Program Site 40 (Concrete Pit/Gravel Area), Naval Weapons Station Seal Beach, Seal Beach, California. September 12.

TABLES

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TABLE 1-1

TARGET CLEANUP GOALS FOR IRP SITE 40 GROUNDWATER (micrograms per liter)

Analyte	Federal Maximum Contaminant Level[a]	California Maximum Contaminant Level[b]	Controlling ARAR
cis-1,2-Dichloroethene	70	6	6
trans-1,2-Dichloroethene	100	10	10
Trichloroethene	5	5	5
Tetrachloroethene	5	5	5
Vinyl chloride	2	0.5	0.5

Notes:

[a] U.S. Environmental Protection Agency Safe Drinking Water Act, Title 40 *Code of Federal Regulations*, Part 141.
[b] *California Code of Regulations*, Title 22, Section 64439, Requirements, and Section 64444, Maximum Contaminant Levels.

Abbreviations and Acronyms:

ARAR – applicable or relevant and appropriate requirement
IRP – Installation Restoration Program

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TABLE 3-1

LIST OF GROUNDWATER MONITORING WELLS, INJECTION WELLS, AND SOIL GAS/VAPOR MONITORING WELLS AND DETAILS

Well ID	Construction Date	Casing Diameter (inches)	Casing Material	Slot Size (inches)	Borehole Diameter (inches)	Top of Filter Pack (feet bgs)	Screen Interval (top) (feet bgs)	Screen Interval (bottom) (feet bgs)	Well Depth (feet bgs)
Wells Installed During Previous Investigations and Pilot Test Prior to February 2005 Full-Scale Enhanced In Situ Bioremediation									
VW-40-01	3/19/2003	2	Sch. 40 PVC	0.01	8	2	2.5	7.5	8
VW-40-02	3/19/2003	2	Sch. 40 PVC	0.01	8	2	2.5	7.5	8
40-MW-01	12/22/1992	2	Sch. 40 PVC	0.01	8	4.0	6.5	16.5	20.0
40-MW-02	12/21/1992	2	Sch. 40 PVC	0.01	8	4.0	6.0	16.0	20.0
40-MW-03	12/21/1992	2	Sch. 40 PVC	0.01	8	4.0	6.5	16.5	19.0
40-MW-04	12/22/1992	2	Sch. 40 PVC	0.01	NA	4.0	6.0	16.0	18.0
40-MW-05	10/30/1995	2	Sch. 40 PVC	0.01	10	6.0	9.5	25.0	26.0
MW-40-06	8/26/1997	4	Sch. 40 PVC	0.01	10	16.3	20.3	30.3	34.0
MW-40-07	9/15/1997	4	Sch. 40 PVC	0.01	12	15.0	20.0	30.0	34.0
MW-40-08	9/12/1997	4	Sch. 40 PVC	0.01	12	13.5	20.0	30.0	34.0
MW-40-09	8/27/1997	4	Stainless Steel	0.01	12	40.0	45.0	55.0	57.0
MW-40-10	8/28/1997	4	Sch. 40 PVC	0.01	10	40.0	45.0	55.0	59.0
MW-40-11	9/5/1997	4	Stainless Steel	0.01	12	40.0	45.0	55.0	57.0
MW-40-12	9/11/1997	4	Sch. 40 PVC	0.01	12	40.0	45.0	55.0	59.0
MW-40-13	9/15/1997	4	Sch. 40 PVC	0.01	12	40.0	45.0	55.0	58.0
MW-40-14	9/8/1997	4	Sch. 40 PVC	0.01	12	25.0	30.0	40.0	59.0
MW-40-15	9/16/1997	4	Sch. 40 PVC	0.01	12	17.0	20.0	30.0	33.5
MW-40-16	9/16/1997	4	Sch. 40 PVC	0.01	12	34.0	42.3	52.3	57.5
MW-40-17	4/11/2000	4	Sch. 40 PVC	0.01	10	17.0	20.0	30.0	32.0
MW-40-18	4/12/2000	4	Sch. 40 PVC	0.01	10	47.0	50.0	60.0	62.0
MW-40-19	4/12/2000	4	Sch. 40 PVC	0.01	10	17.0	19.8	29.8	32.0
MW-40-20	4/13/2000	4	Sch. 40 PVC	0.01	10	47.0	49.7	59.7	62.0
MW-40-21	4/11/2000	4	Sch. 40 PVC	0.01	10	47.0	50.5	60.5	62.0
MW-40-22	7/6/2001	4	Sch. 40 PVC	0.01	11	12	15.3	35.5	35.7
MW-40-23	7/9/2001	4	Sch. 40 PVC	0.01	11	10.5	15.1	35.1	35.5
MW-40-24	7/9/2001	4	Sch. 40 PVC	0.01	11	12.9	15.1	35.1	35.5
MW-40-25	7/9/2001	4	Sch. 40 PVC	0.01	11	13	15.3	35.3	35.7
MW-40-26	7/6/2001	4	Sch. 40 PVC	0.01	11	12.5	15.2	35.2	35.6
MW-40-27	7/9/2001	4	Sch. 40 PVC	0.01	11	12.6	15.1	35.1	35.5
MW-40-28	7/9/2001	4	Sch. 40 PVC	0.01	11	11	15.0	35.0	35.4
MW-40-29	3/19/2003	4	Sch. 40 PVC	0.01	10	13	15.0	35.0	35.5
Injection, Groundwater Monitoring, and Soil Vapor/Gas Monitoring Wells Installed as Part of the In Situ Bioremediation after February 2005									
IW-1	3/7/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-2	3/7/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-3	2/28/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-4	3/2/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-5 Existing Monitoring Well MW-40-27	7/9/2001	4	Sch. 40 PVC	0.01	11	12.6	15.1	35.1	35.5
IW-6	3/1/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-7	3/1/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-8	2/28/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-9	2/28/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-10	3/7/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-11	3/2/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-12	3/2/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-13	2/25/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-14	3/7/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-15	2/28/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-16	3/2/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-17	3/1/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
IW-18	8/19/2005	4	Sch. 40 PVC	0.01	10	12	14.0	34.0	35.0
IW-19	9/10/2005	4	Sch. 40 PVC	0.01	10	12	14.0	34.0	35.0
MW-40-30	2/28/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	35.0
MW-40-31	3/3/2005	4	Sch. 40 PVC	0.01	12	40	42.0	52.0	53.0
MW-40-32	2/28/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0

TABLE 3-1

LIST OF GROUNDWATER MONITORING WELLS, INJECTION WELLS, AND SOIL GAS/VAPOR MONITORING WELLS AND DETAILS

Well ID	Construction Date	Casing Diameter (inches)	Casing Material	Slot Size (inches)	Borehole Diameter (inches)	Top of Filter Pack (feet bgs)	Screen Interval (top) (feet bgs)	Screen Interval (bottom) (feet bgs)	Well Depth (feet bgs)
MW-40-33	3/2/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
MW-40-34	3/1/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
MW-40-35	2/23/2005	4	Sch. 40 PVC	0.01	12	43	45.0	55.0	60.0
MW-40-36	2/24/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	36.0
MW-40-37	2/25/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
MW-40-38	3/4/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
MW-40-39	3/4/2005	4	Sch. 40 PVC	0.01	12	14	15.0	35.0	38.0
VW-40-3	3/4/2005	2	Sch. 40 PVC	0.01	10	2.5	3.0	10.0	10.0
VW-40-4	3/3/2005	2	Sch. 40 PVC	0.01	10	2.5	3.0	10.0	10.0
VW-40-5	3/3/2005	2	Sch. 40 PVC	0.01	10	2.5	3.0	10.0	10.0
VW-40-6	3/4/2005	2	Sch. 40 PVC	0.01	10	2.5	3.0	10.0	10.0

Abbreviations and Acronyms:

bgs – below ground surface
NA – not available
PVC – polyvinyl chloride
Sch. – schedule

TABLE 4-1

GROUNDWATER LEVEL MEASUREMENT DATA COLLECTED OVER THE COURSE OF THE PROJECT FOR KEY MONITORING WELLS

Well Details		MW-40-07	MW-40-08	MW-40-14	MW-40-30	MW-40-31	MW-40-32	MW-40-34	MW-40-35	MW-40-36	MW-40-37
Northing		2218687.3	2218790.5	2218779.6	2218814.211	2218800.956	2218813.4	2218719.18	2218761.89	2218770.714	2218744.44
Easting		6002367.9	6002447.1	6002207	6002294.153	6002310.664	6002339.32	6002233.69	6002239.24	6002274.762	6002331.56
Top of PVC casing (NAVD 29)		10.3	10.32	10.67	10.35	10.57	10.2	10.23	10.78	10.92	10.56
Top of Vault cover (NAVD 29)		10.8	10.7	10.95	10.99	10.75	10.48	10.92	11.16	11.17	10.96
	Date	**Water Elevation (feet above MSL)**									
	11/1/2005	NM	NM	1.68	2.27	1.78	1.98	2.35	2.00	1.89	2.06
	11/22/2005	1.77	NM	1.87	2.41	1.83	2.06	2.48	2.12	2.08	2.12
	12/21/2005	1.70	NM	1.61	2.10	1.59	1.76	2.18	1.86	1.77	1.91
	1/17/2006	1.68	1.65	1.67	2.22	1.64	1.88	2.31	2.00	1.87	2.02
	2/24/2006	NM	NM	1.51	2.14	1.50	1.78	2.22	1.79	1.82	1.88
	3/16/2006	1.32	1.39	1.30	1.95	1.39	1.61	2.00	1.54	1.56	1.69
	6/23/2006	1.56	1.55	1.52	2.18	1.57	1.87	2.19	1.73	1.77	1.90
	9/13/2006	1.66	1.90	1.67	2.24	1.54	1.84	2.31	1.77	1.85	2.00
	1/11/2007	1.68	0.70	1.60	2.23	1.64	1.87	2.31	1.72	1.81	1.93
	4/5/2007	1.32	1.38	1.40	1.99	1.41	1.60	2.02	1.44	1.62	1.67
	7/12/2007	1.29	1.20	1.27	1.87	1.27	1.49	1.86	1.32	1.44	1.59
	10/16/2007	1.24	1.20	1.16	1.73	1.10	1.39	1.85	1.32	1.42	1.66
	1/8/2008	1.13	0.37	1.16	1.78	1.16	1.34	1.92	1.25	1.44	1.56
	4/10/2008	1.15	0.38	1.19	1.85	1.22	1.41	2.02	1.27	1.53	1.64
	7/16/2008	1.13	1.24	1.22	1.76	1.19	1.39	1.81	1.28	1.36	1.47
	10/2/2008	1.13	1.08	1.09	1.75	1.17	1.43	1.80	1.17	1.46	1.47
	5/28/2009	1.20	1.17	0.87	1.45	-0.08	0.97	1.61	0.98	1.12	1.01
	5/3/2010	1.55	1.15	1.12	1.99	1.47	1.52	2.08	1.51	1.62	1.71

Abbreviations and Acronyms:

MSL – mean sea level
NAVD – North American Vertical Datum
NM – not measured
PVC – polyvinyl chloride

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TABLE 4-2

SUMMARY OF LABORATORY ANALYTICAL RESULTS FOR COCs FOR MAY 2010 ANNUAL MONITORING EVENT

Well Number		Tetrachloroethene	Trichloroethene	CIS-1,2-DCE	Vinyl Chloride
	Result Units	MCL = 5 µg/L	MCL = 5 µg/L	MCL = 6 µg/L	MCL = 0.5 µg/L
IW-1	µg/L	1.0U	1.0U	0.40J	**1.4**
IW-4	µg/L	1.0U	0.33J	0.40J	**1.0**
IW-6	µg/L	1.0U	0.71J	1.5	**2.3**
IW-12	µg/L	1.0U	0.43J	0.62J	0.39J
IW-14	µg/L	1.0U	0.64J	1.4	**1.1**
IW-16	µg/L	1.0U	1.3	0.84J	0.50U
IW-16 (FD)	µg/L	1.0U	1.4	0.93J	0.50U
MW-40-07	µg/L	1.0U	0.28J	0.67J	**0.78**
MW-40-08	µg/L	1.0U	0.46J	**27**	0.50U
MW-40-08[a]	µg/L	1.0U	1.0U	**38**	0.50U
MW-40-13	µg/L	1.0U	1.0U	1.0U	0.50U
MW-40-14	µg/L	1.0U	0.92J	1.3	**3.1**
MW-40-22	µg/L	1.0U	1.9	2.5	**4.6**
MW-40-30	µg/L	1.0U	0.79J	3.7	**4.0**
MW-40-31	µg/L	1.0U	1.0U	0.83J	**0.6**
MW-40-32	µg/L	1.0U	1.0U	1.2	**2.1**
MW-40-34	µg/L	1.0U	1.0U	1.0U	0.33J
MW-40-35	µg/L	1.0U	0.26J	2.5	0.50U
MW-40-36	µg/L	1.0U	0.56J	1.5	**2.2**
MW-40-37	µg/L	1.0U	4.0	**90**	**37**
MW-40-39	µg/L	0.49J	1.0U	1.0U	0.50U
MW-40-39 (FD)	µg/L	0.41J	1.0U	1.0U	0.50U

Notes:

Concentrations in bold exceed MCL

[a] A confirmatory sample was collected on September 30, 2010 to verfify the May 2010 result for cis-1,2-DCE.

Abbreviations and Acronyms:

µg/L – micrograms per liter
FD – field duplicate
J – estimated value
MCL – maximum contaminant level
U – analyte is not detected at the listed reporting limit

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TABLE 4-3

SUMMARY OF LABORATORY ANALYTICAL RESULTS FOR COCs AND BREAKDOWN COMPOUNDS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	PCE (µg/L)	TCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	1,1-DCE (µg/L)	Vinyl Chloride (µg/L)	Ethene (µg/L)
MW-40-07	10/25/2005	**85**	2	0.28 J	1 U	1 U	0.5 U	1.2 U
	11/28/2005	**90**	2.4	0.34 J	1 U	1 U	0.5 U	NA
	1/9/2006	**110**	3.7 J	0.41 J	1 U	1 U	0.5 U	1.2 U
	3/23/2006	**25**	0.85 J	1 U	1 U	1 U	0.5 U	1.2 U
	7/11/2006	**100**	3.2	0.31	1	1	0.5	1.2
	9/21/2006	**94**	3.1	0.43 J	1 U	1 U	0.5 U	1.2 U
	1/9/2007	**83**	2.7	0.34 J	1 U	1 U	0.5 U	1.2 U
	4/4/2007	**49**	1.8	1 U	1 U	1 U	0.5 U	1.2 U
	5/16/2007	NA	NA	NA	NA	NA	NA	NA
	6/14/2007	NA	NA	NA	NA	NA	NA	NA
	7/10/2007	**11**	**6.7**	**36**	0.53 J	1 U	0.5 U	0.95 J
	10/16/2007	3	1.4	**48**	1 U	1 U	0.5 U	1.2 U
	1/15/2008	2.8	1.7	**47**	0.23 J	1 U	0.5 U	1.2 U
	4/14/2008	2.6	1.7	**42**	1 U	1 U	**5.4**	1.2 U
	7/16/2008	1.3	1.8	**12**	0.55 J	1 U	**8.3**	0.8 J
	10/6/2008	1 U	1.1	3.9	0.23 J	1 U	**4.7**	1.6
	5/21/2009	1 U	0.51 J	3.2	1 U	1 U	**1.2**	1.2 U
	5/6/2010	1 U	0.28 J	0.67 J	1 U	1 U	**0.78**	2.3
MW-40-08	1/6/2006	**7.5**	1.5	0.24 J	1 U	1 U	0.5 U	1.2 U
	3/22/2006	**5.5**	1.1	1 U	1 U	1 U	0.5 U	NA
	7/13/2006	**6.2**	1.2	1	1	1	0.5	NA
	9/21/2006	**6.6**	1.4	1 U	1 U	1 U	0.5 U	NA
	1/11/2007	**5.4**	1.1	1 U	1 U	1 U	0.5 U	NA
	4/4/2007	**5.3**	1.1	1 U	1 U	1 U	0.5 U	NA
	7/12/2007	**6.1**	1.5	0.23 J	1 U	1 U	0.5 U	NA
	10/16/2007	**6.5**	1.4	0.29 J	1 U	1 U	0.5 U	NA
	1/16/2008	**6.8**	1.5	0.33 J	1 U	1 U	0.5 U	NA
	7/15/2008	**11**	3.3	0.69 J	1 U	1 U	0.5 U	NA
	10/7/2008	**10**	3.7	0.83 J	1 U	1 U	0.5 U	NA
	5/22/2009	0.29 J	1 U	1 U	1 U	1 U	0.5 U	1.2 U
	5/6/2010	1 U	0.46 J	**27**	1 U	1 U	0.5 U	1.2 U
	9/30/2010	1 U	1 U	**38**	1 U	1 U	0.5 U	NA

TABLE 4-3

SUMMARY OF LABORATORY ANALYTICAL RESULTS FOR COCs AND BREAKDOWN COMPOUNDS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	PCE (µg/L)	TCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	1,1-DCE (µg/L)	Vinyl Chloride (µg/L)	Ethene (µg/L)
MW-40-14	10/24/2005	1.1	1	**66**	0.77 J	1 U	0.5 U	1.7
	11/28/2005	1 U	0.37 J	**38**	0.66 J	1 U	**5**	1.2 U
	1/4/2006	1 U	1 U	5.2	0.36 J	1 U	**13**	1.5
	3/21/2006	0.55 J	**8.1**	**16**	0.59 J	1 U	**17**	1.4
	7/11/2006	1	3.3	**16**	0.61	1	**16**	1.4
	9/19/2006	1 U	1.8	**11**	0.55 J	1 U	**11**	0.91 J
	1/9/2007	1 U	0.61 J	1.2	0.35 J	1 U	**4.6**	1.2 U
	4/3/2007	1 U	1.1	1.5	0.35 J	1 U	**2.8**	1.2 U
	7/10/2007	1 U	0.58 J	0.51 J	0.26 J	1 U	0.5 U	1.2 U
	10/15/2007	1 U	2.4	**11**	0.34 J	1 U	**3.8**	1.2 U
	1/15/2008	0.65 J	4.2	**20**	0.48 J	1 U	**4**	1.2 U
	4/14/2008	4.6	**6**	**26**	0.36 J	1 U	**2.8**	1.2 U
	7/15/2008	**5.2**	**5.8**	**14**	0.4 J	1 U	**3.6**	1.2 U
	10/7/2008	4.8	**5.9**	**13**	0.37 J	1 U	**6**	1.2 U
	5/22/2009	**8.7**	**36**	**19**	0.46 J	1 U	**23**	1.2 U
	5/6/2010	1 U	0.92 J	1.3	0.44 J	1 U	**3.1**	1.2 U
MW-40-30	10/24/2005	**130**	**44**	**44**	0.28 J	1 U	**0.85**	1.2 U
	11/30/2005	**110**	**42**	**37**	0.31 J	1 U	**0.83**	1.2 U
	1/9/2006	**150**	**60**	**57**	0.38 J	1 U	**1.2**	1.2 U
	3/22/2006	**130**	**43**	**36**	0.29 J	1 U	0.48 J	1.2 U
	7/12/2006	**83**	**35**	**26**	0.45	1	0.46	1.2
	9/20/2006	**81**	**40**	**34**	0.37 J	1 U	**0.65**	1.2 U
	1/10/2007	**74**	**31**	**48**	2.4	1 U	0.39 J	1.2 U
	4/4/2007	**91**	**38**	**70**	0.3 J	1 U	0.42 J	1.2 U
	5/16/2007	NA	NA	NA	NA		NA	NA
	6/14/2007	NA	NA	NA	NA		NA	NA
	7/11/2007	**66**	**34**	**45**	0.31 J	1 U	0.38 J	1.2 U
	10/16/2007	**60**	**28**	**32**	1 U	1 U	**1.2**	1.2 U
	1/16/2008	0.36 J	1 U	**110**	0.82 J	1 U	**11**	1.8
	4/14/2008	0.84 J	2.2	**86**	1.1	1 U	**8.3**	1.8
	7/16/2008	**5.6**	**12**	**47**	4.8	1 U	**4.2**	1 J
	10/6/2008	2.6	**29**	**31**	0.68 J	1 U	**5.4**	1.9
	5/21/2009	1 U	2	5.7	0.93 J	1 U	**6.3**	2.1
	5/6/2010	1 U	0.79 J	3.7	1.1	1 U	**4**	2.1

TABLE 4-3

SUMMARY OF LABORATORY ANALYTICAL RESULTS FOR COCs AND BREAKDOWN COMPOUNDS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	PCE (µg/L)	TCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	1,1-DCE (µg/L)	Vinyl Chloride (µg/L)	Ethene (µg/L)
MW-40-31	10/26/2005	1 U	0.61 J	**9 J**	1 U	1 U	3.2 J	1.2 U
	11/30/2005	1 U	0.93 J	**6.2**	1 U	1 U	2.8	1.2 U
	1/9/2006	1 U	0.84 J	4.5	1 U	1 U	2.6	1.2 U
	3/22/2006	0.59 J	0.55 J	1.9	1 U	1 U	0.83	1.2 U
	7/12/2006	1 U	0.23 J	0.96 J	1 U	1 U	0.7	1.2 U
	9/20/2006	1 U	1 U	0.88 J	1 U	1 U	0.49 J	1.2 U
	1/10/2007	1 U	0.37 J	0.61 J	1 U	1 U	0.37 J	1.2 U
	4/4/2007	1 U	0.29 J	0.45 J	1 U	1 U	0.39 J	0.75 J
	7/11/2007	1 U	0.3 J	0.67 J	1 U	1 U	0.25 J	1.2 U
	10/16/2007	1 U	1 U	0.47 J	1 U	1 U	0.23 J	1.2 U
	1/16/2008	1 U	1 U	0.58 J	1 U	1 U	0.2 J	1.2 U
	5/21/2009	1 U	1 U	0.53 J	1 U	1 U	0.26 J	NA
	5/6/2010	1 U	1 U	0.83 J	1 U	1 U	0.6	NA
MW-40-32	10/25/2005	1.3	1.4	**150**	0.5 J	1 U	**8.5**	1.2 U
	11/30/2005	**19**	**9.6**	**82**	0.39 J	1 U	**5.7**	1.2 U
	1/9/2006	**10**	**6.1 J**	**150**	0.52 J	1 U	0.5 U	1.2 U
	3/22/2006	**5.1**	2.6	**160**	0.43 J	1 U	**1.8**	1.2 U
	7/12/2006	**34**	**16**	**46**	0.82	1	**1.7**	1.2
	9/20/2006	**39**	**20**	**44**	1.4	1 U	**1.8**	1.2 U
	1/10/2007	**50**	**23**	**30**	0.99 J	1 U	**1.2**	1.2 U
	4/4/2007	**47**	**22**	**25**	1 U	1 U	**0.97**	1.2 U
	5/16/2007	NA	NA	NA	NA	NA	NA	NA
	6/14/2007	NA	NA	NA	NA	NA	NA	NA
	7/11/2007	10	**13**	**26**	1 U	1 U	**1.6**	1.2 U
	10/16/2007	1 U	1.4	**10**	1 U	1 U	**9.5**	4.9
	1/16/2008	0.74 J	1.3	**12**	0.21 J	1 U	**5.6**	0.99 J
	4/14/2008	0.6 J	3.1	**20**	0.29 J	1 U	**4.8**	0.88 J
	7/16/2008	0.22 J	1.3	**8.6**	0.28 J	1 U	**3.8**	0.75 J
	10/6/2008	1 U	0.62 J	5.1	1 U	1 U	**4.2**	1.7
	5/22/2009	1 U	1 U	0.64 J	1 U	1 U	**1.3**	1.2 U
	5/6/2010	1 U	1 U	1.2	1 U	1 U	**2.1**	1.2 U

TABLE 4-3

SUMMARY OF LABORATORY ANALYTICAL RESULTS FOR COCs AND BREAKDOWN COMPOUNDS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	PCE (µg/L)	TCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	1,1-DCE (µg/L)	Vinyl Chloride (µg/L)	Ethene (µg/L)
MW-40-34	10/24/2005	**33**	**6.5**	**74**	0.24 J	1 U	**0.79**	1.2 U
	11/28/2005	**31**	2.1	**7.5**	1 U	1 U	**1.1**	1.2 U
	1/5/2006	**29**	1.3	4.7	1 U	1 U	**1.6**	1.2 U
	3/22/2006	**22**	0.64 J	2.1	1 U	1 U	**0.59**	1.2 U
	7/12/2006	**18**	0.89	2.3	1	1	**0.54**	1.2
	9/20/2006	**28**	1.2	2.8	1 U	1 U	**0.67**	NA
	1/10/2007	**22**	1	1.8	1 U	1 U	**0.53**	1.2 U
	4/3/2007	**24**	1.2	1.9	1 U	1 U	**0.66**	1.2 U
	5/16/2007	NA	NA	NA	NA	NA	NA	NA
	6/14/2007	NA	NA	NA	NA	NA	NA	NA
	7/11/2007	4.5	1.3	**14**	0.29 J	1 U	0.5 U	1.2 U
	10/15/2007	0.31 J	1.2	**17**	0.23 J	1 U	**2.2**	1.2 U
	1/16/2008	1 U	0.65 J	**8.5**	1 U	1 U	**2.6**	1.2 U
	4/14/2008	1 U	0.25 J	3	1 U	1 U	**1.7**	1.2 U
	7/16/2008	1 U	1 U	1.6	1 U	1 U	**1.3**	1.2 U
	10/6/2008	1 U	1 U	1.6	1 U	1 U	**1.1**	1.2 U
	5/21/2009	1 U	1 U	0.44 J	1 U	1 U	0.35 J	1.2 U
	5/6/2010	1 U	1 U	1 U	1 U	1 U	0.33 J	1.2 U
MW-40-35	10/25/2005	**13**	4.4	**22**	0.25 J	1 U	**0.65**	1.2 U
	11/30/2005	**7**	**5.6**	**20**	1 U	1 U	**2.1**	1.2 U
	1/5/2006	3.5	**6.4**	**22**	1 U	1 U	**2.6**	1.2 U
	3/22/2006	0.48 J	**5.6**	**9.7**	1 U	1 U	**1.1**	1.2 U
	7/12/2006	1 U	1.2	5.5	0.25 J	1 U	**0.73**	1.2 U
	9/20/2006	1 U	0.67 J	**6.6**	1 U	1 U	**0.58**	1.2 U
	1/10/2007	1 U	0.64 J	3.5	1 U	1 U	0.25 J	1.2 U
	4/3/2007	1 U	0.66 J	2.6	1 U	1 U	0.5 U	1.2 U
	7/11/2007	1 U	0.95 J	2.1	1 U	1 U	0.5 U	1.2 U
	10/15/2007	0.29 J	2.2	3.5	0.42 J	1 U	0.5 U	1.2 U
	1/16/2008	1 U	0.55 J	3.6	1 U	1 U	0.5 U	1.2 U
	5/22/2009	0.26 J	0.27 J	**11**	1 U	1 U	0.22 J	NA
	5/6/2010	1 U	0.26 J	3	1 U	1 U	0.5 U	NA

TABLE 4-3

SUMMARY OF LABORATORY ANALYTICAL RESULTS FOR COCs AND BREAKDOWN COMPOUNDS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	PCE (µg/L)	TCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	1,1-DCE (µg/L)	Vinyl Chloride (µg/L)	Ethene (µg/L)
MW-40-36	10/24/2005	**160**	**14**	**20**	0.23 J	1 U	0.5 U	1.2 U
	11/30/2005	**390**	**29**	**48**	0.26 J	1 U	0.5 U	2.9
	1/5/2006	**160**	**16**	**22**	0.22 J	1 U	**0.6**	1.2 U
	3/22/2006	**140**	**15**	**20**	0.21 J	1 U	0.41 J	1.2 U
	7/12/2006	**110**	**18**	**18**	0.44	1	0.42	1.2
	9/20/2006	**150**	**24**	**20**	0.32 J	1 U	**0.6**	1.2 U
	1/10/2007	**87**	**30**	**26**	0.3 J	1 U	**0.95**	1.2 U
	4/3/2007	**43**	**85**	**17**	1.9	1 U	**0.65**	1.2 U
	5/16/2007	NA	NA	NA	NA	NA	NA	NA
	6/14/2007	NA	NA	NA	NA	NA	NA	NA
	7/11/2007	1	2	**35**	0.58 J	1 U	**9.6**	6.9
	10/15/2007	2.6	4.6	**19**	0.54 J	1 U	**6.4**	4.2
	1/16/2008	1.1	2.1	**17**	0.3 J	1 U	**6.5**	2.9
	4/14/2008	1 U	0.68 J	**11**	0.5 J	1 U	**4.6**	2.1
	7/16/2008	1 U	1 U	4.8	0.34 J	1 U	**3.5**	0.92 J
	10/6/2008	1 U	1 U	1.6	0.3 J	1 U	**2.3**	4
	5/22/2009	1 U	0.42 J	1.5	0.37 J	1 U	**1.9**	2.5
	5/6/2010	1 U	0.56 J	1.5	0.38 J	1 U	**2.2**	3.2
MW-40-37	10/25/2005	**380**	**38**	**58**	0.46 J	1 U	0.5 U	2.9
	11/30/2005	**150**	**13**	**17**	1 U	1 U	0.23 J	1.2 U
	1/9/2006	**440**	**48 J**	**63**	0.41 J	0.25 J	0.5 U	3
	3/23/2006	**100**	**28**	**35**	0.28 J	1 U	**1.2**	1.2 U
	7/12/2006	**84**	**39**	**33**	0.92	1	**3.2**	2
	9/20/2006	1.3	**16**	**140**	1.8	1 U	**4.5**	2.6
	1/10/2007	2.1	0.94 J	**140**	1.7	1 U	**18**	4.1
	4/4/2007	1.1	4.9	**89**	0.58 J	1 U	**18**	3
	5/16/2007	NA	NA	NA	NA	NA	NA	NA
	6/14/2007	NA	NA	NA	NA	NA	NA	NA
	7/11/2007	0.31 J	0.36 J	**64**	0.81 J	1 U	**24**	11
	10/1/2007	1.6	3	**69**	1.6	1 U	**16**	6.2
	1/16/2008	0.36 J	1.3	**94**	1	1 U	**18**	6.5
	4/14/2008	1 U	1.3	**58**	2.5	1 U	**12**	4.6
	7/1/2008	0.48 J	1.5	**82**	3.8	1 U	**18**	5.6
	10/1/2008	1 U	1.7	**110**	1.4	1 U	**27**	7
	5/21/2009	1 U	1 U	**46**	1	1 UJ	**13**	5.2
	5/6/2010	1 U	4	**90**	2.4	1 U	**37**	6.5

Notes:

Bold indicates concentrations exceed target cleanup goals.

Abbreviations and Acronyms:

µg/L – micrograms per liter
COC – chemical of concern
DCE – dichloroethene
J – estimated value
NA – not analyzed
PCE – tetrachloroethene
TCE – trichloroethene
U – not detected at or below the reporting limit

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TABLE 4-4

SUMMARY OF LABORATORY ANALYTICAL RESULTS FOR SUBSTRATE INDICATOR PARAMETERS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	COD (mg/L)	Acetic Acid (mg/L)	Propionic Acid (mg/L)	Butyric Acid (mg/L)
MW-40-07	Jul-06	428	NA	NA	NA
	Sep-06	40.8	NA	NA	NA
	Jan-07	37.1	NA	NA	NA
	Apr-07	19.2	NA	NA	NA
	May-07	3,303	NA	NA	NA
	Jun-07	2,100	NA	NA	NA
	Jul-07	2,230	NA	NA	NA
	Oct-07	1,990	NA	NA	NA
	Jan-08	1,150	144.2	997.2	73
	May-08	1,010	NA	NA	NA
	Jul-08	624	112.6	35.8	7.3
	Oct-08	167	179.7	129.5	87.5
	May-09	237	17	2.3	1
	May-10	51.6	10	14	<1
MW-40-08	Jan-08	40.9	NA	NA	NA
	May-09	18.2	NA	NA	NA
	May-10	21.5	NA	NA	NA
MW-40-14	Oct-05	3,050	NA	NA	NA
	Nov-05	5,160	NA	NA	NA
	Jan-06	4,160	NA	NA	NA
	Mar-06	597	NA	NA	NA
	Jul-06	316	NA	NA	NA
	Sep-06	56.2	NA	NA	NA
	Jan-07	37.1	NA	NA	NA
	Apr-07	49.1	NA	NA	NA
	Jul-07	13.5	NA	NA	NA
	Oct-07	19.1	NA	NA	NA
	Jan-08	45.2	<1	<1	<1
	May-08	14.2	NA	NA	NA
	Jul-08	31.5	NA	NA	NA
	Oct-08	41.4	NA	NA	NA
	May-09	3350	NA	NA	NA
	May-10	43.6	NA	NA	NA

TABLE 4-4

SUMMARY OF LABORATORY ANALYTICAL RESULTS FOR SUBSTRATE INDICATOR PARAMETERS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	COD (mg/L)	Acetic Acid (mg/L)	Propionic Acid (mg/L)	Butyric Acid (mg/L)
MW-40-30	Oct-05	22.9	NA	NA	NA
	Nov-05	49	NA	NA	NA
	Jan-06	33.3	NA	NA	NA
	Mar-06	48.9	NA	NA	NA
	Jul-06	24.9	<1	<1	<1
	Sep-06	36.4	<1	<1	<1
	Jan-07	14.5	<1	<1	<1
	Apr-07	28.4	<1	<1	<1
	May-07	36	NA	NA	NA
	Jun-07	10.5	NA	NA	NA
	Jul-07	9.40 J	<1	<1	<1
	Oct-07	10 U	<1	<1	<1
	Jan-08	67.2	17.9	1.3	<1
	May-08	12.1	1U	1U	1U
	Jul-08	37.7	<1	<1	<1
	Oct-08	33.3	<1	<1	<1
	May-09	1090	160	450	25
	May-10	79.6	1.3	<1	<1
MW-40-31	Oct-05	7,680	NA	NA	NA
	Nov-05	5,290	NA	NA	NA
	Jan-06	5,550	NA	NA	NA
	Mar-06	5,450	NA	NA	NA
	Jul-06	1,597	<1	<1	<1
	Sep-06	140.4	<1	<1	<1
	Jan-07	84.4	<1	<1	<1
	Apr-07	109	<1	<1	<1
	Jul-07	880	127.9	550.8	<1
	Oct-07	380	88.5	97.9	3.7
	Jan-08	296	33.5	104.2	<1
	May-09	32.6	NA	NA	NA
	May-10	61.6	NA	NA	NA

TABLE 4-4

SUMMARY OF LABORATORY ANALYTICAL RESULTS FOR SUBSTRATE INDICATOR PARAMETERS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	COD (mg/L)	Acetic Acid (mg/L)	Propionic Acid (mg/L)	Butyric Acid (mg/L)
MW-40-32	Oct-05	30.5	NA	NA	NA
	Nov-05	54.1	NA	NA	NA
	Jan-06	30.5	NA	NA	NA
	Mar-06	35.3	NA	NA	NA
	Jul-06	14.7	<1	<1	<1
	Sep-06	32	<1	<1	<1
	Jan-07	26.1	<1	<1	<1
	Apr-07	37.6	<1	<1	<1
	May-07	17.2	NA	NA	NA
	Jun-07	43.5	NA	NA	NA
	Jul-07	78.8	25.7	7.2	<1
	Oct-07	118	46.1	48.0	<1
	Jan-08	735	171.1	455.7	4.0
	May-08	273	83	112.6	1U
	Jul-08	121	30.8	21.9	<1
	Oct-08	49.5	4.5	3	<1
	May-09	21.3	NA	NA	NA
	May-10	61.6	NA	NA	NA
MW-40-34	Oct-05	40.7	NA	NA	NA
	Nov-05	25.8	NA	NA	NA
	Jan-06	42.0	NA	NA	NA
	Mar-06	40.8	NA	NA	NA
	Jul-06	17.2	<1	<1	<1
	Sep-06	25.4	<1	<1	<1
	Jan-07	28.5	<1	<1	<1
	Apr-07	12.3	<1	<1	<1
	May-07	4,295	NA	NA	NA
	Jun-07	4,660	NA	NA	NA
	Jul-07	4,960	285.9	886.4	1210
	Oct-07	3,090	414.5	904.7	661.6
	Jan-08	2,810	453.8	763.6	648.3
	May-08	601	185.8	213.4	15.1
	Jul-08	228	71.5	73.6	<1
	Oct-08	43.4	<1	<1	<1
	May-09	7.34J	<1	<1	<1
	May-10	29.5	<1	<1	<1

TABLE 4-4

SUMMARY OF LABORATORY ANALYTICAL RESULTS FOR SUBSTRATE INDICATOR PARAMETERS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	COD (mg/L)	Acetic Acid (mg/L)	Propionic Acid (mg/L)	Butyric Acid (mg/L)
MW-40-35	Oct-05	18,300	NA	NA	NA
	Nov-05	24,200	NA	NA	NA
	Jan-06	35,200	NA	NA	NA
	Mar-06	19,600	NA	NA	NA
	Jul-06	9,950	2,995	4118	907.6
	Sep-06	10,000	5,810	5,487	699.3
	Jan-07	6,970	1,927	3,552	121.2
	Apr-07	4,240	1,781	2,988	63.9
	Jul-07	5,410	508.0	224.4	24.1
	Oct-07	2,460	1,441	570.2	51.0
	Jan-08	3,630	2,192	852.7	107.5
	May-09	1,300	NA	NA	NA
	May-10	502	NA	NA	NA
MW-40-36	Oct-05	15.3	<1	<1	<1
	Nov-05	82.5	<1	<1	<1
	Jan-06	28.9	<1	<1	<1
	Mar-06	68	<1	<1	<1
	Jul-06	22.4	<1	<1	<1
	Sep-06	14.4	<1	<1	<1
	Jan-07	14.5	<1	<1	<1
	Apr-07	53.7	<1	<1	<1
	May-07	859	NA	NA	NA
	Jun-07	1,010	NA	NA	NA
	Jul-07	794	280.5	810.7	113.2
	Oct-07	2,720	392.0	1,139	372.3
	Jan-08	2,360	319.9	1,086	422
	May-08	1,090	261.8	486.3	20.2
	Jul-08	437	79.4	209.0	<1
	Oct-08	41.4	<1	<1	<1
	May-09	57.3	NA	NA	NA
	May-10	43.6	NA	NA	NA

TABLE 4-4

SUMMARY OF LABORATORY ANALYTICAL RESULTS FOR SUBSTRATE INDICATOR PARAMETERS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	COD (mg/L)	Acetic Acid (mg/L)	Propionic Acid (mg/L)	Butyric Acid (mg/L)
MW-40-37	Oct-05	10.2	<1	<1	<1
	Nov-05	51.6	<1	<1	<1
	Jan-06	19.4	<1	<1	<1
	Mar-06	392	<1	<1	<1
	Jul-06	14.7	<1	<1	<1
	Sep-06	16.6	<1	<1	<1
	Jan-07	21.5	<1	<1	<1
	Apr-07	13.3	<1	<1	<1
	May-07	15.1	NA	NA	NA
	Jun-07	18.7	NA	NA	NA
	Jul-07	38.0	<1	<1	<1
	Oct-07	15.1	<1	<1	<1
	Jan-08	40.9	<1	<1	<1
	May-08	14.2	1U	1U	1U
	Jul-08	41.9	<1	<1	<1
	Oct-08	37.3	<1	<1	<1
	May-09	30.1	<1	<1	<1
	May-10	29.5	<1	<1	<1

Abbreviations and Acronyms:

COD – chemical oxygen demand
J – estimated value
mg/L – milligrams per liter
NA – not analyzed
U – not detected at or below the reporting limit

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TABLE 4-5

SUMMARY OF SELECT GEOCHEMICAL PARAMETER TESTING RESULTS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	DO (mg/L)	ORP (mV)	Nitrate (mg/L)	Sulfate (mg/L)	Methane (µg/L)	Ethane (mg/L)	pH	Sodium (mg/L)
MW-40-07	Oct-05	0.2	53	2.79	295	730	1.3 U	7.07	307
	Jan-06	0.28	14	1.35	278	2,600	1.3 U	6.88	326
	Mar-06	0.42	209	NA	NA	410	1.3 U	7.00	225
	Jul-06	0.13	-25	1.64	288	200	1.3	7.00	326
	Sep-06	NA	153	1.47	281	400	1.3 U	6.75	334
	Jan-07	0.14	117	2.21	291	480	1.3 U	6.71	310
	Apr-07	0.12	111	2.85	300	650	1.3 U	7.10	318
	May-07	0.16	-103	NA	NA	NA	NA	NA	NA
	Jun-07	0.05	-195	NA	NA	NA	NA	NA	NA
	Jul-07	0.1	-91	0.0710 J	1.47	9,200	1.3 U	NA	297
	Oct-07	0.19	-227	NA	NA	9,200	1.3 U	5.99	354
	Jan-08	0.18	-202	0.0971 J	1.97	17,000	1.3 U	6.30	361
	Apr-08	0.32	-168	0.104	0.983	14,000	1.3 U	6.36	343
	Jul-08	0.09	-142	0.287	2.78	14,000	1.3 U	6.46	340
	Oct-08	0.10	-83.2	0.170	1.36	18,000	1.3 U	6.74	320
	May-09	0.13	-112.6	0.298	1.55	16,000	1.3 U	7.1	317
	May-10	0.18	-156	.0745 J	36	15,000	1.3 U	6.58	282
MW-40-08	Jan-06	NA	NA	6.03	155	1.2 U	1.3 U	NA	223
	Jul-06	0.16	102	NA	NA	NA	NA	6.83	NA
	Sep-06	NA	142	NA	NA	NA	NA	7.51	NA
	Jan-07	0.42	196	NA	NA	NA	NA	7.20	NA
	Apr-07	0.16	105	NA	NA	NA	NA	7.13	NA
	Jul-07	0.17	67	NA	NA	NA	NA	NA	NA
	Oct-07	0.19	-75	NA	NA	NA	NA	7.18	NA
	Jan-08	0.28	-51	NA	NA	NA	NA	7.30	NA
	Jul-08	0.14	-29	NA	NA	NA	NA	7.31	NA
	Oct-08	0.15	45.0	NA	NA	NA	NA	6.8	NA
	May-09	0.09	-32.1	NA	NA	280	1.3 U	6.92	NA
	May-10	0.10	-134.0	NA	NA	11,000	1.3 U	6.75	NA
MW-40-14	Oct-05	0.17	-72	0.1 U	77.1	9,000	1.3 U	5.99	748
	Nov-05	0.18	0.18	0.5 U	10.2	9,800	1.3 U	6.11	1,220
	Jan-06	0.17	-249	0.1 U	0.84	11,000	1.3 U	5.99	1,330
	Mar-06	NA	NA	NA	NA	11,000	1.3 U	NA	NA
	Jul-06	0.08	-79	.08 J	34.8	510	1.3 U	6.23	572
	Sep-06	0.08	-60	0.2 U	17.7	15,000	1.3 U	NA	NA
	Jan-07	0.23	30	NA	NA	16,000	1.3 U	5.97	NA
	Apr-07	0.17	43	NA	NA	9,800	1.3 U	6.39	NA
	Jul-07	0.11	-26	NA	NA	15,000	1.3 U	NA	NA
	Oct-07	0.29	-141	NA	NA	8,100	1.3 U	6.45	NA
	Jan-08	0.59	-155	NA	NA	17,000	1.3 U	6.38	575
	Apr-08	0.49	-146	NA	NA	15,000	1.3 U	6.3	NA
	Jul-08	0.13	-110	NA	NA	15,000	1.3 U	6.12	NA
	Oct-08	0.19	-50.1	NA	NA	17,000	1.3 U	6.62	NA
	May-09	0.10	-72.8	0.0703 J	79.6	14,000	1.3 U	6.67	328
	May-10	0.36	-200	0.0878 J	121	16,000	1.3 U	6.46	360

TABLE 4-5

SUMMARY OF SELECT GEOCHEMICAL PARAMETER TESTING RESULTS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	DO (mg/L)	ORP (mV)	Nitrate (mg/L)	Sulfate (mg/L)	Methane (µg/L)	Ethane (mg/L)	pH	Sodium (mg/L)
MW-40-30	Oct-05	0.24	78	0.1 U	162	13,000	1.3 U	6.27	209
	Nov-05	0.17	78	0.44	143	9,900	1.3 U	6.3	200
	Jan-06	0.18	45	0.93	138	9,200	1.3 U	5.88	217
	Mar-06	0.3	135	NA	NA	12,000	1.3 U	5.80	193
	Jul-06	0.11	19	1.74	138	520	1.3	5.98	196
	Sep-06	NA	90	0.25 J	143	11,000	1.3 U	6.23	220
	Jan-07	0.18	77	0.11	148	16,000	1.3 U	6.22	206
	Apr-07	0.15	103	0.0661 J	147	14,000	1.3 U	6.35	193
	May-07	0.12	-9	NA	NA	NA	NA	NA	NA
	Jun-07	0.05	16	NA	NA	NA	NA	NA	NA
	Jul-07	0.1	-62	0.100 U	140	16,000	1.3 U	NA	196
	Oct-07	0.19	42	NA	NA	11,000	1.3 U	6.22	214
	Jan-08	0.1	-275	0.175	27.5	17,000	1.3 U	6.62	423
	Apr-08	0.49	-142	0.0686 J	123	15,000	1.3 U	6.59	379
	Jul-08	0.11	-5	0.0913 J	136	18,000	1.3 U	6.38	337
	Oct-08	0.09	22.4	0.100	124	14,000	1.3 U	5.94	326
	May-09	0.12	-70	0.1 U	0.36 J	12,000	1.3 U	6.95	286
	May-10	0.09	-147	0.0712 J	1.75	13,000	1.3 U	6.50	300
MW-40-31	Oct-05	0.14	-98	0.1 U	1.17	13,000	1.3 U	6.3	1,580
	Nov-05	0.18	-96	0.2 U	1.72	11,000	1.3 U	6.27	1,920
	Jan-06	0.14	-245	0.1 U	1.02	12,000	1.3 U	6.14	1,380
	Mar-06	NA	NA	NA	NA	15,000	1.3 U	NA	1,860
	Jul-06	0.05	-122	0.2	1.11	600	1.3	6.60	1,810
	Sep-06	NA	-13	0.5 UJ	2.15 J	15,000	1.3 U	NA	1,920
	Jan-07	0.13	-121	0.134J	4.18	22,000	1.3 U	6.89	1,610
	Apr-07	0.14	49	0.127	6.31	14,000	1.3 U	6.71	1,520
	Jul-07	0.08	-174	0.100 U	1.64	21,000	1.3 U	NA	1,670
	Oct-07	0.15	-164	NA	NA	15,000	1.3 U	6.88	1,730
	Jan-08	0.16	-220	0.165	1.39	20,000	1.3 U	6.97	1,680
	May-09	0.13	-121.4	NA	NA	NA	NA	7.20	NA
	May-10	0.09	-153	NA	NA	NA	NA	6.79	NA
MW-40-32	Oct-05	0.14	55	0.1 U	52.7	11,000	1.3 U	6.32	163
	Nov-05	0.11	-60	0.14	65.8	9,200	1.3 U	6.42	150
	Jan-06	0.12	-60	0.1 U	18.3	11,000	1.3 U	5.97	160
	Mar-06	NA	NA	NA	NA	12,000	1.3 U	NA	167
	Jul-06	0.08	-50	0.1 U	68.4	510	1.3	5.85	167
	Sep-06	NA	47	0.1 U	69.4	11,000	1.3 U	6.46	193 J
	Jan-07	0.12	76	0.1 U	70.9	15,000	1.3 U	6.49	226
	Apr-07	0.14	79	0.1 U	67.2	12,000	1.3 U	6.44	199
	May-07	0.13	-35	NA	NA	NA	NA	NA	NA
	Jun-07	0.29	-177	NA	NA	NA	NA	NA	NA
	Jul-07	0.11	-157	0.100 U	4.96	13,000	1.3 U	NA	209
	Oct-07	0.20	-223	NA	NA	9,000	1.3 U	6.41	207
	Jan-08	0.25	-202	0.14	2.73	10,000	1.3 U	6.60	616
	Apr-08	0.48	-174	0.0892 J	1.16	14,000	1.3 U	6.58	487
	Jul-08	0.09	-154	0.141	2.24	14,000	1.3 U	6.58	394
	Oct-08	0.14	-81.4	0.0900 J	1.36	18,000	1.3 U	6.62	360
	May-09	0.14	-109.4	0.1 U	0.48 J	16,000	1.3 U	6.80	377
	May-10	0.06	-168	0.148	0.88	14,000	1.3 U	6.53	229

TABLE 4-5

SUMMARY OF SELECT GEOCHEMICAL PARAMETER TESTING RESULTS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	DO (mg/L)	ORP (mV)	Nitrate (mg/L)	Sulfate (mg/L)	Methane (µg/L)	Ethane (mg/L)	pH	Sodium (mg/L)
MW-40-34	Oct-05	0.14	14	0.1 U	94.5	11,000	1.3 U	6.15	273
	Nov-05	0.11	-15	0.59	201	9,700	1.3 U	6.21	304
	Jan-06	0.17	87	0.78	139	11,000	1.3 U	6.00	267
	Mar-06	NA	159	NA	NA	11,000	1.3 U	NA	245
	Jul-06	0.12	123	0.91	149	470	1.3	5.92	283
	Sep-06	NA	87	0.1 U	183	12,000	1.3 U	6.29	274
	Jan-07	0.23	137	0.1 U	170	16,000	1.3 U	6.27	275
	Apr-07	0.11	90	0.0931 J	129	9,600	1.3 U	6.16	267
	May-07	0.19	-37	NA	NA	NA	NA	NA	NA
	Jun-07	0.11	-21	NA	NA	NA	NA	NA	NA
	Jul-07	0.09	-123	NA	NA	12,000	1.3 U	NA	296
	Oct-07	0.18	-179	NA	NA	14,000	1.3 U	5.63	333
	Jan-08	0.18	-176	NA	NA	12,000	1.3 U	5.97	327
	Apr-08	0.19	-202	NA	NA	15,000	1.3 U	6.44	328
	Jul-08	0.14	-168	0.0817 J	3.48	14,000	1.3 U	6.39	295
	Oct-08	0.25	-108.4	0.361	3.6	17,000	1.3 U	6.85	283
	May-09	0.09	-64.8	0.123	41.7	13,000	1.3 U	6.88	216
	May-10	0.13	-134	0.0592	41.4	14,000	1.3 U	6.38	153
MW-40-35	Oct-05	0.19	-34	0.1 U	6.08	6,700	1.3 U	6.15	3,480
	Nov-05	0.21	-119	0.2 U	2.72	6,800	1.3 U	6.31	4,000
	Jan-06	0.23	-99	0.5 U	7.84	5,200	1.3 U	5.94	5,160
	Mar-06	NA	1	NA	NA	8,600	1.3 U	NA	4,000
	Jul-06	0.06	-80	1	2.61	370	1.3	6.43	3,280
	Sep-06	NA	-48	1.0 U	11.8	14,000	0.75 J	NA	3,550
	Jan-07	0.18	-203	0.123J	0.787J	18,000	1.3 U	7.01	3,550
	Apr-07	0.14	50	0.254	1.93	16,000	1.3 U	6.96	3,110
	Jul-07	0.09	-164	NA	NA	21,000	1.3 U	NA	2,800
	Oct-07	0.15	-215	NA	NA	9,800	1.3 U	7.17	2,690
	Jan-08	0.15	-194	NA	NA	18,000	1.3 U	7.04	2,880
	May-09	0.12	-134.9	NA	NA	NA	NA	7.22	NA
	May-10	0.06	-209	NA	NA	NA	NA	7.08	NA
MW-40-36	Oct-05	0.21	67	0.78	168	1,700	1.3 U	6.91	219
	Nov-05	0.29	31	0.1 U	288	520	1.3 U	7.00	258
	Jan-06	0.17	86	0.48	152	4,700	1.3 U	6.62	230
	Mar-06	NA	114	NA	NA	5,800	1.3 U	NA	248
	Jul-06	0.11	35	0.57	169	450	1.3	6.39	277
	Sep-06	NA	81	0.441	177	9,700	1.3 U	NA	279
	Jan-07	0.20	51	0.1U	176	8,300	1.3 U	6.66	310
	Apr-07	0.14	91	0.0991 J	188	7,400	1.3 U	6.48	295
	May-07	0.19	-140	NA	NA	NA	NA	NA	NA
	Jun-07	0.08	-134	NA	NA	NA	NA	NA	NA
	Jul-07	0.08	-135	.0840 J	1.20	13,000	1.3 U	NA	281
	Oct-07	0.18	-173	NA	NA	14,000	1.3 U	5.84	316
	Jan-08	0.13	-167	0.156	1.51	14,000	1.3 U	6.05	292
	Apr-08	0.37	-164	0.0896 J	0.952	19,000	1.3 U	6.38	284
	Jul-08	0.11	-161	0.0931 J	0.799	20,000	1.3 U	6.51	246
	Oct-08	0.19	-102.1	0.114	1.18	18,000	1.3 U	6.62	231
	May-09	0.09	-152.3	NA	NA	15,000	1.3 U	6.87	NA
	May-10	0.08	-200	NA	NA	10,000	2	6.38	NA

TABLE 4-5

SUMMARY OF SELECT GEOCHEMICAL PARAMETER TESTING RESULTS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	DO (mg/L)	ORP (mV)	Nitrate (mg/L)	Sulfate (mg/L)	Methane (µg/L)	Ethane (mg/L)	pH	Sodium (mg/L)
MW-40-37	Oct-05	0.16	82	0.1 U	286	330	1.3 U	7.23	271
	Nov-05	0.2	-59	1.11	154	1,600	1.3 U	7.48	211
	Jan-06	0.16	-3	0.1 U	277	920	1.3 U	7.22	282
	Mar-06	NA	219	NA	NA	1.2 U	1.3 U	NA	272
	Jul-06	0.13	-76	0.1 U	256	230	1.3	6.77	277
	Sep-06	NA	53	0.1 UJ	248	1,600	1.3 U	NA	297
	Jan-07	0.16	111	0.083J	252	2,600	1.3 U	7.04	301
	Apr-07	0.16	89	0.1 U	261	2,000	1.3 U	6.87	278
	May-07	0.18	-191	NA	NA	NA	NA	NA	NA
	Jun-07	0.09	-274	NA	NA	NA	NA	NA	NA
	Jul-07	0.09	-243	.0964 J	185	2,400	NA	NA	278
	Oct-07	0.19	-188	NA	NA	3,700	1.3 U	6.88	305
	Jan-08	0.20	-156	0.0999 J	170	5,300	1.3 U	6.79	296
	Apr-08	0.44	-117	0.108	208	2,800	1.3 U	6.79	297
	Jul-08	0.12	-109	0.100 U	188	3,400	1.3 U	6.63	293
	Oct-08	0.04	-46.8	0.0900 J	193	6,600	1.3 U	6.52	282
	May-09	0.11	-29.1	0.1 U	204	2,200	1.3 U	7.11	284
	May-10	0.25	-84	0.0555 J	246	3,900	0.61 J	6.52	270

Abbreviations and Acronyms:

µg/L – micrograms per liter
DO – dissolved oxygen
J – estimated value
mg/L – milligrams per liter
mV – millivolt
NA – not analyzed
ORP – oxidation/reduction potential
U – analyte is not detected at or below the listed reporting limit

TABLE 4-6

SUMMARY OF MICROBIOLOGICAL PARAMETER LABORATORY ANALYTICAL RESULTS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	DHC (cells/L)	Total PLFA Biomass (cells/L)
MW-40-07	Jul-06	NA	NA
	Sep-06	NA	NA
	Jan-07	NA	NA
	Apr-07	NA	NA
	May-07	NA	NA
	Jun-07	NA	NA
	Jul-07	NA	NA
	Oct-07	NA	NA
	Jan-08	6.81E+03	1.16E+09
	May-08	NA	NA
	Jul-08	1.10E+05	1.60E+09
	Oct-08	2.97E+06	2.53E+09
	May-10	1.14E+07	1.20E+09
MW-40-08	Jan-08	NA	NA
MW-40-14	Oct-05	8.31E+04	NA
	Nov-05	4.30E+03	NA
	Jan-06	2.36E+03	NA
	Mar-06	NA	NA
	Jul-06	NA	NA
	Sep-06	NA	NA
	Jan-07	NA	NA
	Apr-07	NA	NA
	Jul-07	NA	NA
	Oct-07	NA	NA
	Jan-08	6.48E+04	3.79E+08
	May-08	NA	NA
	Jul-08	NA	NA
	Oct-08	NA	NA
MW-40-30	Oct-05	4.79E+00	NA
	Nov-05	1.25E+00	NA
	Jan-06	6.58E+00	NA
	Mar-06	4.76E+00	NA
	Jul-06	1.14E+03	3.41E+08
	Sep-06	1.15E+04	7.12E+08
	Jan-07	5.90E+04	1.94E+08
	Apr-07	1.20E+04	1.93E+08
	May-07	NA	NA
	Jun-07	NA	NA
	Jul-07	3.34E+02	4.48E+07
	Oct-07	2.36E+05	1.24E+09
	Jan-08	2.25E+07	2.50E+09
	May-08	3.01E+07	3.84E+09
	Jul-08	2.38E+05	1.72E+09
	Oct-08	1.85E+06	1.89E+09
	May-10	2.50E+06	1.11E+09

TABLE 4-6

SUMMARY OF MICROBIOLOGICAL PARAMETER LABORATORY ANALYTICAL RESULTS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	DHC (cells/L)	Total PLFA Biomass (cells/L)
MW-40-31	Oct-05	9.95E+03	NA
	Nov-05	6.55E+03	NA
	Jan-06	7.35E+02	NA
	Mar-06	1.38E+03	NA
	Jul-06	1.74E+05	2.91E+09
	Sep-06	3.24E+05	1.70E+09
	Jan-07	1.01E+05	1.35E+09
	Apr-07	6.71E+04	5.54E+08
	Jul-07	2.32E+04	6.51E+08
	Oct-07	4.61E+05	2.17E+09
	Jan-08	2.44E+03	1.77E+09
MW-40-32	Oct-05	3.00E+03	NA
	Nov-05	5.03E+03	NA
	Jan-06	4.32E+03	NA
	Mar-06	2.61E+03	NA
	Jul-06	1.11E+06	2.51E+08
	Sep-06	3.45E+06	1.94E+08
	Jan-07	8.34E+06	2.65E+08
	Apr-07	5.38E+06	1.09E+08
	May-07	NA	NA
	Jun-07	NA	NA
	Jul-07	4.94E+07	8.52E+07
	Oct-07	2.09E+08	1.25E+08
	Jan-08	4.33E+07	5.58E+08
	May-08	1.88E+08	4.57E+08
	Jul-08	1.06E+07	2.13E+08
	Oct-08	2.71E+07	1.10E+08
MW-40-34	Oct-05	2.93E+02	NA
	Nov-05	7.14E+00	NA
	Jan-06	2.44E+01	NA
	Mar-06	9.26E+01	NA
	Jul-06	7.91E+04	1.37E+08
	Sep-06	2.61E+04	8.97E+08
	Jan-07	2.85E+05	1.49E+09
	Apr-07	7.72E+04	1.45E+09
	May-07	NA	NA
	Jun-07	NA	NA
	Jul-07	2.25E+04	1.84E+09
	Oct-07	2.00E+05	6.46E+09
	Jan-08	7.98E+04	1.92E+09
	May-08	7.41E+06	5.24E+09
	Jul-08	1.22E+05	1.70E+09
	Oct-08	8.16E+04	1.44E+09
	May-10	2.63E+04	4.83E+08

TABLE 4-6

SUMMARY OF MICROBIOLOGICAL PARAMETER LABORATORY ANALYTICAL RESULTS FOR KEY MONITORING WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	DHC (cells/L)	Total PLFA Biomass (cells/L)
MW-40-35	Oct-05	3.00E+02	NA
	Nov-05	1.21E+03	NA
	Jan-06	3.79E+03	NA
	Mar-06	1.31E+03	NA
	Jul-06	2.79E+05	2.52E+09
	Sep-06	7.70E+04	2.02E+09
	Jan-07	7.03E+04	2.03E+09
	Apr-07	9.31E+04	1.17E+09
	Jul-07	1.35E+04	1.74E+09
	Oct-07	1.92E+06	5.77E+09
	Jan-08	1.28E+05	3.38E+09
MW-40-36	Oct-05	1.48E+05	NA
	Nov-05	1.47E+05	NA
	Jan-06	4.34E+04	NA
	Mar-06	5.49E+03	NA
	Jul-06	7.03E+04	1.77E+08
	Sep-06	3.88E+04	1.61E+08
	Jan-07	2.70E+05	8.94E+08
	Apr-07	9.67E+04	1.64E+08
	May-07	NA	NA
	Jun-07	NA	NA
	Jul-07	1.51E+06	2.36E+09
	Oct-07	1.02E+07	2.31E+09
	Jan-08	1.54E+06	1.84E+09
	May-08	1.34E+07	3.56E+09
	Jul-08	7.22E+05	1.71E+09
	Oct-08	6.12E+06	1.29E+09
MW-40-37	Oct-05	NA	NA
	Nov-05	1.73E+04	NA
	Jan-06	1.19E+06	NA
	Mar-06	2.46E+05	NA
	Jul-06	1.81E+05	1.64E+08
	Sep-06	5.17E+06	6.17E+08
	Jan-07	3.79E+06	9.74E+08
	Apr-07	1.60E+06	6.55E+08
	May-07	NA	NA
	Jun-07	NA	NA
	Jul-07	5.44E+06	9.84E+09
	Oct-07	9.25E+05	5.60E+08
	Jan-08	1.94E+04	5.37E+08
	May-08	6.38E+06	1.36E+09
	Jul-08	2.46E+05	5.79E+08
	Oct-08	1.47E+06	5.89E+08
	May-10	1.50E+05	6.39E+08

Abbreviations and Acronyms:

cells/L – cells per liter
DHC – *Dehalococcoides* spp.
NA – not analyzed
PLFA – phospholipid fatty acid

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TABLE 4-7

SUMMARY OF SOIL GAS LABORATORY ANALYTICAL RESULTS FOR SAMPLES COLLECTED FROM SELECT SOIL GAS WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	PCE ($\mu g/m^3$)	TCE ($\mu g/m^3$)	cis-1,2-DCE ($\mu g/m^3$)	trans-1,2-DCE ($\mu g/m^3$)	1,1-DCE ($\mu g/m^3$)	Vinyl Chloride ($\mu g/m^3$)	Ethene (percent)	Ethane (percent)	Methane (percent)
IW-1	10/11/05	7,900	5,500	26,000	1300	430	3,700	0 U	0 U	60.63
	10/31/05	3,700	3,600	17,100	790	450	2,600	0 U	0 U	58.31
	11/29/05	4,000	2,800	22,300	1,200	470	4,900	0 U	0 U	63.43
	01/18/06	1,100	2,200	10,000	530 U	610 U	2,300	0 U	0 U	58.91
	03/16/06	680	2,000	5,100	310	240 U	1,600	0 U	0 U	71.29
	07/19/06	500 U	850	8,300	830	450 U	5,400	0 U	0 U	65.92
	09/14/06	270 U	780	10,200	1600	240 U	7,800	0 U	0 U	69.08
	01/08/07	1800 U	450 U	11,500	2,100	NA	6,700	30 U	30 U	69.55
	04/05/07	1800 U	350 U	16,100	2,100	NA	6,900	30 U	30 U	2.59
	07/09/07	3600 U	680 U	14,800	1,600	NA	10,300	30 U	30 U	76.41
	10/11/07	180 U	360 J	9,700	3,200	NA	8,100	30 U	30 U	77.93
	10/11/07	180 U	370 J	12,200	3,900	NA	9,300	30 U	30 U	73.21
	01/22/08	26 U	50 J	1,400	560	26 U	1,700	30 U	30 U	67.73
	04/10/08	360 U	290 U	5,500	2,100	NA	5,300	NA	NA	NA
	07/15/08	360 U	480 J	9,900	3,600	NA	7,500	30 U	30 U	60.14
	07/15/08	360 U	480 J	10,500	3,800	NA	8,000	30 U	30 U	60.29
	10/02/08	140 U	930	15,400	3,800	NA	12,000	30 U	30 U	53.32
	10/02/08	140 U	820	14,500	3,700	NA	11,500	30 U	30 U	54.12
	05/28/09	140 U	180 J	2,600	2,100	NA	1,100	30 U	30 U	54.53
	05/04/10	360 U	330	2,600	3,800	210 U	3,900	0 U	0 U	63.00
IW-3	10/11/05	17,500	6,500	1,300	210 U	550	5,000	0 U	0 U	65.36
	10/31/05	22,100	6,800	2,300	210 U	400	16,400	0 U	0 U	81.22
	11/29/05	22,000	6,400	5,500	850 U	3,900	40,500	0 U	0 U	84.21
	01/18/06	19,400	9,300	2,300	530 U	610 U	27,400	0 U	0 U	69.76
	03/16/06	880	1,400	3,200	210 U	240 U	8,400	0 U	0 U	78.49
	07/19/06	10,200	5,400	3,400	500	530 U	21,000	0 U	0 U	71.66
	09/14/06	9,000	4,200	3,000	800	240 U	21,500	0 U	0 U	74.82
	01/08/07	7,400	1,300 J	1,300	1,000	NA	15,200	30 U	30 U	81.04
	04/05/07	2,300	2,400	3,000	760 J	NA	16,100	30 U	30 U	78.89
	07/09/07	3,600	4,000	4,600	300 J	NA	16,200	30 U	30 U	86.95
	10/11/07	3,900	680	690	1,400	NA	18,400	30 U	30 U	86.40
	01/22/08	280 J	570	1,100	110 J	39 U	3,500	30 U	30 U	75.26
	04/10/08	430 J	810 J	960 J	290 J	NA	6,200	NA	NA	NA
	07/15/08	2,500	1,700	210 U	170 U	NA	130 U	30 U	30 U	0.93
	10/02/08	420 J	340 J	670	1,800	NA	14,000	30 U	30 U	74.57
IW-7	10/11/05	4,600	480 U	74,900	850 U	8,600	19,600	0 U	0 U	82.54
	10/31/05	5,900	400	46,700	380	530	9,500	0 U	0 U	83.21
	11/29/05	6,400	480 U	51,800	850 U	1900	28,900	0 U	0 U	79.05
	01/18/06	5,600	970	10,400	530 U	610 U	25,700	0 U	0 U	66.94
	03/16/06	1,000	100	920	170 U	200 U	7,600	0 U	0 U	82.75
	07/19/06	2,100	850	820	460 U	520 U	14,500	0 U	0 U	70.45
	09/14/06	3,300	800	900	400	240 U	15,500	0 U	0 U	72.01
	01/08/07	8,300	1,600	1,500	520 J	NA	12,200	30 U	30 U	79.99
	04/05/07	1,900	2,000	2,300	900 U	NA	10,000	30 U	30 U	0.86
	07/09/07	550 J	1,400 U	1,100 U	900 U	NA	670 U	30 U	30 U	86.91
	10/11/07	2,900	4,400	1,200	380 J	NA	15,300	30 U	30 U	86.13
	01/22/08	420	1,200	470	120 J	37 J	3,100	30 U	30 U	72.54
	04/10/08	1,100 J	4,000	1,100	290 J	NA	7,000	NA	NA	NA
	07/15/08	2,100	5,600	890	350	NA	9,100	30 U	30 U	66.85
	10/02/08	6,400	5,400	720	320	NA	14,600	30 U	30 U	72.46
	05/28/09	140 J	1,400	810	670	NA	940	30 U	30 U	60.93
	05/04/10	260 J	260 J	210 U	300	210 U	7,000	0 U	0 U	70.47

TABLE 4-7

SUMMARY OF SOIL GAS LABORATORY ANALYTICAL RESULTS FOR SAMPLES COLLECTED FROM SELECT SOIL GAS WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	PCE (µg/m^3)	TCE (µg/m^3)	cis-1,2-DCE (µg/m^3)	trans-1,2-DCE (µg/m^3)	1,1-DCE (µg/m^3)	Vinyl Chloride (µg/m^3)	Ethene (percent)	Ethane (percent)	Methane (percent)
MW-40-34	10/11/05	16,800	910	1,100	210 U	470	330	0 U	0 U	68.32
	10/31/05	21,200	1,300	1,800	210 U	270	470	0 U	0 U	76.41
	11/29/05	41,200	850	580	210 U	240 U	1,100	0 U	0 U	84.02
	01/18/06	55,800	920	310	530 U	610 U	690	0 U	0 U	71.79
	03/16/06	2,600	100	22 U	43 U	48 U	150	0 U	0 U	82.32
	07/19/06	81,900	3,100	360 U	690 U	790 U	810	0 U	0 U	71.25
	09/14/06	60,200	3,100	900	210 U	240 U	900	0 U	0 U	71.71
	01/08/07	30,500	2,900	1,000	900 U	NA	1,100	30 U	30 U	79.70
	04/05/07	47,400	3,100	760	900 U	NA	1,200	30 U	30 U	76.17
	07/09/07	32,900	4,000	1,300	900 U	NA	730	30 U	30 U	82.25
	10/11/07	21,400	1,600	1,400	85 U	NA	480 J	30 U	30 U	81.93
	01/22/08	2,700	590	320	38 J	26 U	380	30 U	30 U	71.07
	04/10/08	16,500	1,700	1,200	170 U	NA	670	NA	NA	NA
	07/15/08	17,600	3,600	3,400	170 U	NA	940	30 U	30 U	67.27
	10/02/08	7,000	1,800	3,300	68 U	NA	3,000	30 U	30 U	37.85
MW-40-37	05/28/09	140 U	1,100	600	130 J	NA	1,700	30 U	30 U	21.85
VW-40-01	10/11/05	5,400	3,800	21,100	630	780	8,800	0 U	0 U	68.39
	10/31/05	4,200	3,900	15,000	420	410	7,200	0 U	0 U	68.95
	11/29/05	7,500	5,000	20,000	850 U	1200	9,400	0 U	0 U	68.27
	01/18/06	2,600	4,100	8,900	530 U	610 U	6,300	0 U	0 U	59.41
	03/16/06	96	330	740	43 U	48 U	430	0 U	0 U	74.36
	07/19/06	1,500	8,800	11,800	1800	460 U	7,500	0 U	0 U	65.05
	09/14/06	1,000	7,500	11,100	2700	240 U	7,600	0 U	0 U	68.78
	01/08/07	1,800 U	1,100 J	6,400	2,000	NA	6,400	30 U	30 U	75.71
	04/05/07	1,800 U	4,600	9,700	3,500	NA	7,100	30 U	30 U	66.98
	07/09/07	1,800 U	4,200	5,500	1,700	NA	6,000	30 U	30 U	79.49
	10/11/07	180 U	2,900	3,400	2,800	NA	3,600	30 U	30 U	78.80
	01/22/08	26 U	310	840	600	26 U	1,300	30 U	30 U	68.72
	04/10/08	360 U	2,400	3,900	3,300	NA	3,800	NA	NA	NA
	07/15/08	360 U	2,400	2,800	3,000	NA	3,200	30 U	30 U	67.24
	10/02/08	180 J	2,200	2,500	3,100	NA	4,400	30 U	30 U	70.05
VW-40-02	10/11/05	6,800	5,700	12,000	510	2,100	6,800	0 U	0 U	63.13
	10/31/05	5,700	4,900	7,900	330	340	4,800	0 U	0 U	64.4
	11/29/05	8,400	5,900	10,400	850 U	970 U	5,800	0 U	0 U	64.25
	01/18/06	7,300	5,000	5,700	530 U	610 U	4,100	0 U	0 U	58.51
	03/16/06	500	460	1,400	43 U	48 U	860	0 U	0 U	68.96
	07/19/06	13,500	10,400	6,600	810	530 U	5,100	0 U	0 U	64.49
	09/14/06	1,700	1,600	17,800	1500	240 U	5,900	0 U	0 U	68.49
	01/08/07	460 J	1,800	11,300	1,700	NA	5,200	30 U	30 U	75.42
	04/05/07	440 J	2,800	16,500	2,200	NA	5,700	30 U	30 U	49.96
	07/09/07	3,600 U	1,200 J	5,400	1,800	NA	6,600	30 U	30 U	79.82
	10/11/07	180 U	1,800	9,300	4,700	NA	5,800	30 U	30 U	79.81
	01/22/08	26 U	210 J	1,100	590	26 U	1,300	30 U	30 U	68.54
	04/10/08	360 U	290 U	5,700	3,100	NA	4,100	NA	NA	NA
	07/15/08	360 U	2,100	1,700	2,300	NA	1,900	30 U	30 U	51.99
	10/02/08	140 U	480 J	4,500	3,800	NA	4,500	30 U	30 U	71.38

TABLE 4-7

SUMMARY OF SOIL GAS LABORATORY ANALYTICAL RESULTS FOR SAMPLES COLLECTED FROM SELECT SOIL GAS WELLS OCTOBER 2005 THROUGH MAY 2010

Location	Date	PCE (µg/m^3)	TCE (µg/m^3)	cis-1,2-DCE (µg/m^3)	trans-1,2-DCE (µg/m^3)	1,1-DCE (µg/m^3)	Vinyl Chloride (µg/m^3)	Ethene (percent)	Ethane (percent)	Methane (percent)
VW-40-03	10/11/05	61,900	6,400	11,100	300	640	7,300	0 U	0 U	67.62
	10/31/05	58,000	6,300	8,800	220	400	5,900	0 U	0 U	69.01
	11/29/05	75,100	7,900	12,000	850 U	1,100	7,000	0 U	0 U	68.91
	01/18/06	60,500	4,500	5,500	530 U	610 U	2,800	0 U	0 U	55.3
	03/16/06	28,900	2,300	4,600	130 U	150 U	1,300	0 U	0 U	73.11
	07/19/06	69,000	6,400	7,000	400 U	460 U	1,800	0 U	0 U	65.54
	09/14/06	57,500	6,000	7,500	220	240 U	1,700	0 U	0 U	68.88
	01/08/07	37,400	4,500	5,800	240	NA	2,000	30 U	30 U	73.76
	04/05/07	49,500	4,400	6,200	230	NA	2,000	30 U	30 U	17.25
	07/09/07	21,400	7,800	3,300	350	NA	2,400	30 U	30 U	78.79
	10/11/07	8,600	16,300	4,800	870	NA	1,900	30 U	30 U	79.24
	01/22/08	840	2,300	810	230	26 U	550	30 U	30 U	67.85
	04/10/08	6,700	22,100	3,300	1,200	NA	1,700	NA	NA	NA
	07/15/08	3,900	23,300	3,600	1,800	NA	1,400	30 U	30 U	65.11
	10/02/08	2,800	25,400	4,400	2,600	NA	1,900	30 U	30 U	68.74
	05/28/09	1,400 U	8,700	7,800	2,900 J	NA	3,400	30 U	30 U	56.36
	05/04/10	180 J	9,300	9,000	2,300	210 U	3,200	0 U	0 U	65.31
VW-40-04	10/11/05	6,600	380	850	210 U	420	220 U	0 U	0 U	0 U
	10/31/05	4,100	230	360	210 U	560	220 U	0 U	0 U	0 U
	11/29/05	4,800	420	540	210 U	240 U	220 U	0 U	0 U	0 U
	01/08/07	7,900	1,200 J	230 J	900 U	NA	670 U	30 U	30 U	30 U
	07/09/07	5,900	2,800	2,500	210 J	NA	16,500	30 U	30 U	2.56
	10/11/07	2,100	190 J	190 J	85 U	NA	67 U	30 U	30 U	17.11
	01/22/08	540	130 J	47 J	21 U	26 U	350	30 U	30 U	52.63
	04/10/08	1,600 J	930 J	210 U	170 U	NA	1,600	NA	NA	NA
	07/15/08	3,900	290 J	210 U	170 U	NA	130 U	30 U	30 U	12.05
	10/02/08	2,000	110 U	84 U	68 U	NA	54 U	30 U	30 U	0.00
VW-40-05	10/11/05	5,300	230	730	210 U	450	220 U	0 U	0 U	0 U
	10/31/05	4,100	220	410	210 U	310	220 U	0 U	0 U	0 U
	11/29/05	4,800	360	520	210 U	240 U	220 U	0 U	0 U	0 U
VW-40-06	10/11/05	44,700	5,900	4,000	850 U	3,500	1,700	0 U	0 U	83.45
	10/31/05	51,000	8,700	2,900	210 U	450	1,800	0 U	0 U	84.62
	11/29/05	65,200	11,400	5,700	850 U	1,200	2,400	0 U	0 U	84.26
	01/18/06	56,600	8,000	3,100	530 U	610 U	1,500	0 U	0 U	66.08
	03/16/06	7,600	1,600	600	170 U	190 U	380	0 U	0 U	82.92
	07/19/06	57,000	10,300	2,500	400 U	450 U	1,700	0 U	0 U	74.08
	09/14/06	40,100	9,300	3,200	210 U	240 U	1,700	0 U	0 U	68.32
	01/08/07	22,700	8,500	2,600 J	900 U	NA	2,500	30 U	30 U	81.06
	04/05/07	26,500	4,000	1,000	900 U	NA	670 U	30 U	30 U	39.82
	07/09/07	12,700	12,100	3,100	900 U	NA	1,400	30 U	30 U	83.12
	10/11/07	5,900	1,800	10,100	12,100	NA	4,400	30 U	30 U	77.88
	01/22/08	620	240 J	1,100	34 U	42 U	2,600	30 U	30 U	65.46
	04/10/08	2,000	960 J	3,300	170 U	NA	8,600	NA	NA	NA
	07/15/08	2,000	1,200	2,100	5,500	NA	7,200	30 U	30 U	61.07
	10/02/08	1,900	1,400	2,600	130 J	NA	5,700	30 U	30 U	64.08
	05/28/09	360 U	1,200 J	990 J	240 J	NA	6,700	30 U	30 U	56.76
	05/28/09	360 U	830 J	590 J	180 U	NA	260 J	30 U	30 U	57.32
	05/04/10	190 J	640	370	98 J	210 U	1,600	0 U	0 U	66.12

Abbreviations and Acronyms:

µg/m^3 – micrograms per cubic meter
DCE – dichloroethene
J – estimated value
PCE – tetrachloroethene
TCE – trichloroethene
U – analyte is not detected at or below the listed reporting limit

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TABLE 4-8

SOIL GAS FIELD TESTING RESULTS – MAY 4, 2010

Well ID	Time	Methane (percent)	Oxygen (percent)	Hydrogen Sulfide (ppm)	Carbon Dioxide (percent)	Carbon Monoxide (ppm)	VOCs (ppm_v)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet bgs)	Well Depth (feet bgs)
VW-40-01	1250	87.5	0.0	1.0	23.4	0.0	0.0		2	2.5 to 7.5	8
VW-40-02	1245	91.9	0.0	0.0	23.6	0.0	0.0		2	2.5 to 7.5	8
VW-40-03	1134	81.4	0.0	0.0	31.7	0.0	0.0		2	3.5 to 10	10.0
VW-40-04	1128	18.6	16.5	0.0	6.4	0.0	0.0		2	3.5 to 10	10.0
VW-40-05	1134	20.1	19.1	0.0	8.9	0.0	0.0		2	3.5 to 10	10.0
VW-40-06	1308	81.9	0.0	19.0	33.8	12.0	0.0		2	3.5 to 10	10.0
IW-1	1255	76.8	0.0	14.0	23.3	0.0	0.0		0.5	3.5 to 10	10.0
IW-2	0858	57.4	0.0	0.0	18.8	0.0	0.0		0.5	3.5 to 10	10.0
IW-3	0905	89.5	0.0	14.0	24.5	0.0	0.0	Flooded	0.5	3.5 to 10	10.0
IW-4	0910	74.4	2.0	4.0	20.3	0.0	0.0		0.5	3.5 to 10	10.0
IW-5		No probe							0.5	3.5 to 10	10.0
IW-6	1128	82.6	0.0	0.0	33.8	14.0	0.0		0.5	3.5 to 10	10.0
IW-7	1124	88.7	0.0	11.0	26.7	16.0	0.0		0.5	3.5 to 10	10.0
IW-8	0918	78.3	1.8	0.0	19.9	0.0	0.0	Flooded	0.5	3.5 to 10	10.0
IW-9	1257	57.6	0.0	2.0	6.3	0.0	0.0		0.5	3.5 to 10	10.0
IW-10	1307	89.3	0.0	0.0	25.8	0.0	0.0		0.5	3.5 to 10	10.0
IW-11	0950	56.7	8.5	0.0	7.2	4.0	0.0		0.5	3.5 to 10	10.0
IW-12	1000	48.6	9.2	0.0	13.4	18.0	0.0		0.5	3.5 to 10	10.0
IW-13	1056	84.3	0.0	1.0	31.9	12.0	0.0		0.5	3.5 to 10	10.0
IW-14	1107	79.7	0.0	0.0	34.2	0.0	0.0	Flooded	0.5	3.5 to 10	10.0
IW-15	1113	77.5	0.0	1.0	29.3	0.0	0.0		0.5	3.5 to 10	10.0
IW-16	1023	0.1	20.9	0.0	0.1	0.1	0.0		0.5	3.5 to 10	10.0
IW-17	1040	0.2	10.7	1.0	25.3	20.0	0.0		0.5	3.5 to 10	10.0
MW-40-30		WATER IN PROBE							0.5	3.5 to 10	10.0
MW-40-31		WATER IN PROBE							0.5	3.5 to 10	10.0
MW-40-32	1302	87.0	0.0	0.0	28.9	0.0	0.0		0.5	3.5 to 10	10.0
MW-40-33	1015	5.9	10.7	0.0	1.6	0.0	0.0		0.5	3.5 to 10	10.0
MW-40-34	1033	27.8	16.6	0.0	8.7	0.0	0.0		0.5	3.5 to 10	10.0
MW-40-35	0942	47.3	6.3	0.0	21.0	12.0	0.0		0.5	3.5 to 10	10.0
MW-40-36	0935	76.5	1.2	0.0	26.5	13.0	0.0		0.5	3.5 to 10	10.0
MW-40-37	1121	82.9	0.0	2.5	30.7	0.0	0.0		0.5	3.5 to 10	10.0
MW-40-38	1311	56.5	0.0	0.0	17.4	25.0	0.0		0.5	3.5 to 10	10.0
MW-40-39	1330	0.1	20.0	0.0	1.9	0.0	0.0		0.5	3.5 to 10	10.0

Notes:

22.1 Exceeding LEL for methane which is 5 percent in air.

Abbreviations and Acronyms:

bgs – below ground surface
LEL – lower explosive limit
ppm – parts per million
ppm_v – parts per million in volume
VOC – volatile organic compound

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TABLE 6-1

ASSESSMENT OF WELLS AND RECOMMENDATIONS FOR ANNUAL MONITORING

Well	TCG Exceedance (Based on Most Recent Sampling/Data for Each Well)	Data of Most Recent Sampling/Analysis	Date/Concentration of Last Exceedence	Recommendation	Comment/Rationale
MW-40-02	None	10/7/2008	7/25/07 [DCE - 6.6 µg/L]	No Further Monitoring	Upgradient, no exceedence for over a year
MW-40-06	None	1/15/2008	6/27/05 [PCE - 9.1 µg/L]	No Further Monitoring	Upgradient, no exceedence for over 2 years
MW-40-07	VC - 0.78 µg/L	5/6/2010	Current	Annual Monitoring	Currently exceeds TCG
MW-40-08	DCE - 27 µg/L	5/6/2010	Current	Annual Monitoring	Currently exceeds TCG
MW-40-10	None	1/15/2008	3/21/06 [PCE - 6.7 µg/L]	No Further Monitoring	Upgradient, no exceedences for over 2 years
MW-40-11	None	1/17/2008	None, monitored since 3/22/05	No Further Monitoring	COCs have never been detected
MW-40-13	None	5/6/2010	1/9/2006 [PCE - 8.2 µg/L; TCE - 9 µg/L]	Annual Monitoring	No exceedences for over 4 years, but serves as deep downgradient check well.
MW-40-14	VC - 3.1 µg/L	5/6/2010	Current	Annual Monitoring	Currently Exceeds TCG
MW-40-15	None	1/17/2008	None, monitored since 3/22/05	No Further Monitoring	COCs have never exceeded TCGs. May be added if COC concentrations in MW-40-08 continue increasing.
MW-40-16	None	1/17/2008	None, monitored since 1/6/06	No Further Monitoring	COCs have never been detected. May be added if COC concentrations in MW-40 08 continue increasing.
MW-40-17	None	1/17/2008	9/28/2005 [PCE - 16 µg/L]	No Further Monitoring	No exceedences for over 2 years. May be added if COC concentrations in MW-40-08 continue increasing
MW-40-18	None	1/17/2008	None, monitored since 1/6/06	No Further Monitoring	COCs have never been detected. May be added if COC concentrations in MW-40 08 continue increasing.
MW-40-19	None	1/15/2008	None, monitored since 3/22/05	No Further Monitoring	COCs have never exceeded TCGs
MW-40-20	None	1/15/2008	None, monitored since 3/22/05	No Further Monitoring	COCs have never exceeded TCGs
MW-40-22	VC - 4.6 µg/L	5/6/2010	Current	Annual Monitoring	Currently exceeds TCG
MW-40-30	VC - 4 µg/L	5/6/2010	Current	Annual Monitoring	Currently exceeds TCG
MW-40-31	VC - 0.60 µg/L	5/6/2010	Current	Annual Monitoring	Currently exceeds TCG
MW-40-32	VC - 2.1 µg/L	5/6/2010	Current	Annual Monitoring	Currently exceeds TCG
MW-40-33	None	1/15/2008	None, monitored since 3/22/05	No Further Monitoring	COCs have never exceeded TCGs
MW-40-34	None	5/6/2010	10/06/08 [VC - 1.1 µg/L]	Annual Monitoring	No exceedences in 2 years; however used as a shallow cross gradient check well.
MW-40-35	None	5/6/2010	5/22/09 [DCE - 11 µg/L]	Annual Monitoring	Deep centrally located check well
MW-40-36	VC - 2.2 µg/L	5/6/2010	Current	Annual Monitoring	Currently exceeds TCG
MW-40-37	DCE - 90 µg/L; VC - 37 µg/L	5/6/2010	Current	Annual Monitoring	Currently exceeds TCG
MW-40-38	None	1/17/2008	None, monitored since 3/22/05	No Further Monitoring	COCs never exceeded TCGs
MW-40-39	None	5/6/2010	None, monitored since 3/22/05	No Further Monitoring	COCs have never exceeded TCGs. May be added if COC concentrations rebound in MW-40-07.
IW-2	VC - 1.0 µg/L	5/6/2010	Current	Annual Monitoring	No exceedences in 2 years; however, used as crossgradient check well
IW-4	VC - 1.0 µg/L	5/6/2010	Current	Annual Monitoring	Currently exceeds TCG

TABLE 6-1

ASSESSMENT OF WELLS AND RECOMMENDATIONS FOR ANNUAL MONITORING

Well	TCG Exceedance (Based on Most Recent Sampling/Data for Each Well)	Data of Most Recent Sampling/Analysis	Date/Concentration of Last Exceedence	Recommendation	Comment/Rationale
Vapor Probe					
IW-1	Methane - 76.8%	5/4/2010		Annual Monitoring	High methane concentrations updgradient of Building 240
IW-3	Methane - 89.5%	5/4/2010		Annual Monitoring	High methane concentrations south of Building 240
MW-40-32	Methane - 87%	5/4/2010		Annual Monitoring	High methane concentrations east of Building 239
MW-40-37	Methane - 82.9%	5/4/2010		Annual Monitoring	High methane concentrations west of Building 239
VW-40-2	Methane - 91.9%	5/4/2010		Annual Monitoring	High methane concentrations west of Building 240
VW-40-3	Methane - 81.4%	5/4/2010		Annual Monitoring	High methane concentrations south of Building 240
VW-40-6	Methane - 81.9%	5/4/2010		Annual Monitoring	High methane concentrations west of Building 260

Notes:

Refer to Figures 6.1 and 6.2 for concentration data, and Figure 6.3 for locations of recommended monitoring wells/points.

Abbreviations and Acronyms

COC - chemical of concern

DCE – dichloroethene
PCE - tetrachloroethene
TCG - trichloroethene
VC - vinyl chloride
µg/L – micrograms per liter

FIGURES

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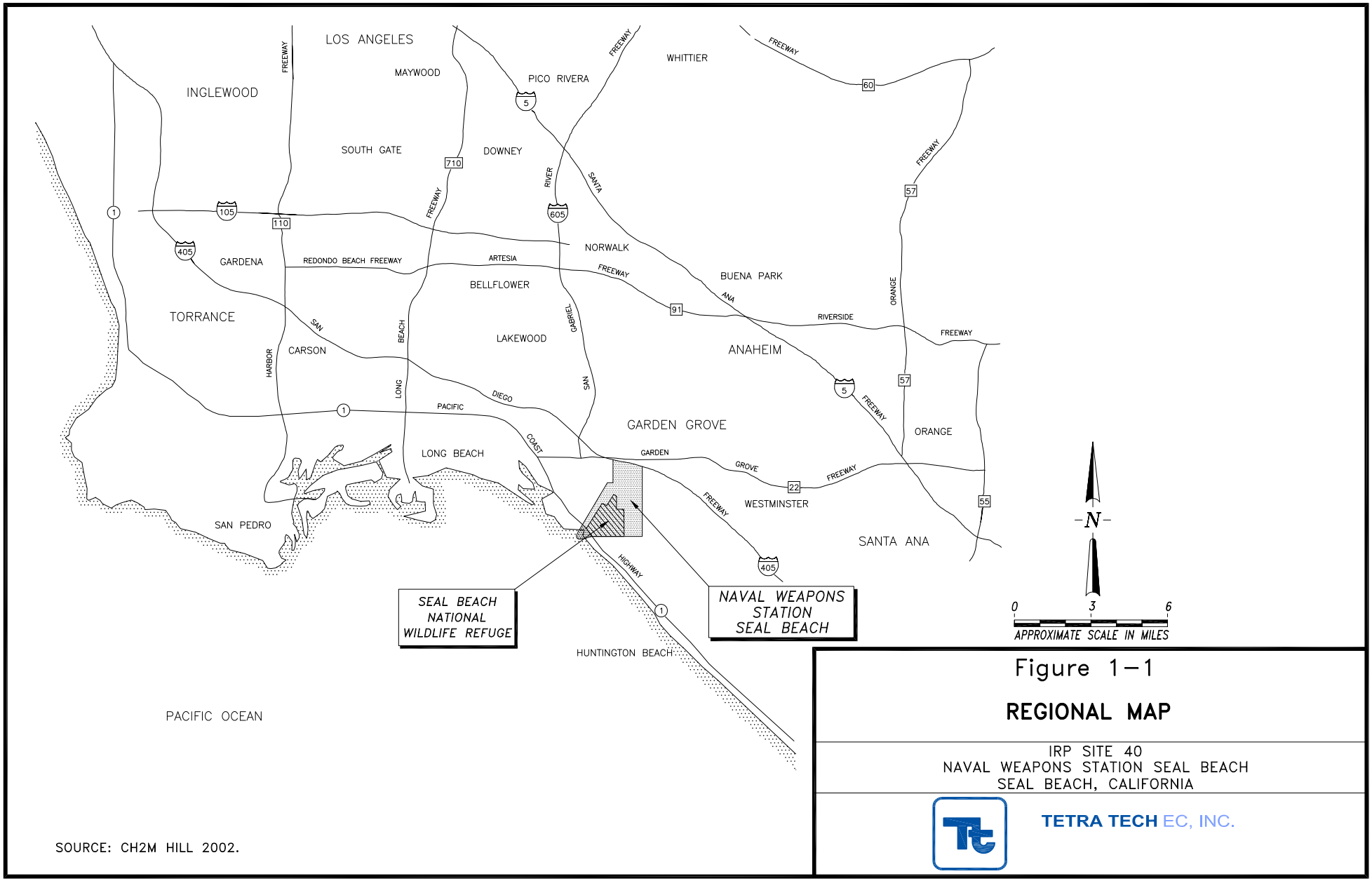

SOURCE: CH2M HILL 2002.

Figure 1-1

REGIONAL MAP

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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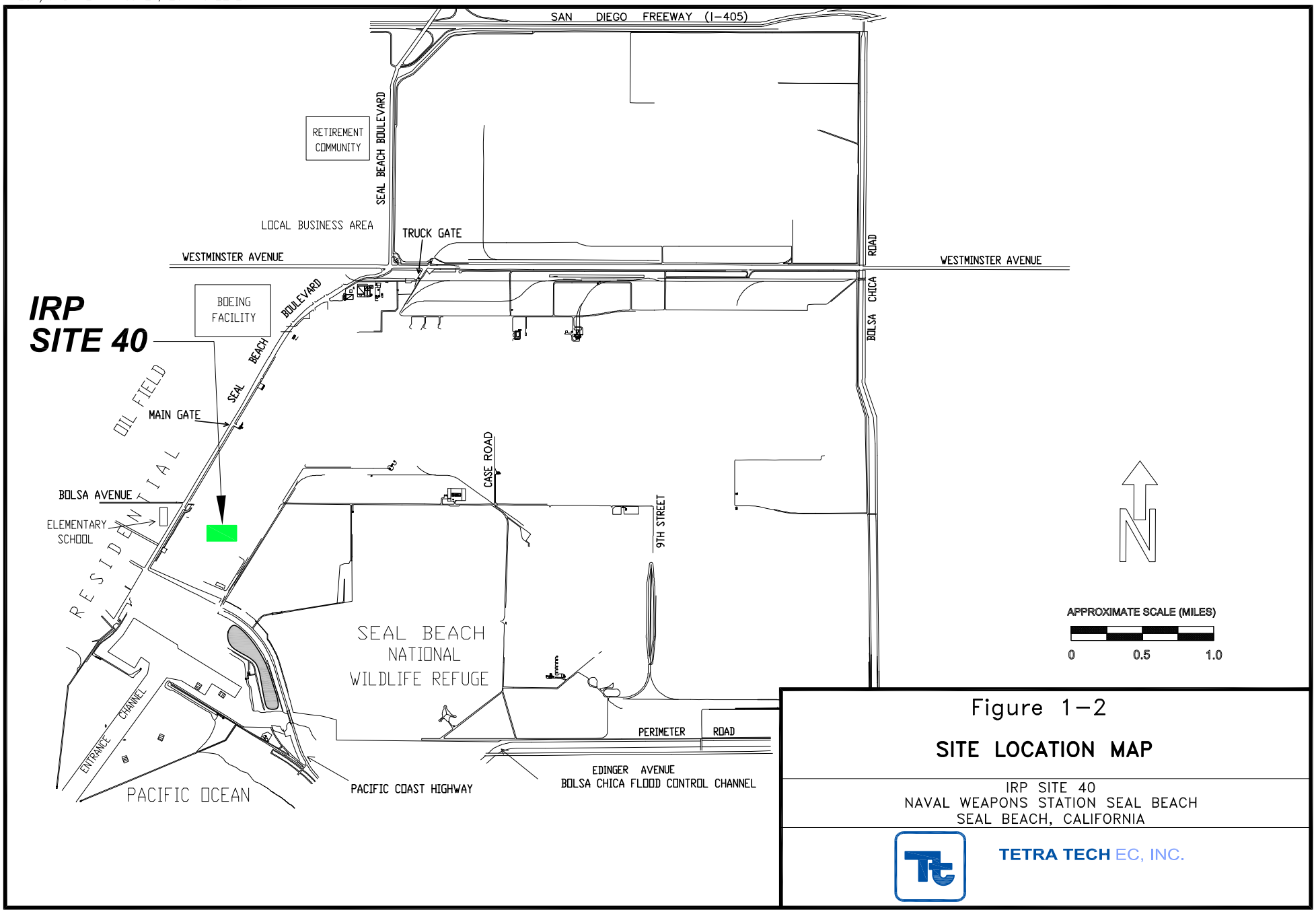

Figure 1-2

SITE LOCATION MAP

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

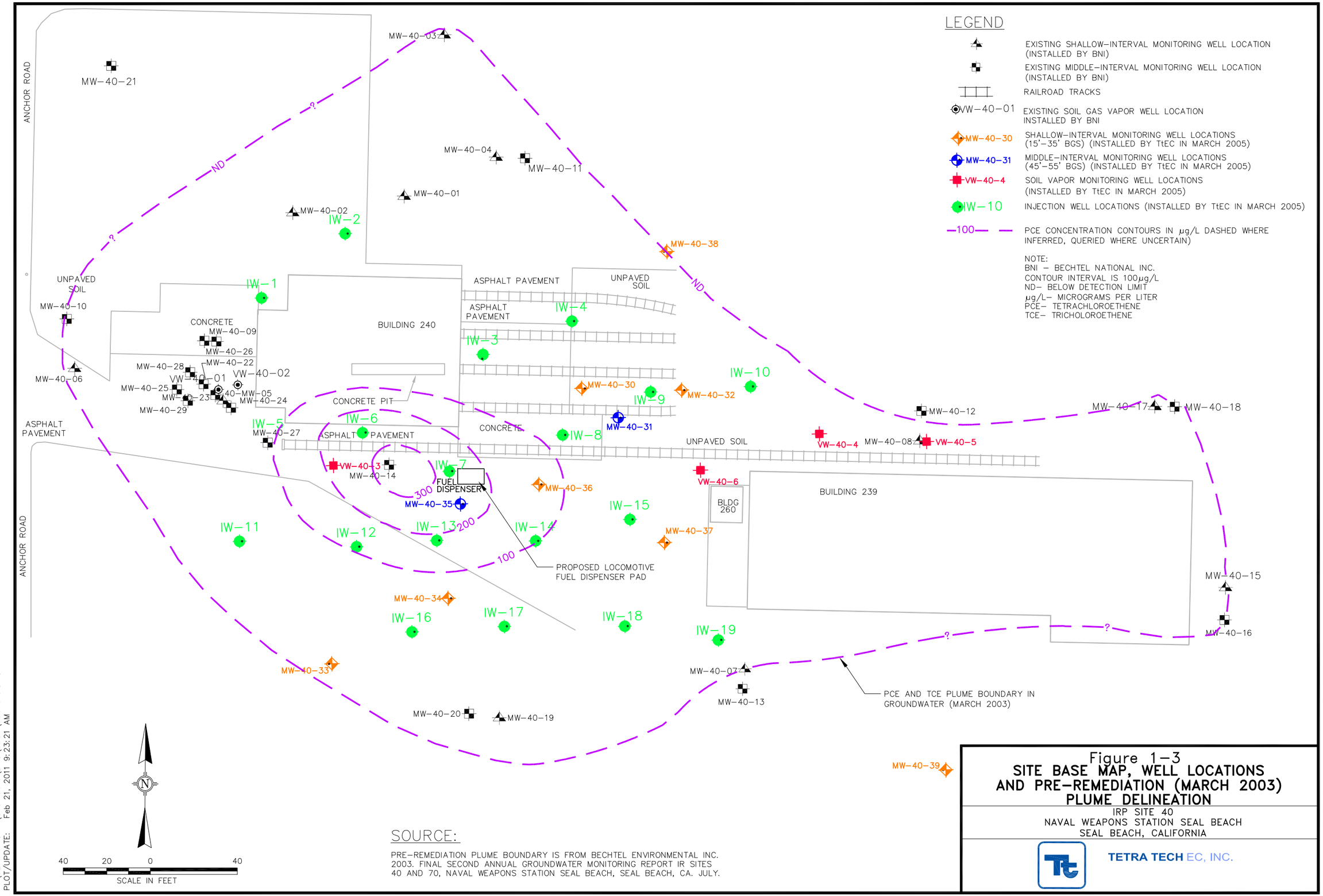

Figure 1-3
SITE BASE MAP, WELL LOCATIONS AND PRE-REMEDIATION (MARCH 2003) PLUME DELINEATION
IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

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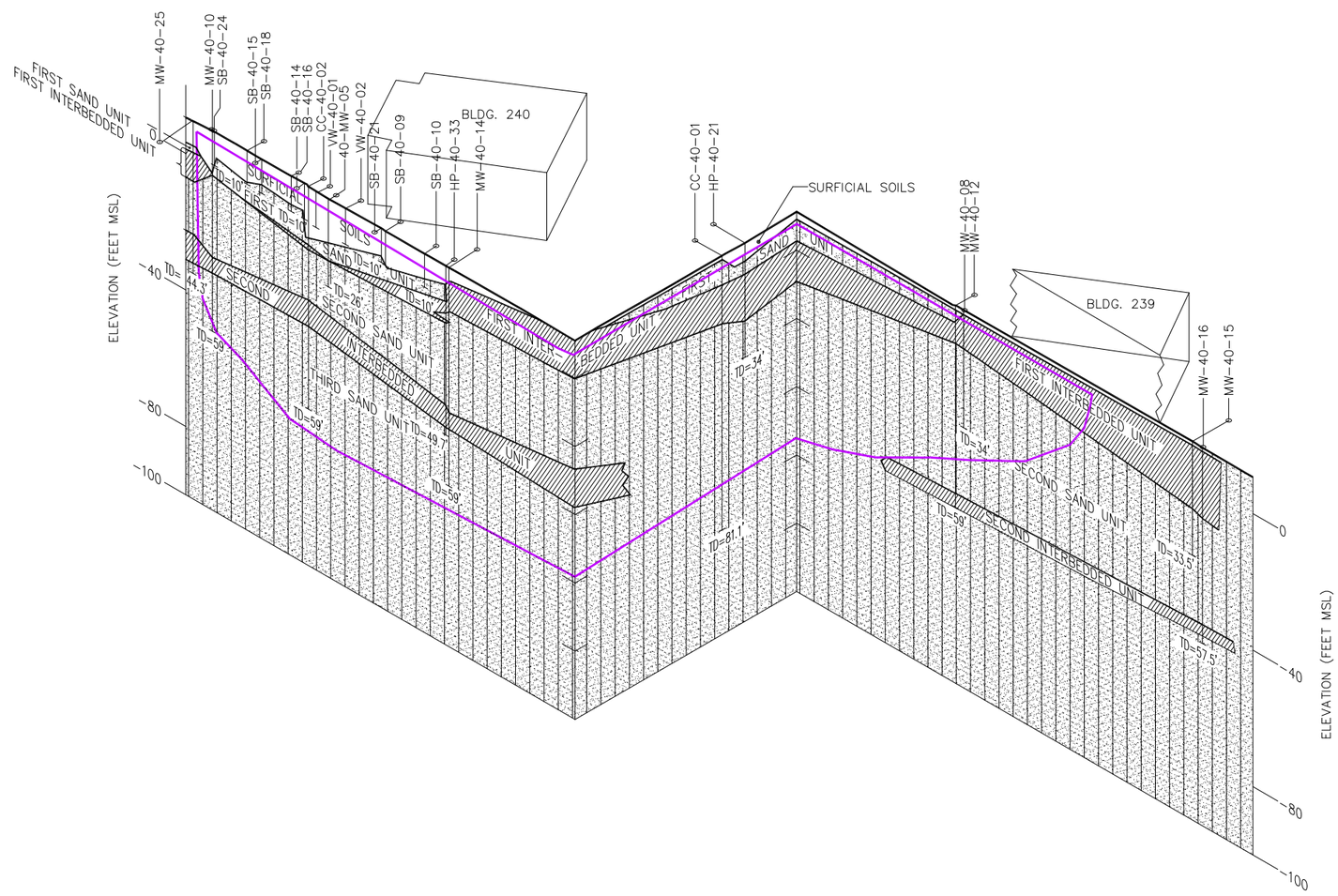

LEGEND

SUBSURFACE STRATIGRAPHIC SYMBOLS

PREDOMINANTLY FINE-GRAINED UNIT (CLAY, SILT, SILTY CLAY, CLAYEY SILT, SANDY CLAY AND SANDY SILT)

PREDOMINANTLY COARSE-GRAINED UNIT (SAND, SILTY SAND AND CLAYEY SAND)

UNIT BOUNDARY

APPROXIMATE EXTENT OF VOC PLUME IN GROUNDWATER

IR – INSTALLATION RESTORATION

SOURCE:

BECHTEL ENVIRONMENTAL, INC. 2003. FINAL SECOND ANNUAL GROUNDWATER MONITORING REPORT IR SITES 40 AND 70, NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA. JULY.

0 80 160

FEET

VERTICAL SCALE: 1 INCH = 40 FEET

Figure 2-1

SITE PHYSICAL – CONCEPTUAL MODEL

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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ABBREVIATIONS:

PCE	TETRACHLOROETHENE
TCE	TRICHLOROETHENE
DCE	CIS-1,2-DICHLOROETHENE
VC	VINYL CHLORIDE
FT BGS	FEET BELOW GROUND SURFACE

LEGEND

—0.5—	PCE (DASHED WHERE INFERRED)
—0.5—	TCE (DASHED WHERE INFERRED)
—0.5—	DCE (DASHED WHERE INFERRED)
—0.5—	VC (DASHED WHERE INFERRED)
	EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION
	EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION
	RAILROAD TRACKS
VW-40-01	EXISTING SOIL GAS VAPOR WELL LOCATION
MW-40-30	SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
MW-40-31	MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
VW-40-4	SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
IW-10	INJECTION WELL LOCATION (INSTALLED MARCH 2005)
HP 1	HYDROPUNCH LOCATIONS

NOTES:

ALL CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µg/L)
VALUES IN RED EXCEED MAXIMUM CONTAMINANT LEVELS (MCLs)

U NOT DETECTED AT REPORTING LIMIT GIVEN

J ESTIMATED VALUE

ALTHOUGH WELLS MW-40-14 AND MW-40-22 ARE DESIGNATED AS MIDDLE-INTERVAL WELLS, THEY WERE INCLUDED AS A PART OF THE SHALLOW WELL CONCENTRATION CONTOUR INTERPRETATION CONSIDERING THEIR SCREEN INTERVAL (30-40 FT BGS, AND 15.3-35.5 FT BGS, RESPECTIVELY)

LATERAL PLUME EXTENTS ARE BASED ON MCC VALUES

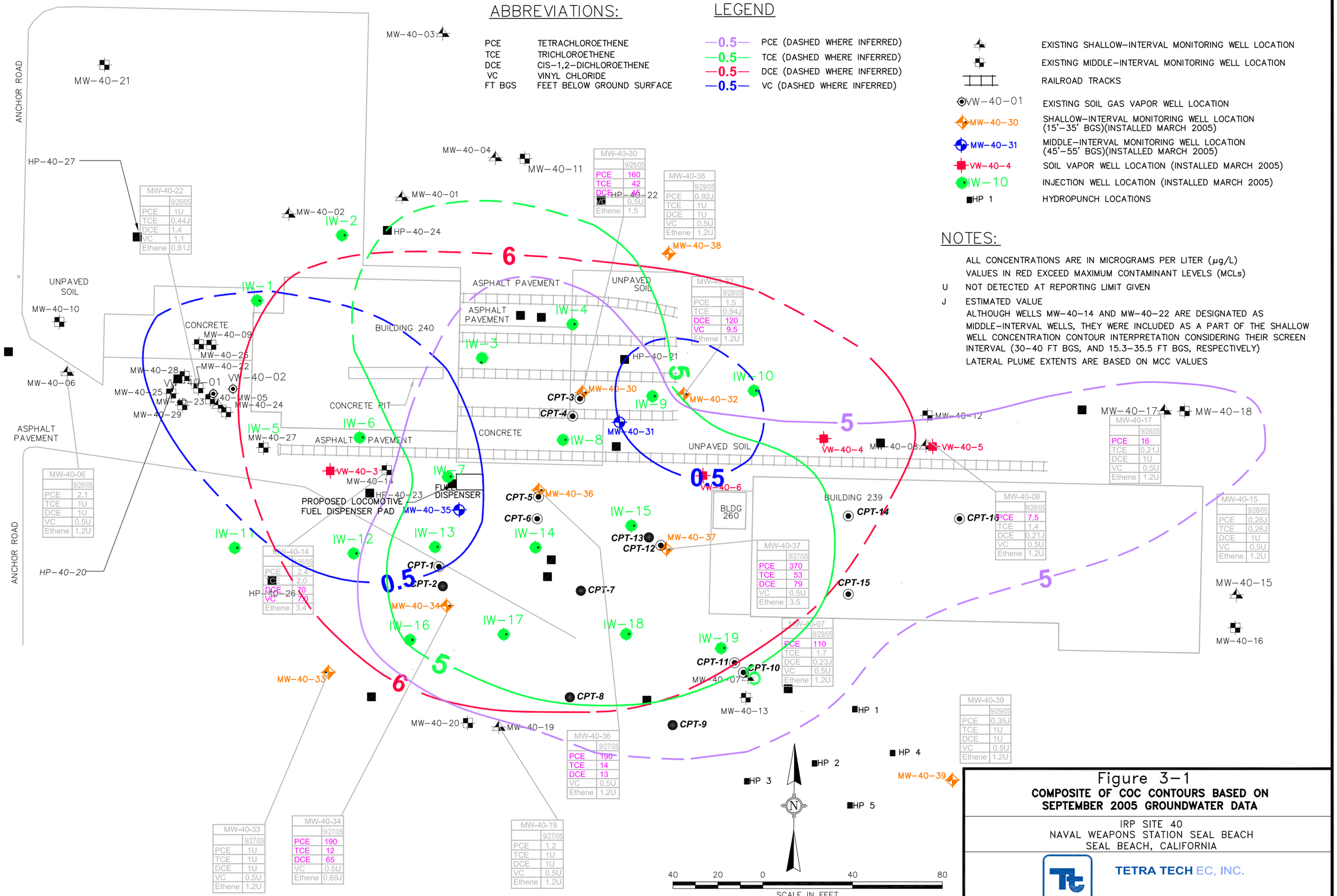

Figure 3-1

COMPOSITE OF COC CONTOURS BASED ON SEPTEMBER 2005 GROUNDWATER DATA

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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DCN: FWSD-RAC-06-0169
CTO: #0090
APPROVED BY: HH
CHECKED BY: HH
REV: REVISION 0
DRAWN BY: MD
DATE: 11/30/05

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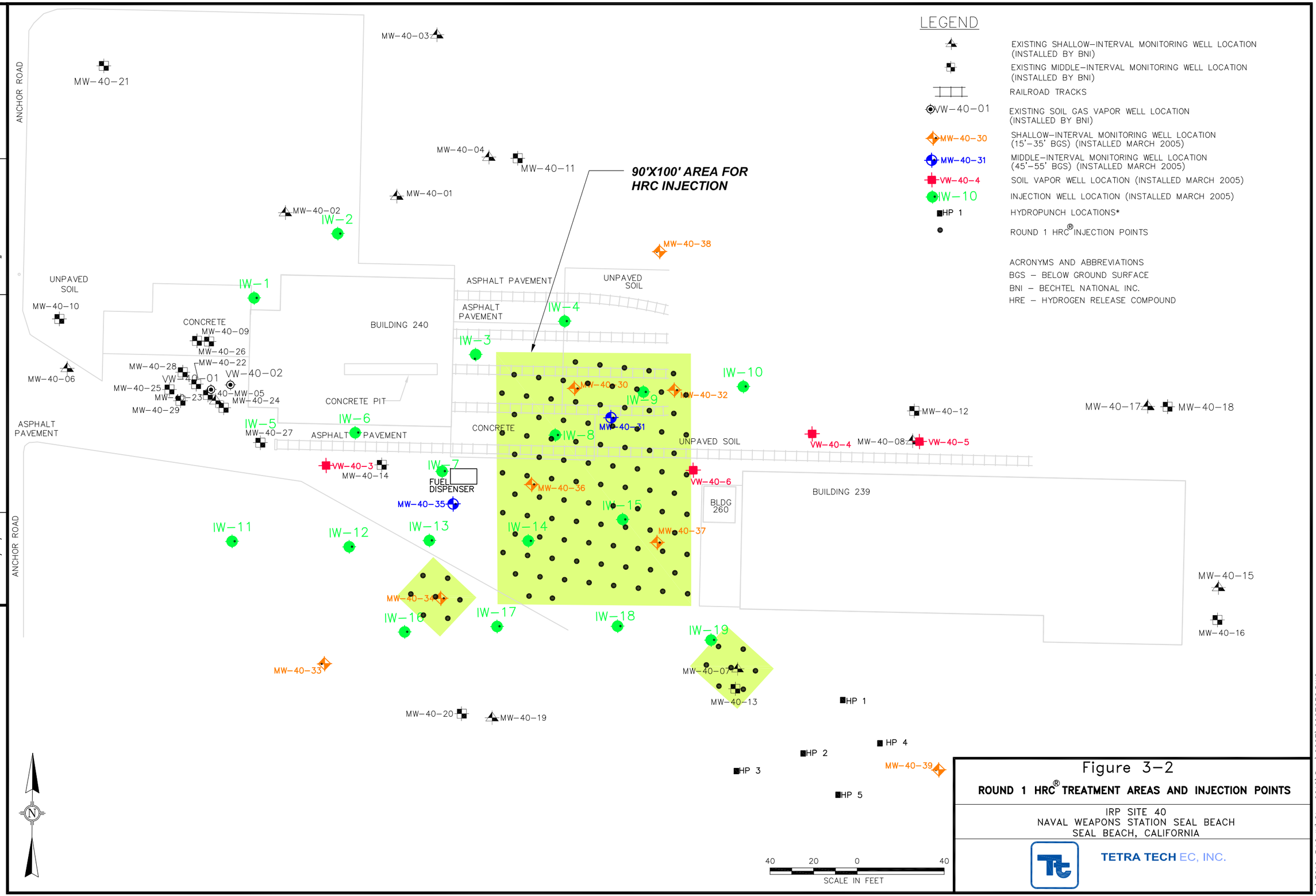

Figure 3-2

ROUND 1 HRC® TREATMENT AREAS AND INJECTION POINTS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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CHECKED BY: HH
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DRAWN BY: MD
DATE: 05/16/07

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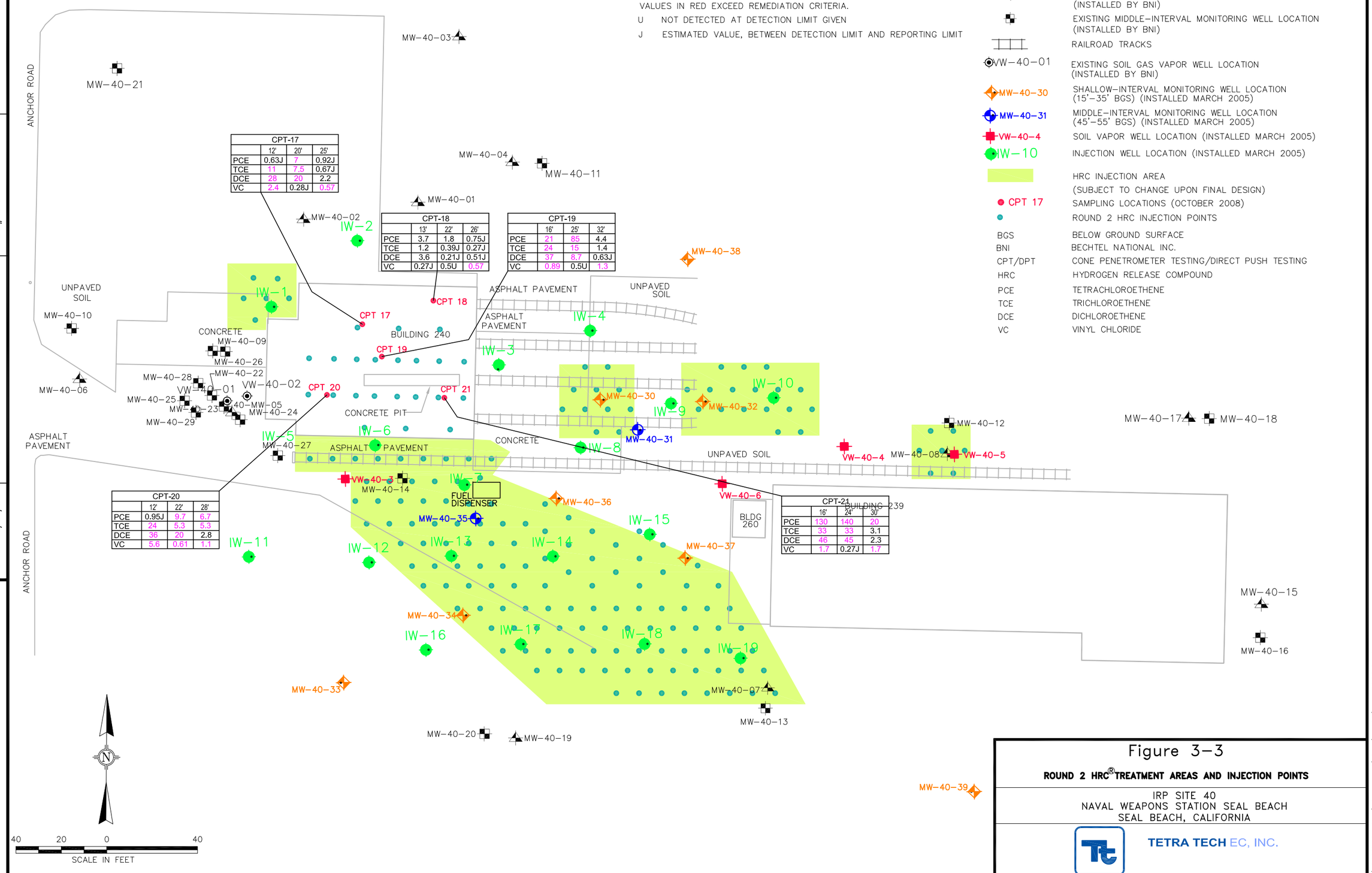
NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (μg/L).
VALUES IN RED EXCEED REMEDIATION CRITERIA.
U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS) (INSTALLED MARCH 2005)
- MW-40-31 MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS) (INSTALLED MARCH 2005)
- VW-40-4 SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HRC INJECTION AREA (SUBJECT TO CHANGE UPON FINAL DESIGN)
- CPT 17 SAMPLING LOCATIONS (OCTOBER 2008)
- ROUND 2 HRC INJECTION POINTS

BGS	BELOW GROUND SURFACE
BNI	BECHTEL NATIONAL INC.
CPT/DPT	CONE PENETROMETER TESTING/DIRECT PUSH TESTING
HRC	HYDROGEN RELEASE COMPOUND
PCE	TETRACHLOROETHENE
TCE	TRICHLOROETHENE
DCE	DICHLOROETHENE
VC	VINYL CHLORIDE



CPT-17	12'	20'	25'
PCE	0.63J	7	0.92J
TCE	11	7.5	0.67J
DCE	28	20	2.2
VC	2.4	0.28J	0.57

CPT-18	13'	22'	26'
PCE	3.7	1.8	0.75J
TCE	1.2	0.39J	0.27J
DCE	3.6	0.21J	0.51J
VC	0.27J	0.5U	0.57

CPT-19	16'	25'	32'
PCE	21	85	4.4
TCE	24	15	1.4
DCE	37	8.7	0.63J
VC	0.89	0.5U	1.3

CPT-20	12'	22'	28'
PCE	0.95J	9.7	6.7
TCE	24	5.3	5.3
DCE	36	20	2.8
VC	5.6	0.61	1.1

CPT-21	16'	24'	30'
PCE	130	140	20
TCE	33	33	3.1
DCE	46	45	2.3
VC	1.7	0.27J	1.7

Figure 3-3

ROUND 2 HRC® TREATMENT AREAS AND INJECTION POINTS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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DCN: ECSD-2201-0010-0006
CTO: #0010
APPROVED BY: HH
CHECKED BY: HH
REV:
DRAWN BY: MD
DATE: 10/27/08

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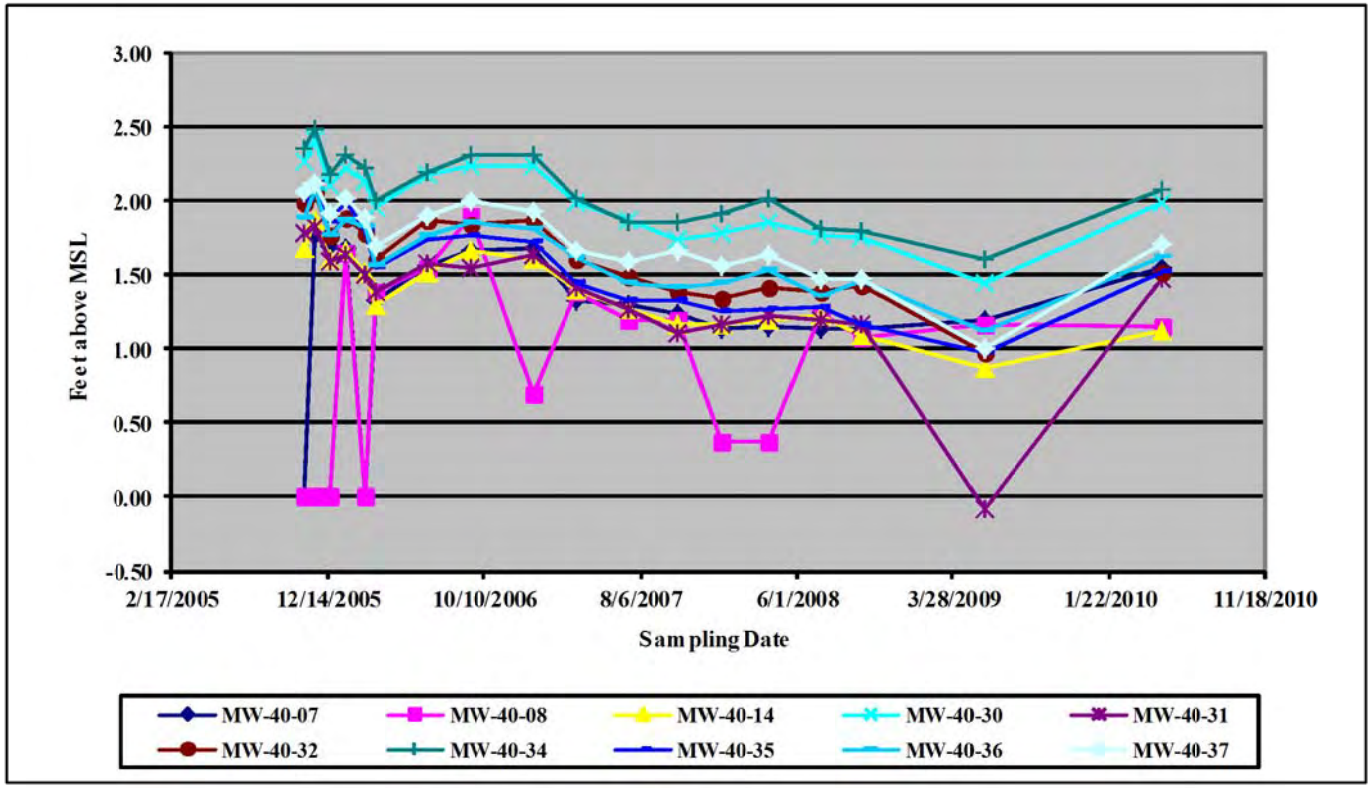

MSL – MEAN SEA LEVEL

Figure 4-1

WATER LEVELS MEASURED IN KEY MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

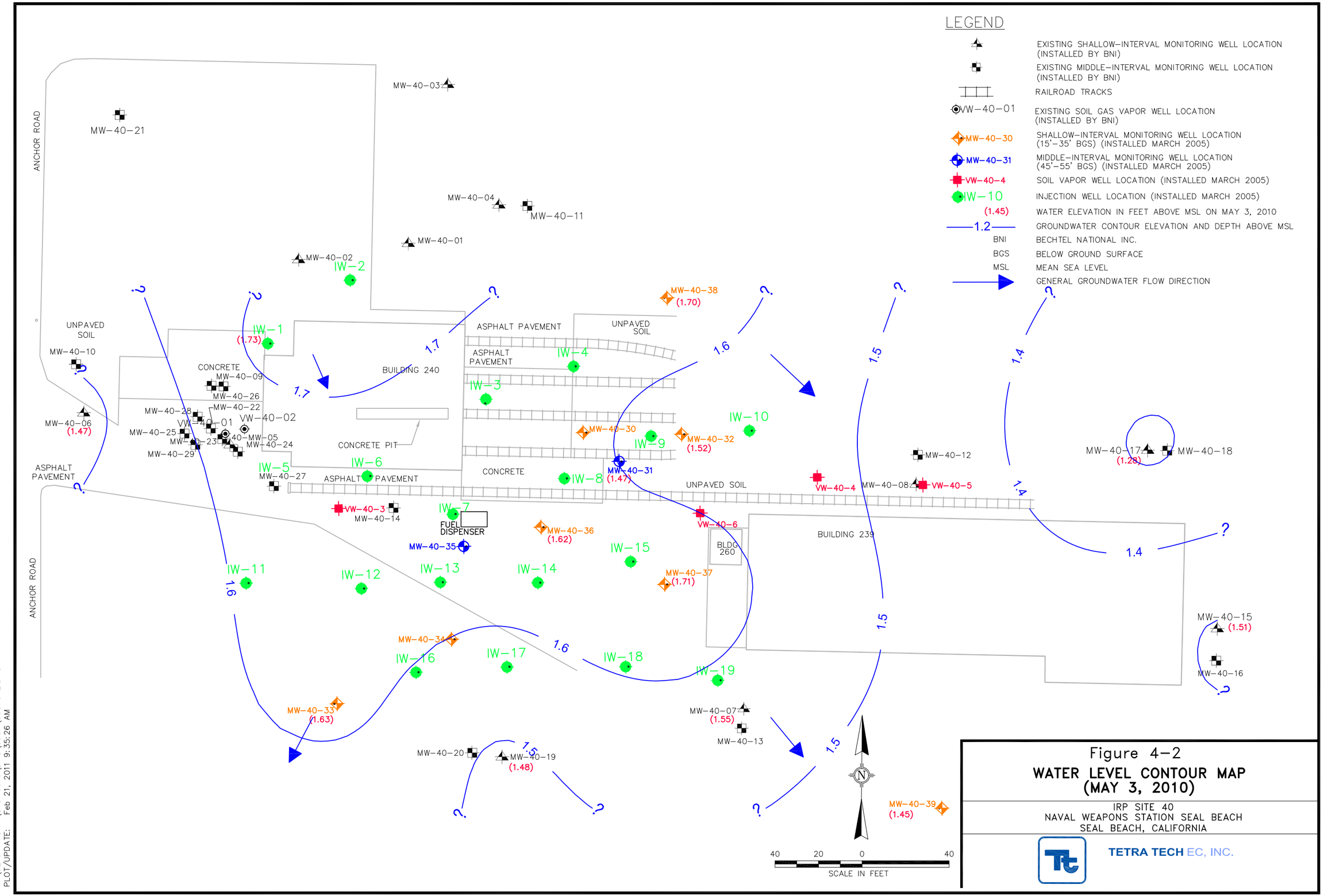

Figure 4-2

WATER LEVEL CONTOUR MAP (MAY 3, 2010)

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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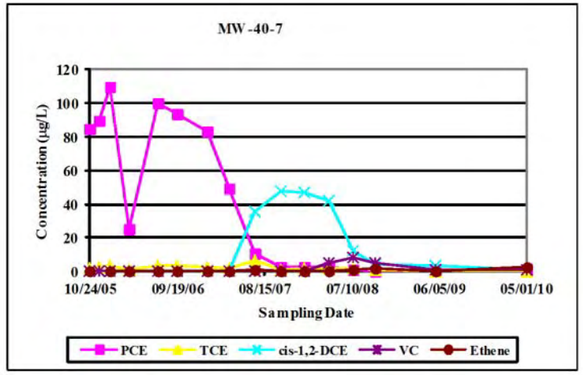

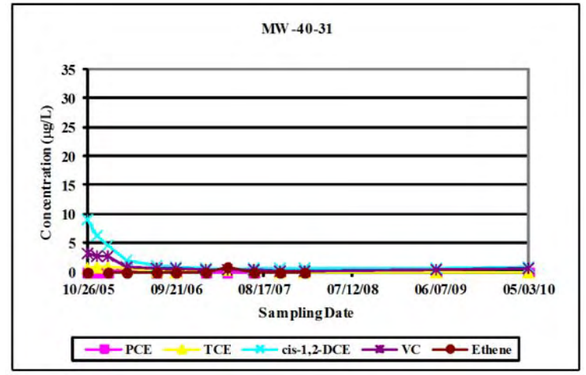

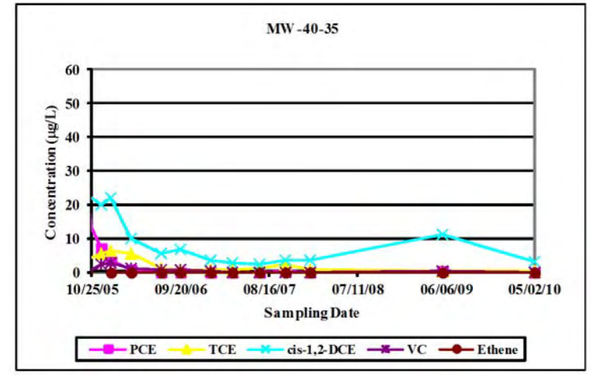

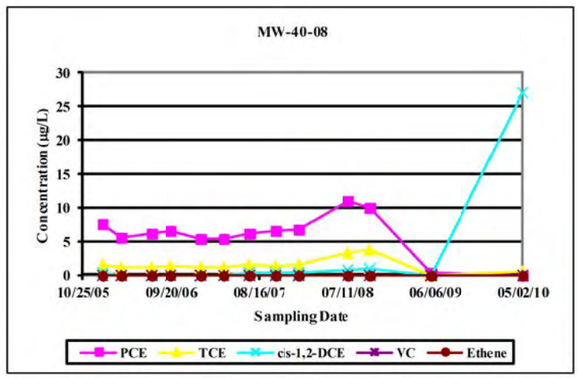

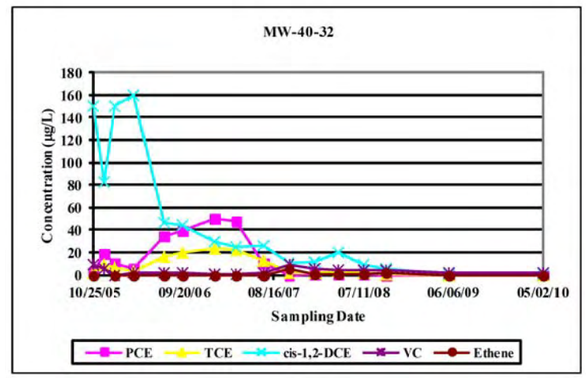

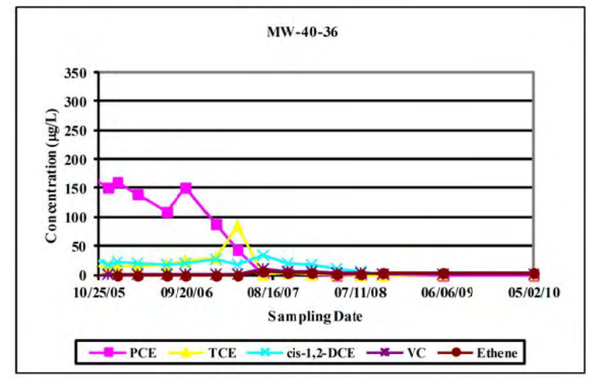

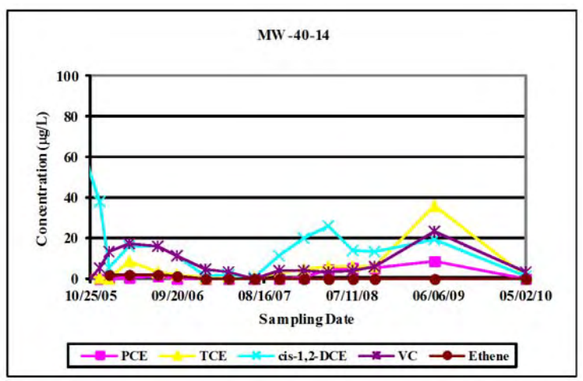

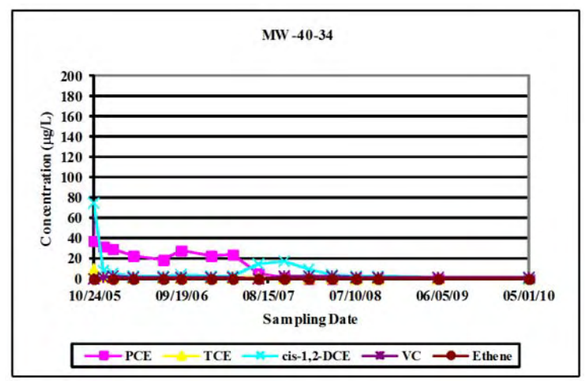

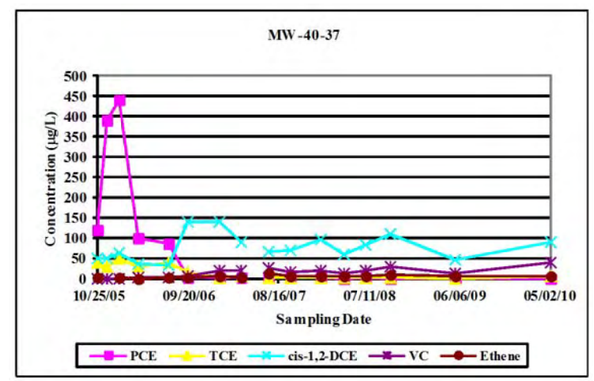

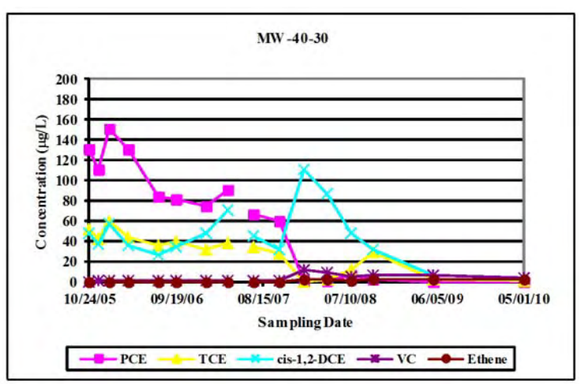

NOTES:

PCE – TETRACHLOROETHENE
TCE – TRICHLOROETHENE
DCE – DICHLOROETHENE
VC – VINYL CHLORIDE
µg/L – MICROGRAMS PER LITER
COC – CHEMICAL OF CONCERN

Figure 4-3
COC TRENDS (MASS BASIS) IN GROUNDWATER FOR KEY MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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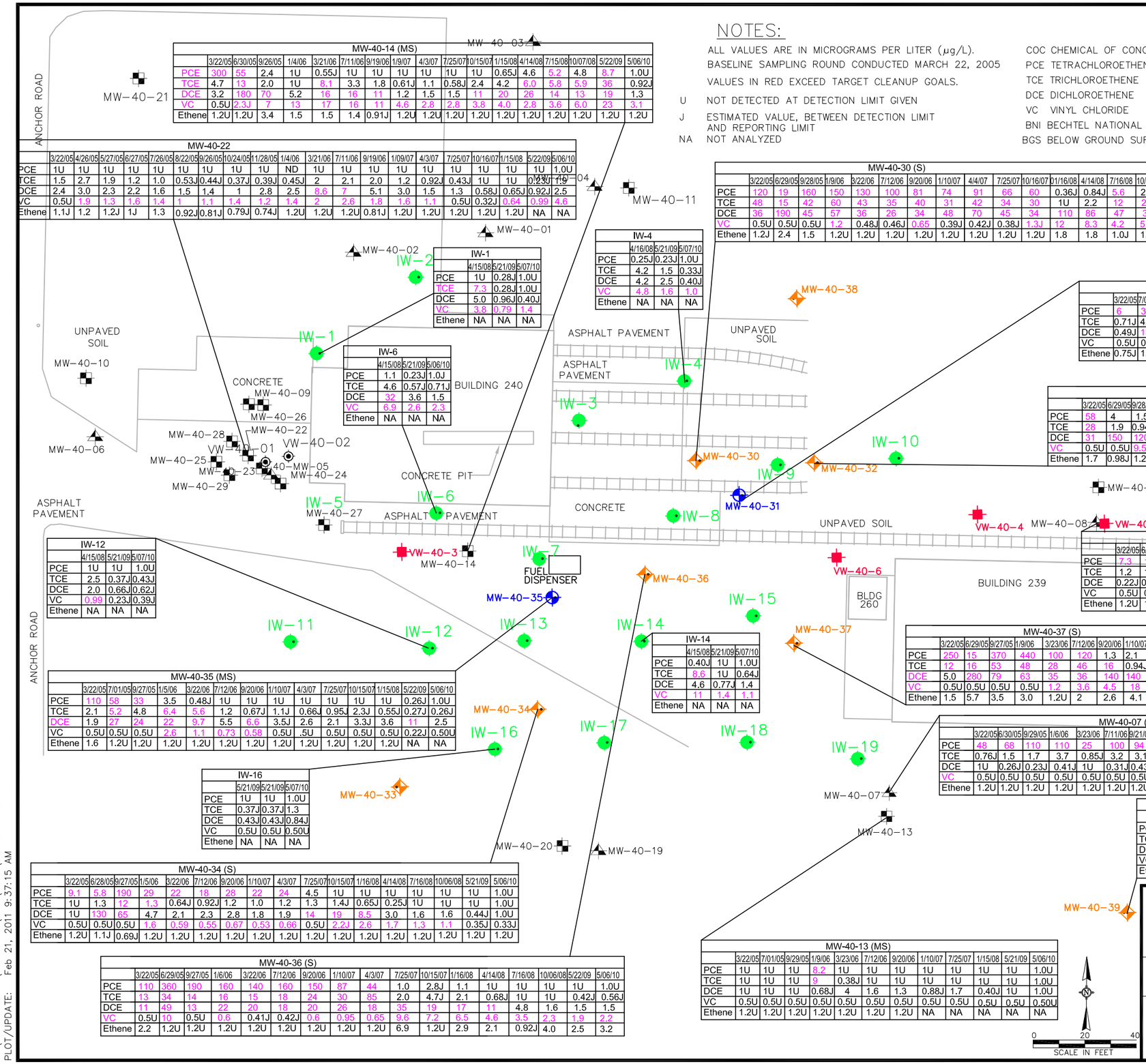

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (μg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED TARGET CLEANUP GOALS.

U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED

COC CHEMICAL OF CONCERN
PCE TETRACHLOROETHENE
TCE TRICHLOROETHENE
DCE DICHLOROETHENE
VC VINYL CHLORIDE
BNI BECHTEL NATIONAL INC.
BGS BELOW GROUND SURFACE

LEGEND

EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
RAILROAD TRACKS
VW-40-01 EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
MW-40-30 SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS) (INSTALLED MARCH 2005)
MW-40-31 MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS) (INSTALLED MARCH 2005)
VW-40-4 SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
IW-10 INJECTION WELL LOCATION (INSTALLED MARCH 2005)

MW-40-14 (MS)

	3/22/05	6/30/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	4/3/07	7/25/07	10/15/07	1/15/08	4/14/08	7/15/08	10/07/08	5/22/09	5/06/10
PCE	300	55	2.4	1U	0.55J	1U	1U	1U	1U	1U	1U	0.65J	4.6	5.2	4.8	8.7	1.0U
TCE	4.7	13	2.0	1U	8.1	3.3	1.8	0.61J	1.1	0.58J	2.4	4.2	6.0	5.8	5.9	36	0.92J
DCE	3.2	180	70	5.2	16	16	11	1.2	1.5	1.5	11	20	26	14	13	19	1.3
VC	0.5U	2.3J	7	13	17	16	11	4.6	2.8	2.8	3.8	4.0	2.8	3.6	6.0	23	3.1
Ethene	1.2U	1.2U	3.4	1.5	1.5	1.4	0.91J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-22

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/09/07	4/3/07	7/25/07	10/16/07	1/15/08	5/22/09	5/06/10
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	ND	1U	1U	1U	1U	1U	1U	1U	1U	1U	1.0U
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J	0.37J	0.39J	0.45J	2	2.1	2.0	1.2	0.92J	0.43J	1U	1U	0.23J	1.9
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4	1	2.8	2.5	8.6	7	5.1	3.0	1.5	1.3	0.58J	0.65J	0.92J	2.5
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1	1.4	1.2	1.4	2	2.6	1.8	1.6	1.1	0.5U	0.32J	0.64	0.99	4.6
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J	0.79J	0.74J	1.2U	1.2U	1.2U	0.81J	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA

IW-1

	4/15/08	5/21/09	5/07/10
PCE	1U	0.28J	1.0U
TCE	7.3	0.28J	1.0U
DCE	5.0	0.96J	0.40J
VC	3.8	0.79	1.4
Ethene	NA	NA	NA

IW-6

	4/15/08	5/21/09	5/06/10
PCE	1.1	0.23J	1.0J
TCE	4.6	0.57J	0.71J
DCE	32	3.6	1.5
VC	6.9	2.6	2.3
Ethene	NA	NA	NA

IW-4

	4/16/08	5/21/09	5/07/10
PCE	0.25J	0.23J	1.0U
TCE	4.2	1.5	0.33J
DCE	4.2	2.5	0.40J
VC	4.8	1.6	1.0
Ethene	NA	NA	NA

MW-40-30 (S)

	3/22/05	6/29/05	9/28/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	01/16/08	4/14/08	7/16/08	10/06/08	5/21/09	5/06/10
PCE	120	19	160	150	130	100	81	74	91	66	60	0.36J	0.84J	5.6	2.6	1U	1.0U
TCE	48	15	42	60	43	35	40	31	42	34	30	1U	2.2	12	29	2.0	0.79J
DCE	36	190	45	57	36	26	34	48	70	45	34	110	86	47	31	5.7	3.7
VC	0.5U	0.5U	0.5U	1.2	0.48J	0.46J	0.65	0.39J	0.42J	0.38J	1.3J	12	8.3	4.2	5.4	6.3	4
Ethene	1.2J	2.4	1.5	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.8	1.8	1.0J	1.9	2.1	2.1

MW-40-31 (MS)

	3/22/05	7/01/05	10/26/05	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/16/08	5/21/09	5/06/10
PCE	6	32	1U	0.59J	1U	1U	1U	1U	1U	1U	1U	1U	1.0U
TCE	0.71J	4.8	0.61J	0.55J	0.23J	1U	0.37J	0.29J	0.30J	1U	1U	1U	1.0U
DCE	0.49J	13	9	1.9	0.96J	0.88J	0.61J	0.45J	0.67J	0.47J	0.58J	0.53J	0.83J
VC	0.5U	0.5U	3.2	0.83	0.7	0.49J	0.37J	0.39J	0.25J	0.23J	0.20J	0.26J	0.60
Ethene	0.75J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.75J	1.2J	1.2U	1.2U	NA	NA

MW-40-32 (S)

	3/22/05	6/29/05	9/28/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/16/08	4/14/08	7/16/08	10/06/08	5/22/09	5/06/10
PCE	58	4	1.5	10	5.1	34	39	50	47	10	1U	0.74J	0.60J	0.22J	1U	1U	1.0U
TCE	28	1.9	0.94J	6.1	2.6	16	20	23	22	13	1.4	1.3	3.1	1.3	0.62J	1U	1.0U
DCE	31	150	120	150	160	46	44	30	25	26	10	12	20	8.6	5.1	0.64J	1.2
VC	0.5U	0.5U	9.5	0.5U	1.8	1.7	1.8	1.2	0.97	1.6	9.5	5.6	4.8	3.8	4.2	1.3	2.1
Ethene	1.7	0.98J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	4.9	0.99J	0.88J	0.75J	1.7	1.2U	1.2U

MW-40-08 (S)

	3/22/05	6/29/05	9/28/05	1/6/06	3/22/06	7/13/06	9/21/06	1/11/07	4/4/07	7/25/07	10/16/07	1/16/08	7/15/08	10/07/08	5/22/09	5/06/10
PCE	7.3	10	7.5	7.5	5.5	6.2	6.6	5.4	5.3	6.1	7.0	6.8	11	10	3.1	1.0U
TCE	1.2	1.9	1.4	1.5	1.1	1.2	1.4	1.1	1.1	1.5	1.5	1.5	3.3	3.7	3.8	0.46J
DCE	0.22J	0.34J	0.21J	0.24J	1U	1U	1U	1U	1U	0.23J	0.30J	0.33J	0.69J	0.83J	5.0	27
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.50U
Ethene	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.2U	1.2U

IW-12

	4/15/08	5/21/09	5/07/10
PCE	1U	1U	1.0U
TCE	2.5	0.37J	0.43J
DCE	2.0	0.66J	0.62J
VC	0.99	0.23J	0.39J
Ethene	NA	NA	NA

MW-40-37 (S)

	3/22/05	6/29/05	9/27/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/15/07	1/16/08	4/14/08	7/16/08	10/06/08	5/21/09	5/06/10
PCE	250	15	370	440	100	120	1.3	2.1	1.1	0.31J	1.8J	0.36J	1U	0.48J	1U	1U	1.0U
TCE	12	16	53	48	28	46	16	0.94J	4.9	0.36J	3.1J	1.3	1.3	1.5	1.7	1U	4
DCE	5.0	280	79	63	35	36	140	140	89	64	69	94	58	82	110	46	90
VC	0.5U	0.5U	0.5U	0.5U	1.2	3.6	4.5	18	18	24	18	18	12	18	27	13	37
Ethene	1.5	5.7	3.5	3.0	1.2U	2	2.6	4.1	3.0	11	1.2U	6.5	4.6	5.6	7	5.2	6.5

MW-40-35 (MS)

	3/22/05	7/01/05	9/27/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/15/08	5/22/09	5/06/10
PCE	110	58	33	3.5	0.48J	1U	1U	1U	1U	1U	1U	1U	0.26J	1.0U
TCE	2.1	5.2	4.8	6.4	5.6	1.2	0.67J	1.1U	0.66J	0.95J	2.3J	0.55J	0.27J	0.26J
DCE	1.9	27	24	22	9.7	5.5	6.6	3.5J	2.6	2.1	3.3J	3.6	11	2.5
VC	0.5U	0.5U	0.5U	2.6	1.1	0.73	0.58	0.5U	.5U	0.5U	0.5U	0.5U	0.22J	0.50U
Ethene	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA

IW-14

	4/15/08	5/21/09	5/07/10
PCE	0.40J	1U	1.0U
TCE	8.6	1U	0.64J
DCE	4.6	0.77J	1.4
VC	11	1.4	1.1
Ethene	NA	NA	NA

MW-40-07 (S)

	3/22/05	6/30/05	9/29/05	1/6/06	3/23/06	7/11/06	9/21/06	1/9/07	4/4/07	7/25/07	10/16/07	1/15/08	4/14/08	7/16/08	10/06/08	5/21/09	5/06/10
PCE	48	68	110	110	25	100	94	83	49	11	1.4J	2.8	2.6	1.3	1U	1U	1.0U
TCE	0.76J	1.5	1.7	3.7	0.85J	3.2	3.1	2.7	1.8	6.7	1U	1.7	1.7	1.8	1.1	0.51J	0.28J
DCE	1U	0.26J	0.23J	0.41J	1U	0.31J	0.43J	0.34J	1U	36	54	47	42	12	3.9	3.2	0.67J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	5.4	8.3	4.7	1.2	0.78
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.95J	1.2U	1.2U	1.2U	0.80J	1.6	1.2U	2.3

IW-16

	5/21/09	5/21/09	5/07/10
PCE	1U	1U	1.0U
TCE	0.37J	0.37J	1.3
DCE	0.43J	0.43J	0.84J
VC	0.5U	0.5U	0.50U
Ethene	NA	NA	NA

MW-40-39 (S)

	3/22/05	6/30/05	9/29/05	1/6/06	3/21/06	7/11/06	9/21/06	1/9/07	7/25/07	1/15/08	5/22/09	5/06/10
PCE	1U	1U	0.35J	0.71J	0.72J	1.7	2.4	2.5	2.8	1.3	0.29J	0.49J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1.0U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1.0U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.50U
Ethene	0.69J	1.2U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

MW-40-34 (S)

	3/22/05	6/28/05	9/27/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/16/08	4/14/08	7/16/08	10/06/08	5/21/09	5/06/10
PCE	9.1	5.8	190	29	22	18	28	22	24	4.5	1U	1U	1U	1U	1U	1U	1.0U
TCE	1U	1.3	12	1.3	0.64J	0.92J	1.2	1.0	1.2	1.3	1.4J	0.65J	0.25J	1U	1U	1U	1.0U
DCE	1U	130	65	4.7	2.1	2.3	2.8	1.8	1.9	14	19	8.5	3.0	1.6	1.6	0.44J	1.0U
VC	0.5U	0.5U	0.5U	1.6	0.59	0.55	0.67	0.53	0.66	0.5U	2.2J	2.6	1.7	1.3	1.1	0.35J	0.33J
Ethene	1.2U	1.1J	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-13 (MS)

	3/22/05	7/01/05	9/29/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	7/25/07	1/15/08	5/21/09	5/06/10
PCE	1U	1U	1U	8.2	1U	1U	1U	1U	1U	1U	1U	1.0U
TCE	1U	1U	1U	9	0.38J	1U	1U	1U	1U	1U	1U	1.0U
DCE	1U	1U	1U	0.68J	4	1.6	1.3	0.88J	1.7	0.40J	1U	1.0U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.50U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-36 (S)

	3/22/05	6/29/05	9/27/05	1/6/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/16/08	4/14/08	7/16/08	10/06/08	5/22/09	5/06/10
PCE	110	360	190	160	140	160	150	87	44	1.0	2.8J	1.1	1U	1U	1U	1U	1.0U
TCE	13	34	14	16	15	18	24	30	85	2.0	4.7J	2.1	0.68J	1U	1U	0.42J	0.56J
DCE	11	49	13	22	20	18	20	26	18	35	19	17	11	4.8	1.6	1.5	1.5
VC	0.5U	10	0.5U	0.6	0.41J	0.42J	0.6	0.95	0.65	9.6	7.2	6.5	4.6	3.5	2.3	1.9	2.2
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	6.9	1.2U	2.9	2.1	0.92J	4.0	2.5	3.2

Figure 4-4
COC CONCENTRATIONS IN SELECT SHALLOW AND MID-SHALLOW MONITORING WELLS AND INJECTION WELLS – THROUGH MAY 2010

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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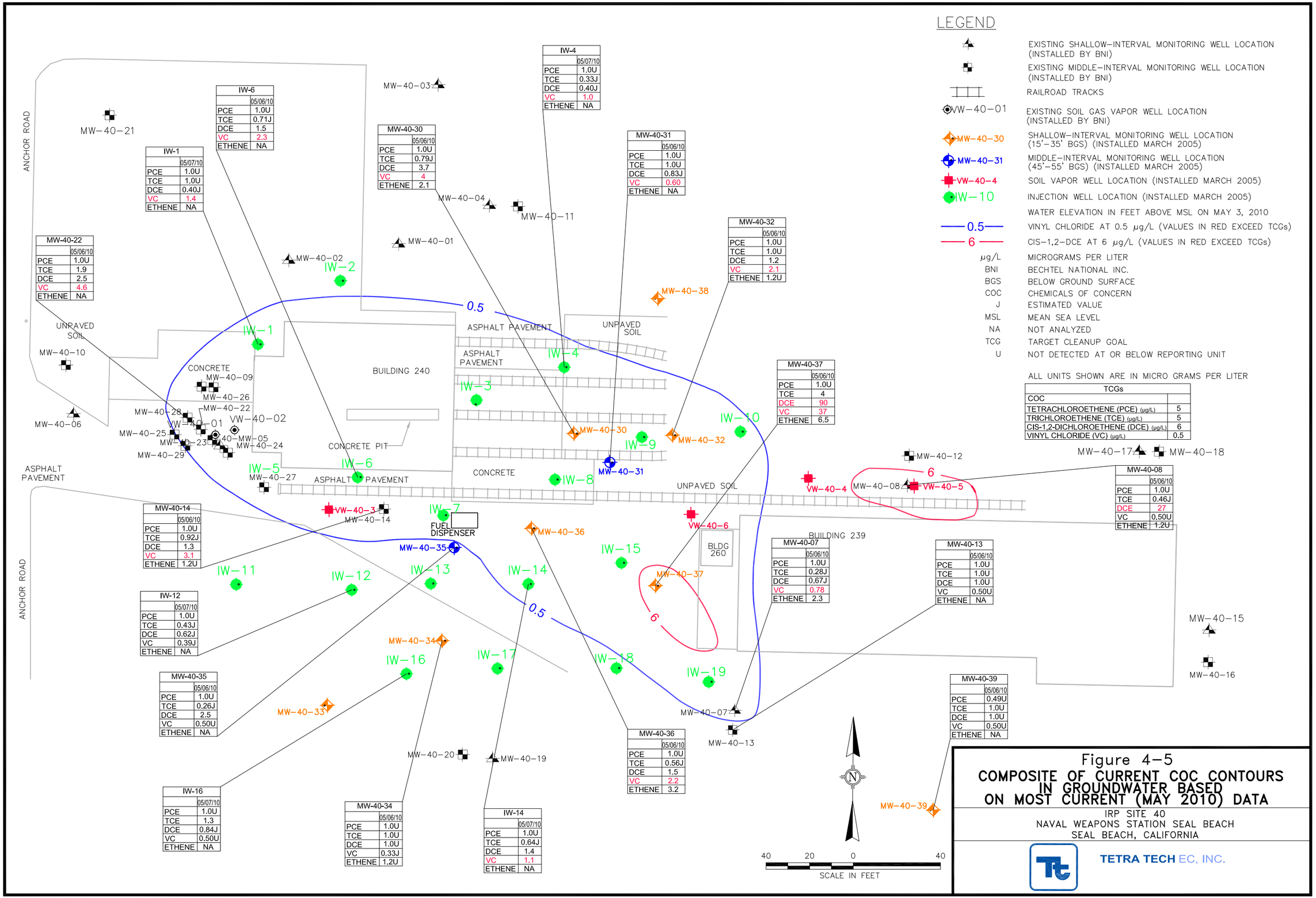

IW-4	05/07/10
PCE	1.0U
TCE	0.33J
DCE	0.40J
VC	1.0
ETHENE	NA

IW-6	05/06/10
PCE	1.0U
TCE	0.71J
DCE	1.5
VC	2.3
ETHENE	NA

MW-40-30	05/06/10
PCE	1.0U
TCE	0.79J
DCE	3.7
VC	4
ETHENE	2.1

MW-40-31	05/06/10
PCE	1.0U
TCE	1.0U
DCE	0.83J
VC	0.60
ETHENE	NA

IW-1	05/07/10
PCE	1.0U
TCE	1.0U
DCE	0.40J
VC	1.4
ETHENE	NA

MW-40-22	05/06/10
PCE	1.0U
TCE	1.9
DCE	2.5
VC	4.6
ETHENE	NA

MW-40-32	05/06/10
PCE	1.0U
TCE	1.0U
DCE	1.2
VC	2.1
ETHENE	1.2U

MW-40-37	05/06/10
PCE	1.0U
TCE	4
DCE	90
VC	37
ETHENE	6.5

MW-40-08	05/06/10
PCE	1.0U
TCE	0.46J
DCE	27
VC	0.50U
ETHENE	1.2U

MW-40-14	05/06/10
PCE	1.0U
TCE	0.92J
DCE	1.3
VC	3.1
ETHENE	1.2U

MW-40-07	05/06/10
PCE	1.0U
TCE	0.28J
DCE	0.67J
VC	0.78
ETHENE	2.3

MW-40-13	05/06/10
PCE	1.0U
TCE	1.0U
DCE	1.0U
VC	0.50U
ETHENE	NA

IW-12	05/07/10
PCE	1.0U
TCE	0.43J
DCE	0.62J
VC	0.39J
ETHENE	NA

MW-40-35	05/06/10
PCE	1.0U
TCE	0.26J
DCE	2.5
VC	0.50U
ETHENE	NA

MW-40-39	05/06/10
PCE	0.49U
TCE	1.0U
DCE	1.0U
VC	0.50U
ETHENE	NA

MW-40-36	05/06/10
PCE	1.0U
TCE	0.56J
DCE	1.5
VC	2.2
ETHENE	3.2

IW-16	05/07/10
PCE	1.0U
TCE	1.3
DCE	0.84J
VC	0.50U
ETHENE	NA

MW-40-34	05/06/10
PCE	1.0U
TCE	1.0U
DCE	1.0U
VC	0.33J
ETHENE	1.2U

IW-14	05/07/10
PCE	1.0U
TCE	0.64J
DCE	1.4
VC	1.1
ETHENE	NA

Figure 4-5
COMPOSITE OF CURRENT COC CONTOURS IN GROUNDWATER BASED ON MOST CURRENT (MAY 2010) DATA

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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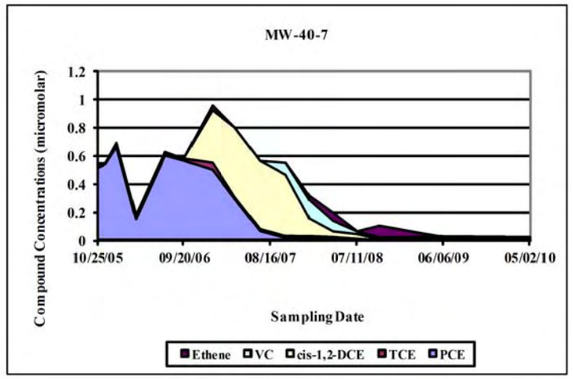

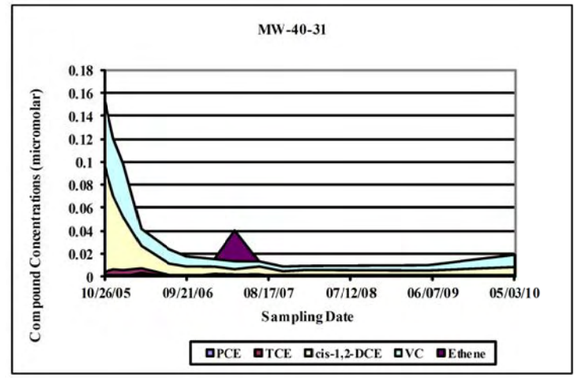

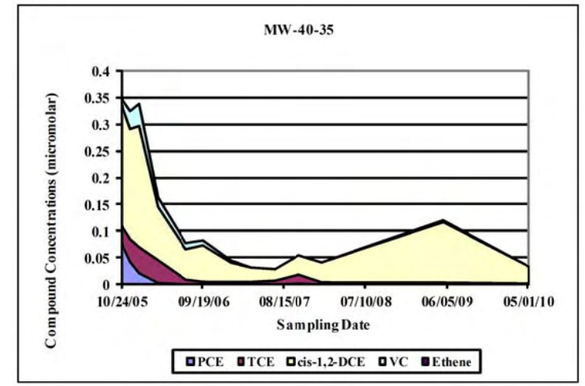

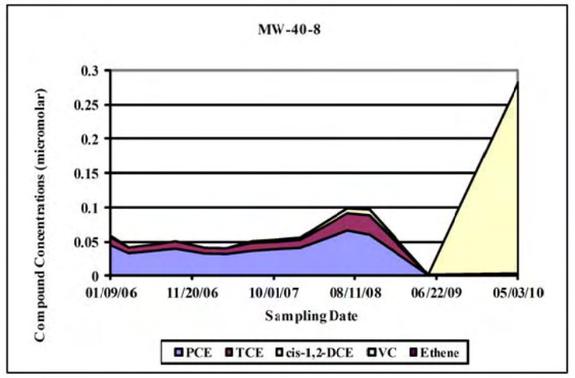

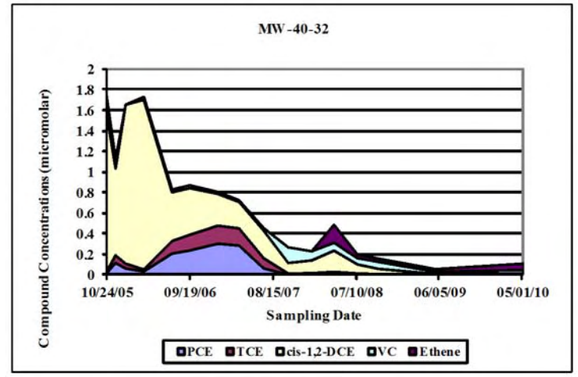

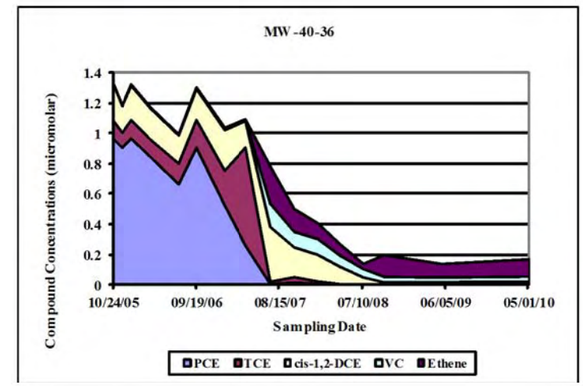

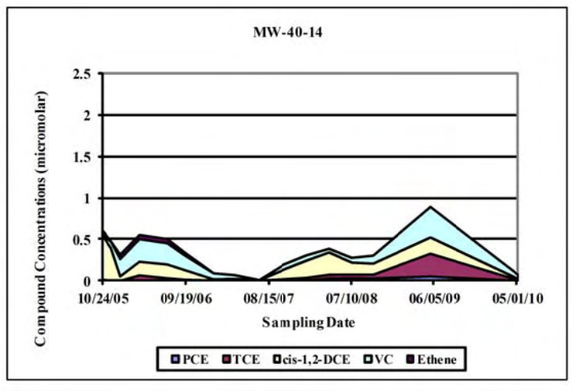

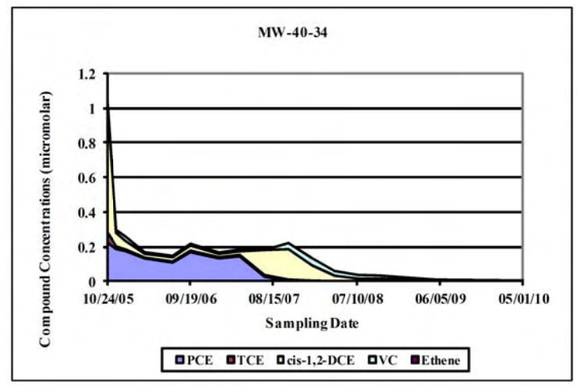

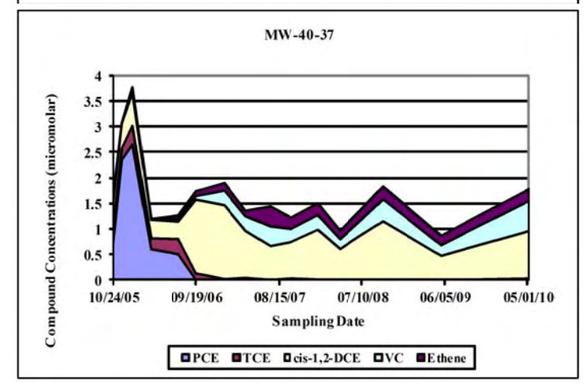

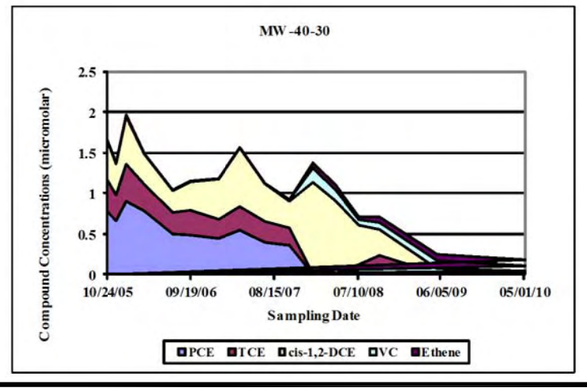

NOTES:

PCE – TETRACHLOROETHYLENE
TCE – TRICHLOROETHENE
DCE – DICHLOROETHENE
VC – VINYL CHLORIDE
µg/L– MICROGRAMS PER LITER
COC – CHEMICAL OF CONCERN

Figure 4–6
COC TRENDS (MOLAR BASIS) IN GROUNDWATER FOR KEY MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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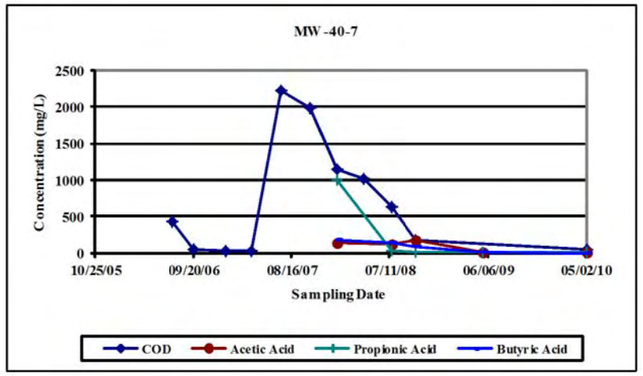

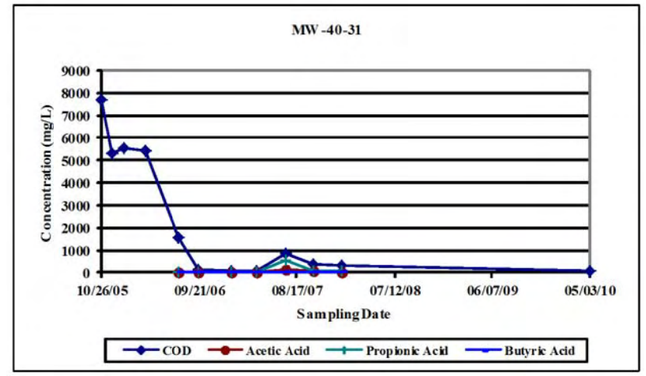

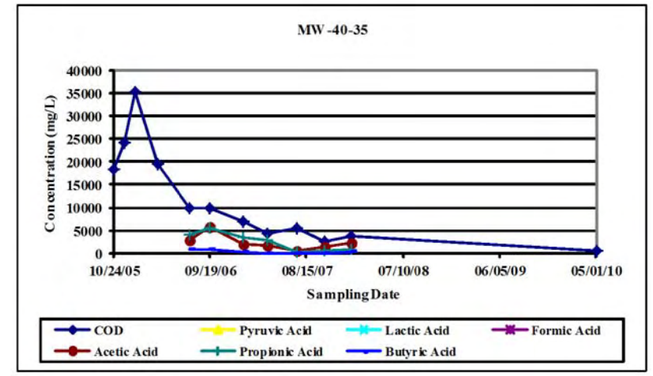

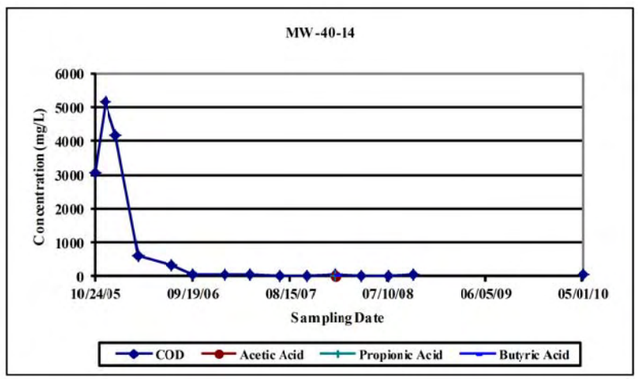

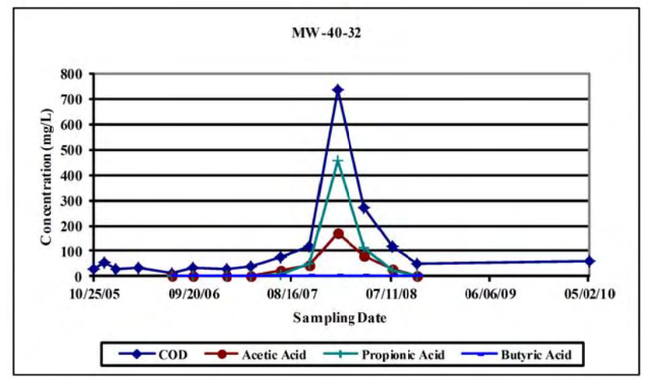

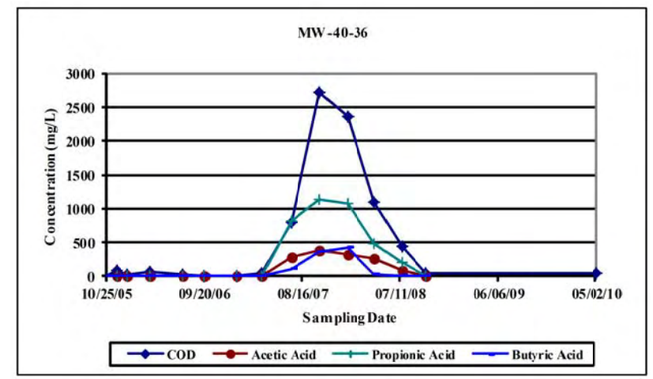

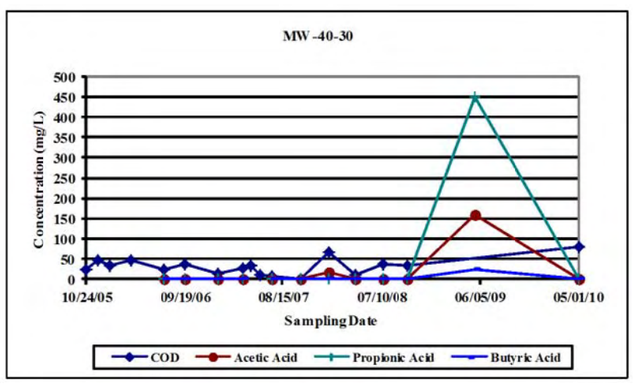

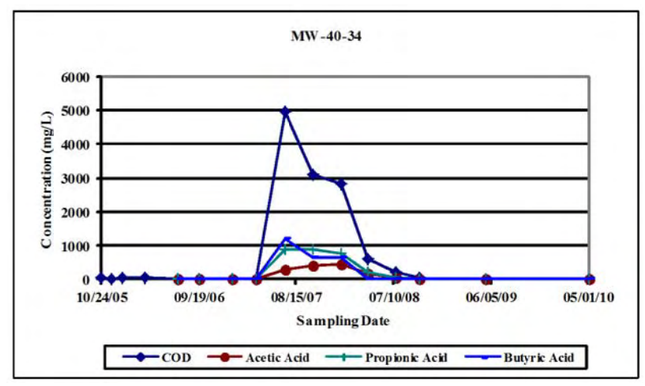

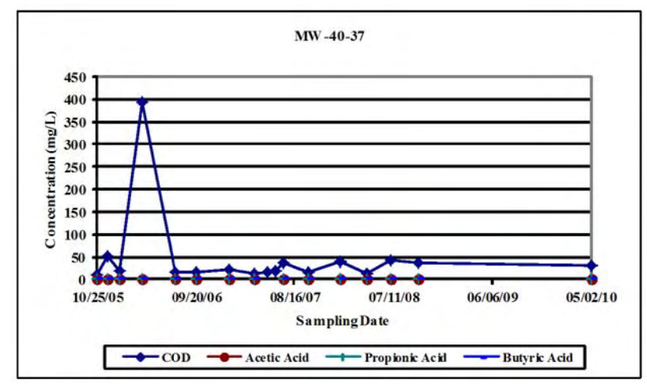

NOTES:

COD – CHEMICAL OXIDATION DEMAND
VFA – VOLATILE FATTY ACIDS
mg/L– MILLIGRAMS PER LITER

Figure 4–7
COD AND VFA TRENDS (MOLAR BASIS) IN GROUNDWATER FOR KEY MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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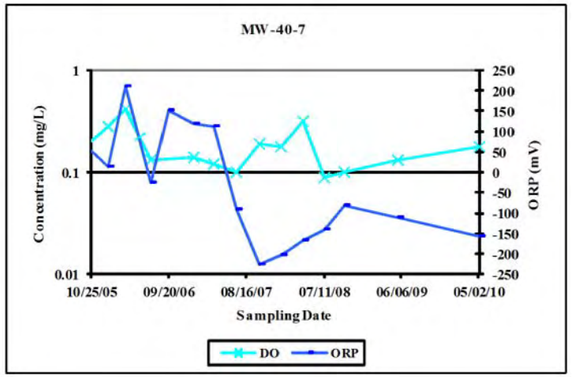

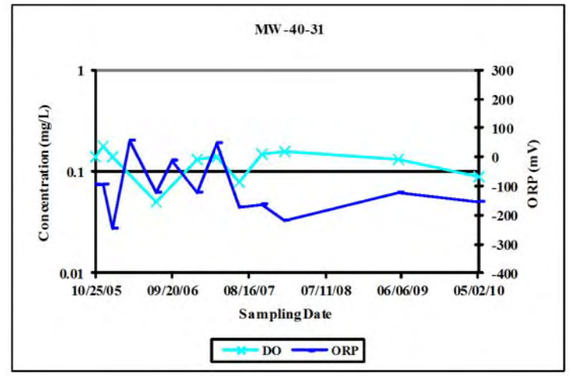

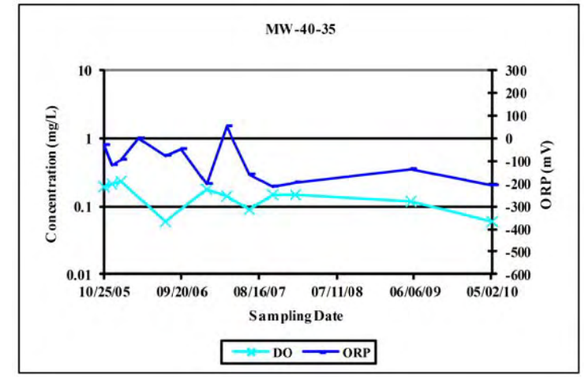

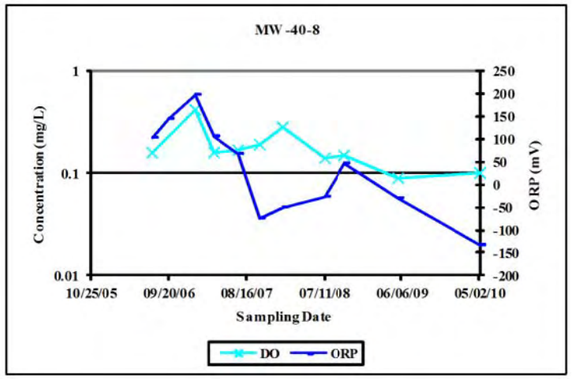

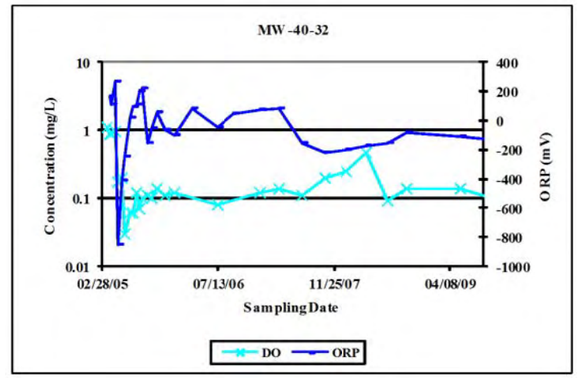

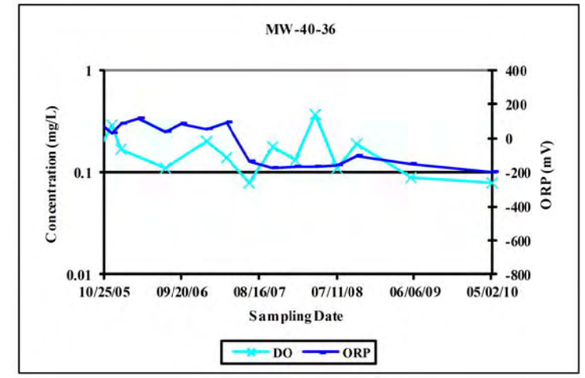

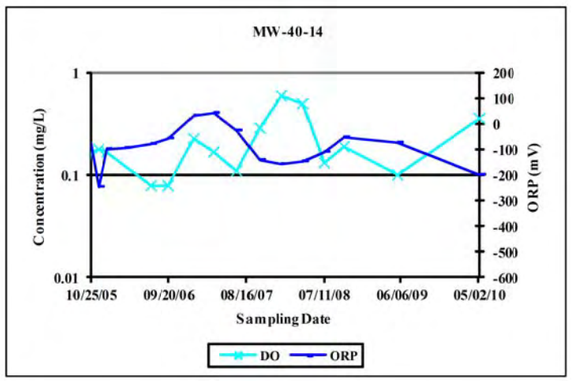

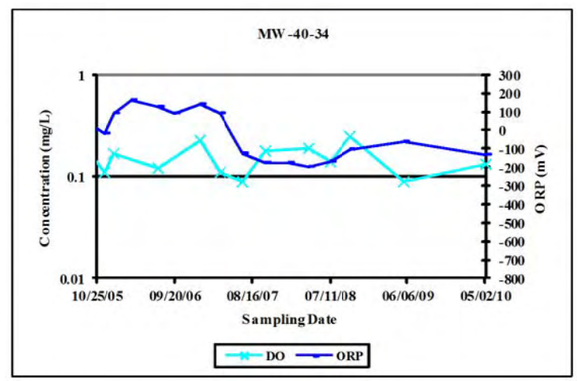

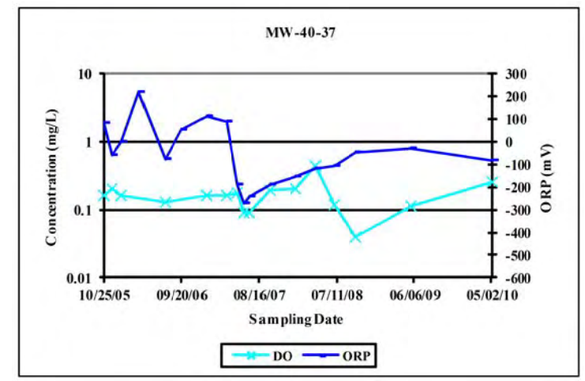

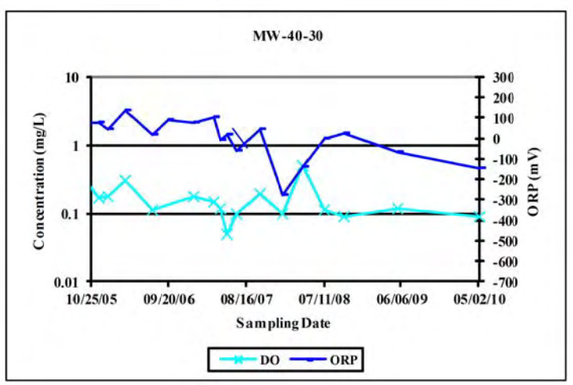

NOTES:

DO – DISSOLVED OXYGEN
ORP – OXIDATION REDUCTION POTENTIAL
mg/L– MILLIGRAMS PER LITER
mV – MILLIVOLTS

Figure 4–8
DO AND ORP TRENDS IN GROUNDWATER FOR KEY MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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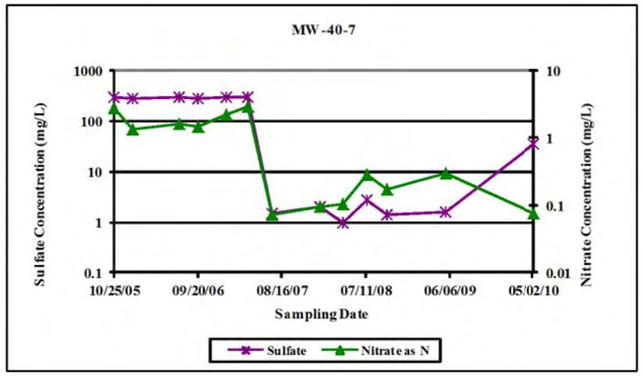

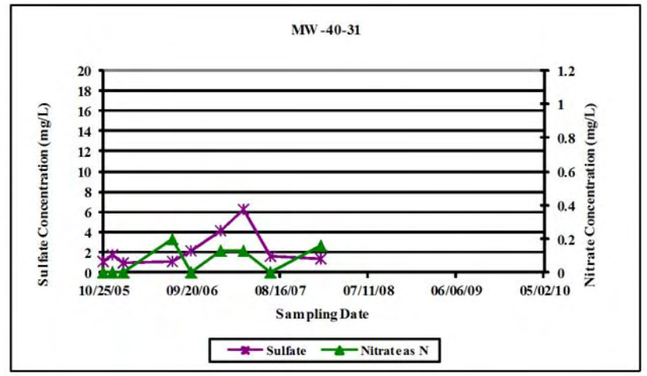

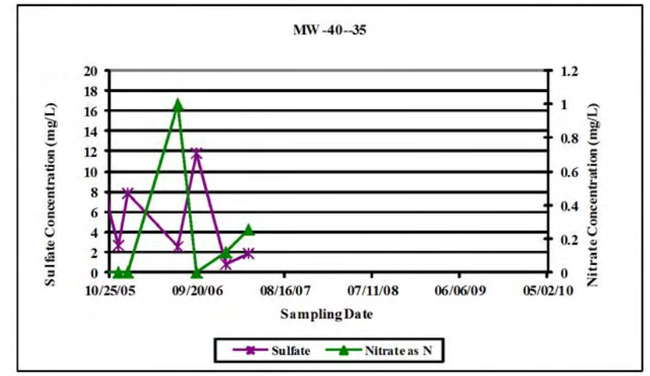

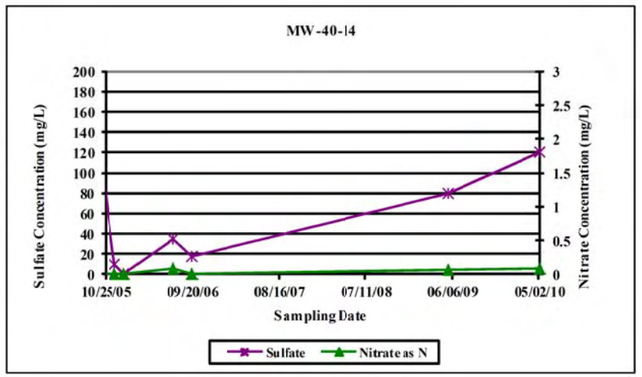

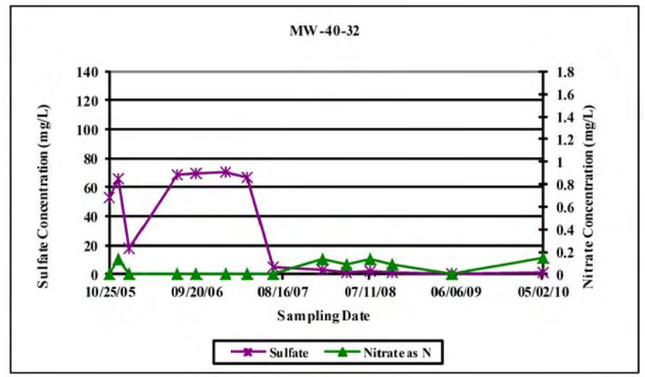

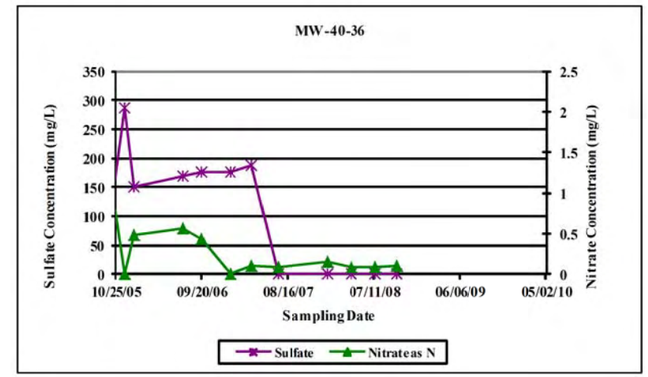

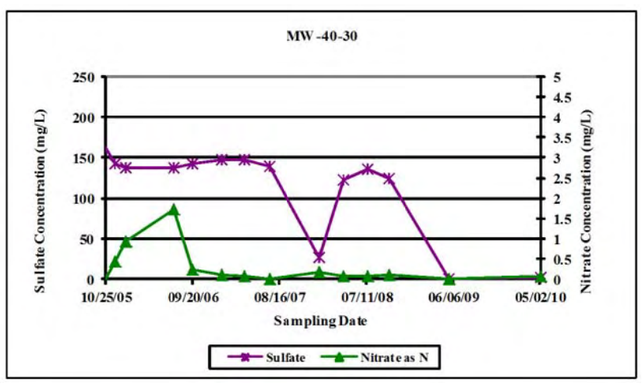

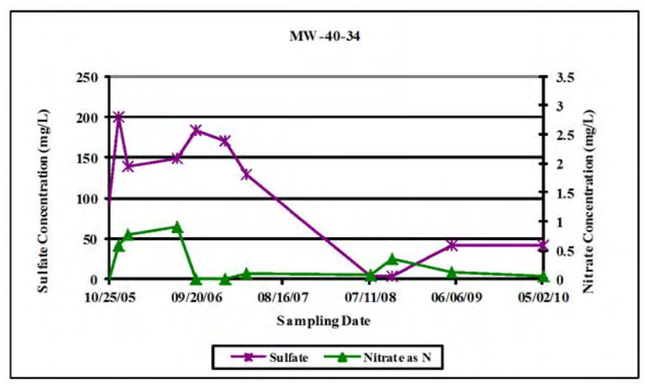

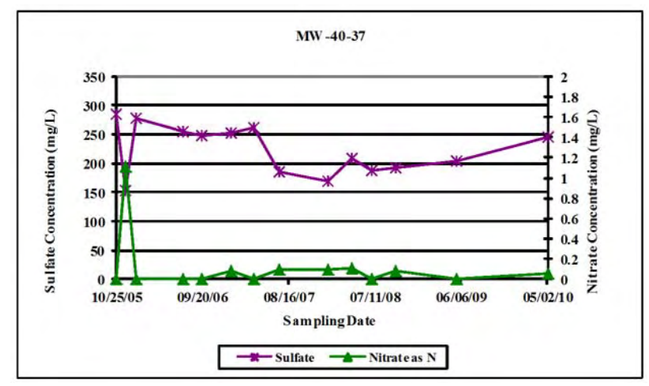

NOTES:

mg/L– MILLIGRAMS PER LITER
N – NITROGEN

Figure 4–9
NITRATE AND SULFATE TRENDS IN GROUNDWATER FOR KEY MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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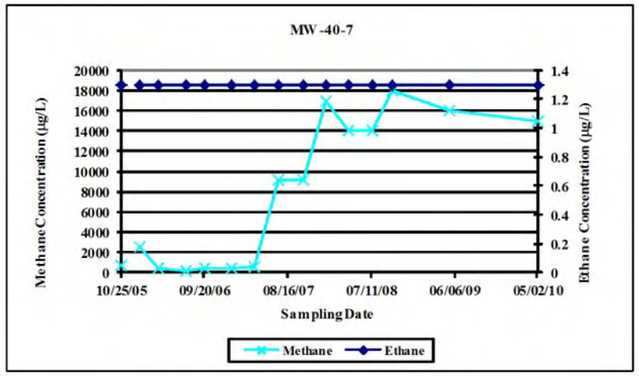

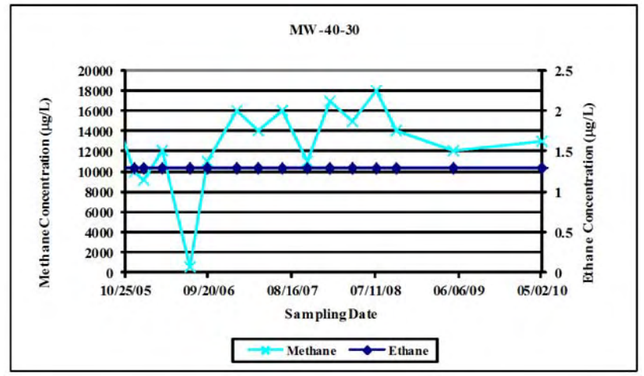

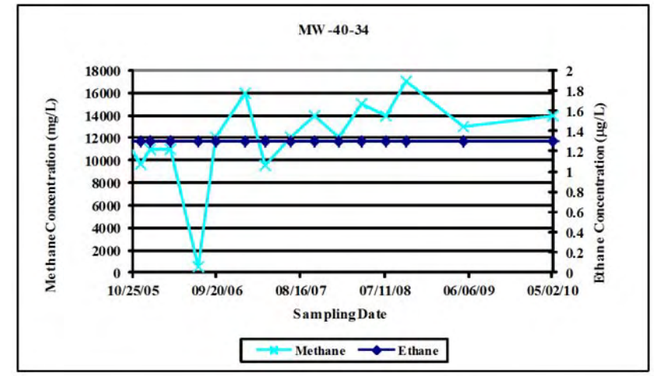

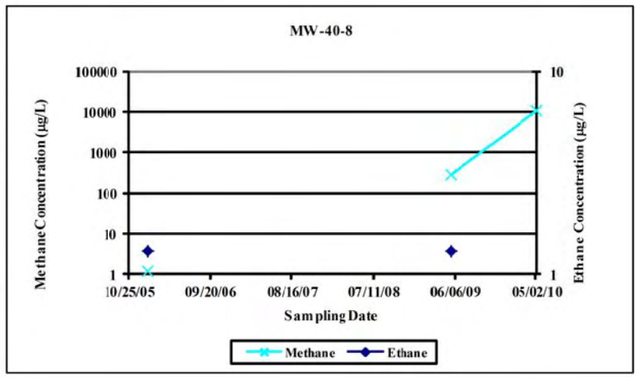

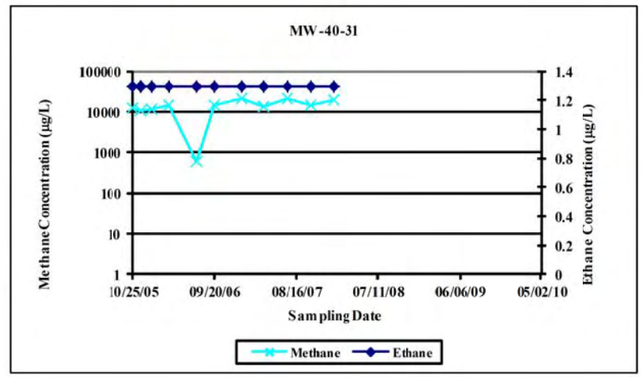

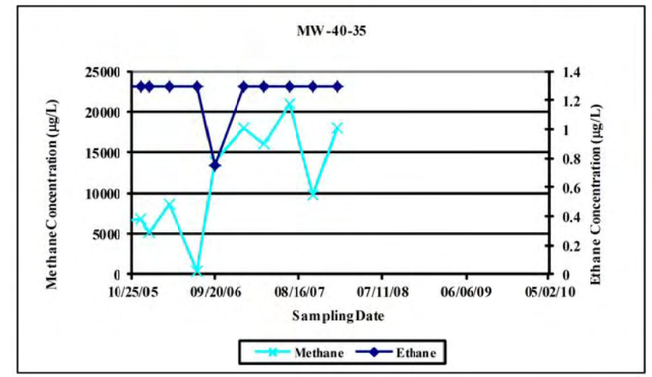

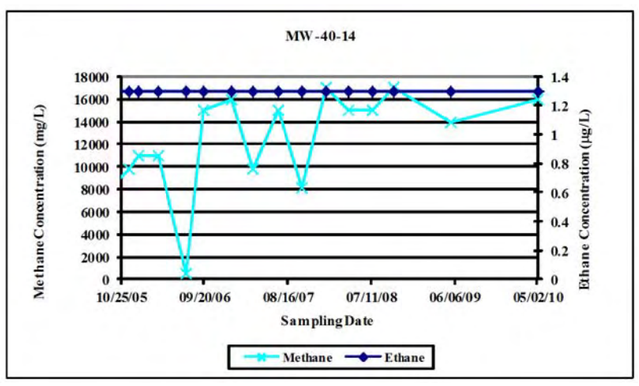

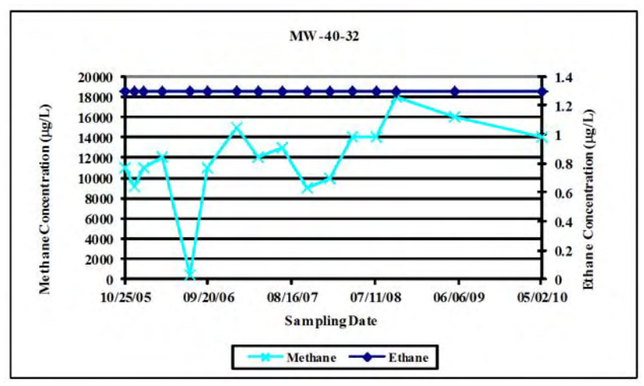

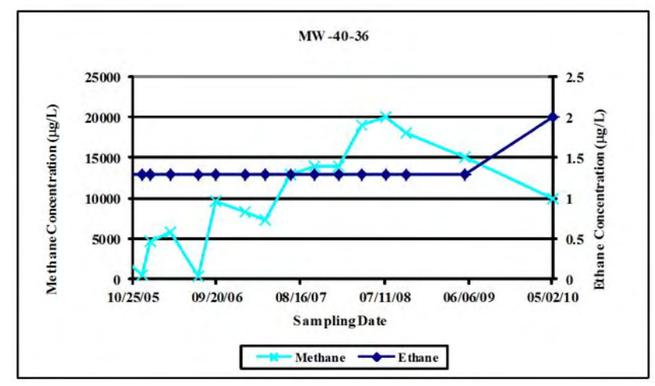

NOTES:

µg/L– MICROGRAMS PER LITER
mg/L– MILLIGRAMS PER LITER

Figure 4–10
METHANE AND ETHANE TRENDS IN GROUNDWATER FOR KEY MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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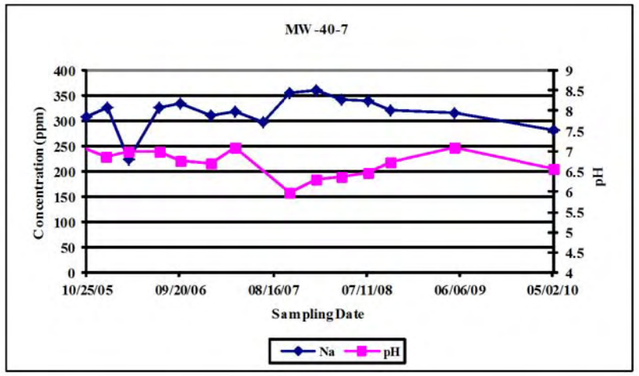

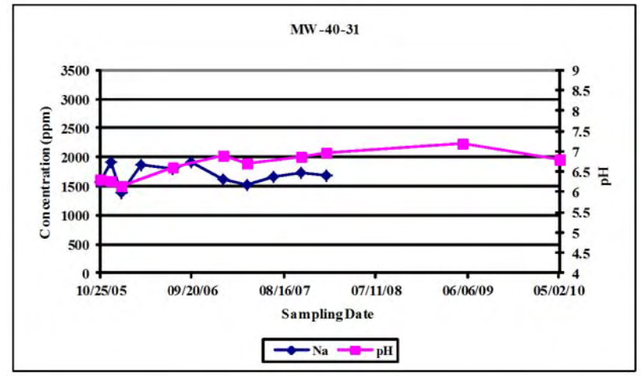

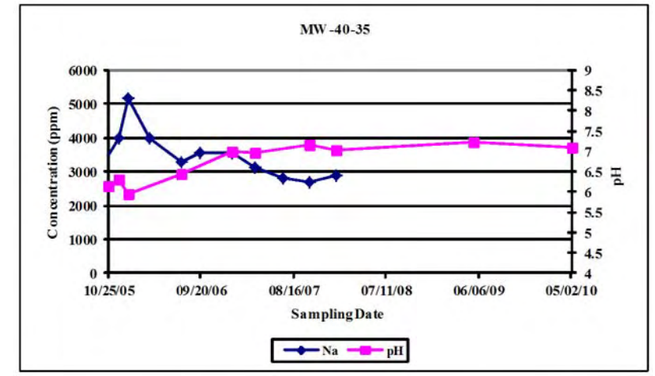

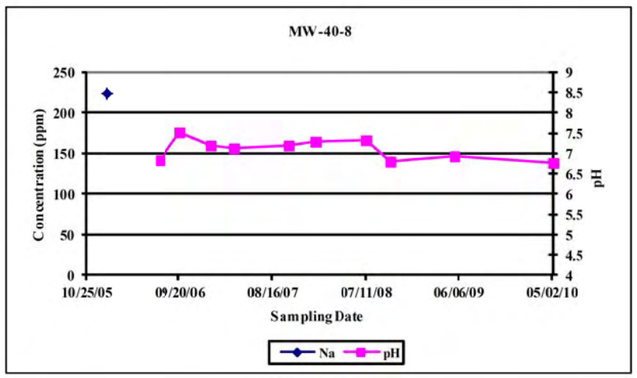

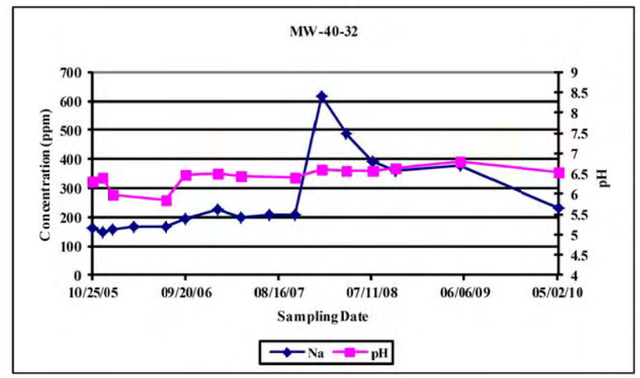

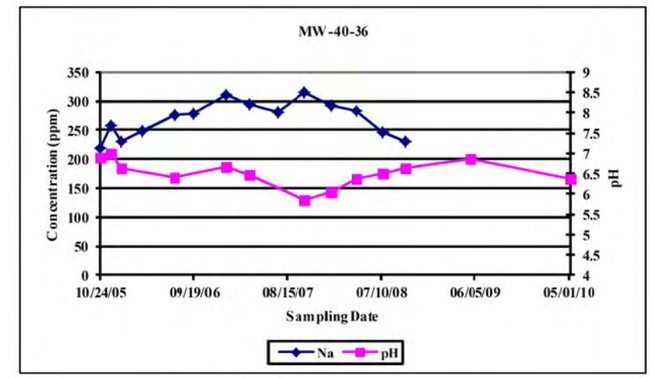

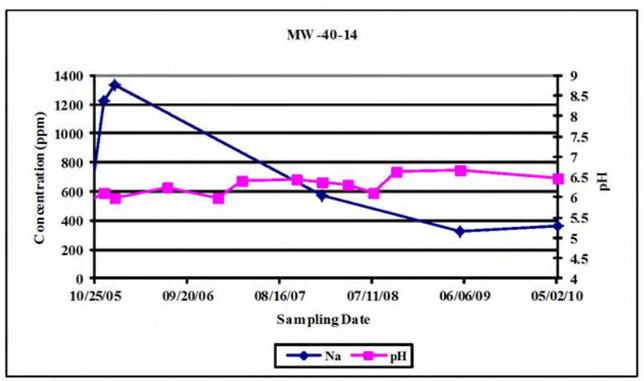

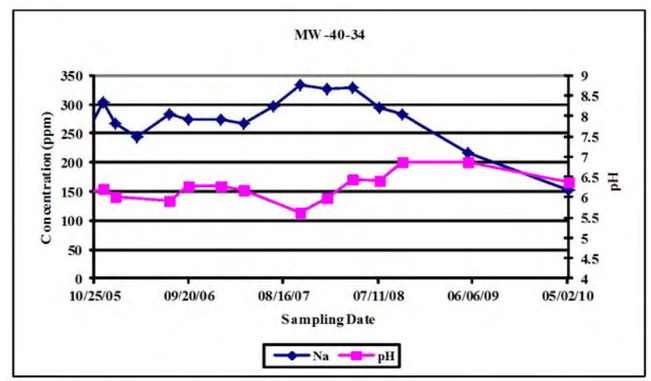

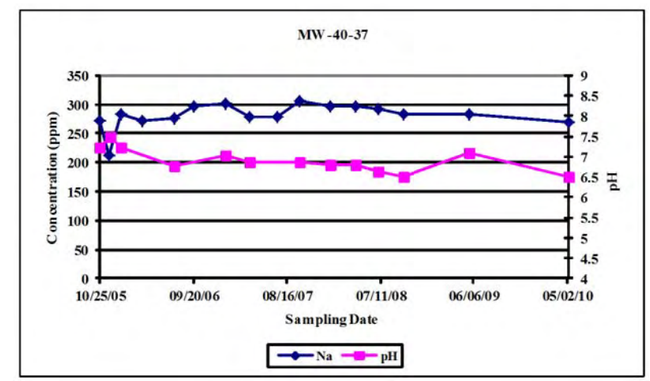

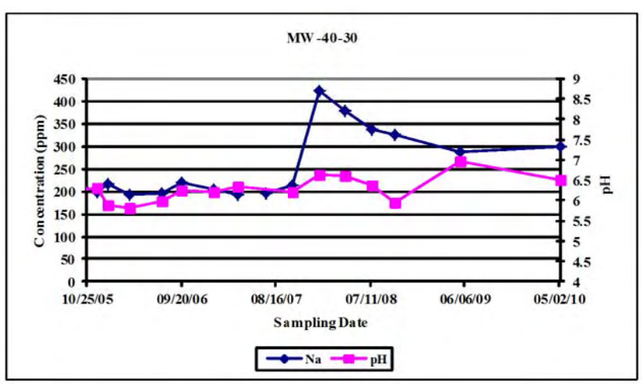

NOTES:

Na – SODIUM
mg/L– MILLIGRAMS PER LITER

Figure 4–11
pH AND Na TRENDS IN GROUNDWATER FOR KEY MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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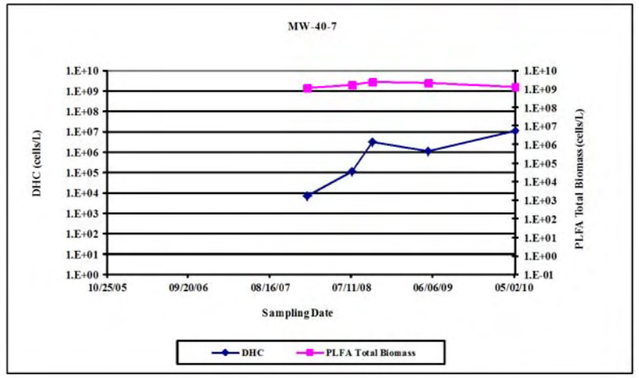

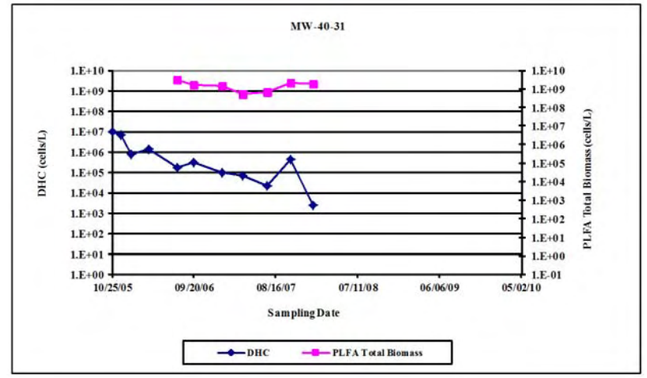

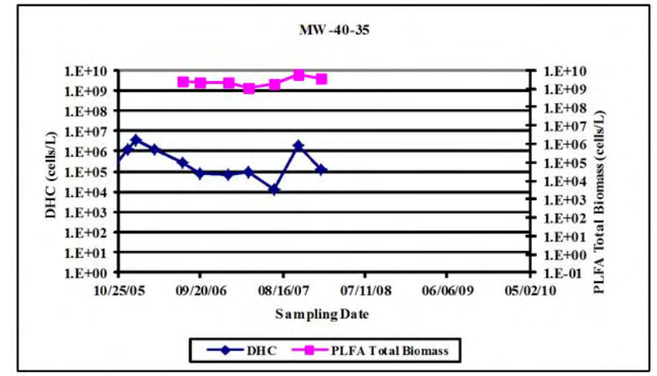

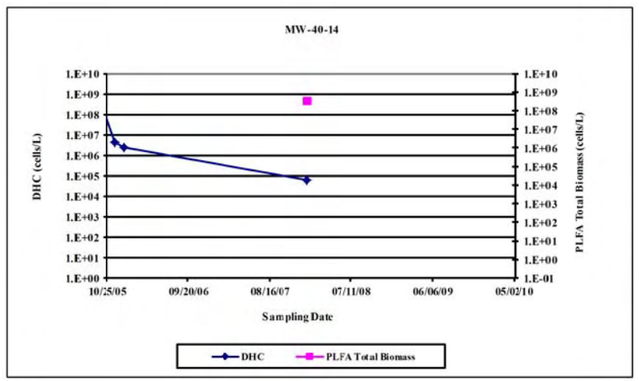

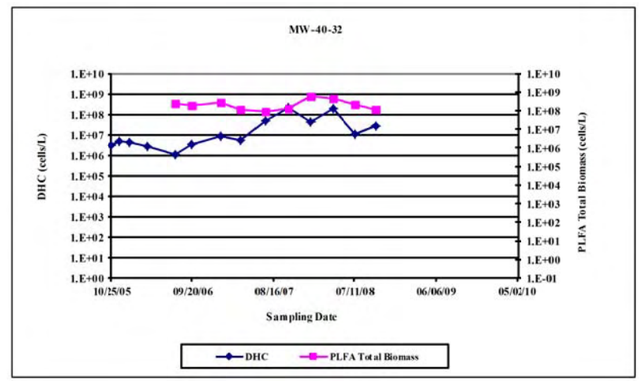

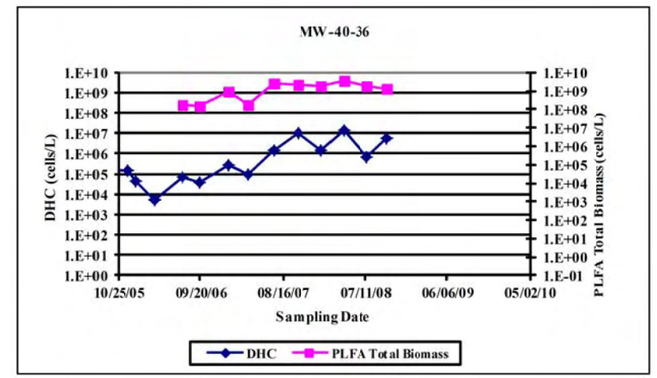

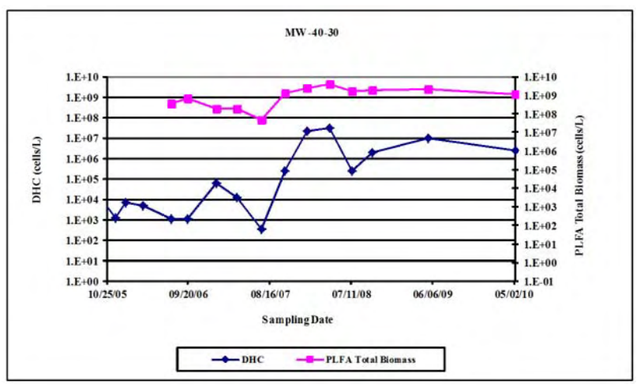

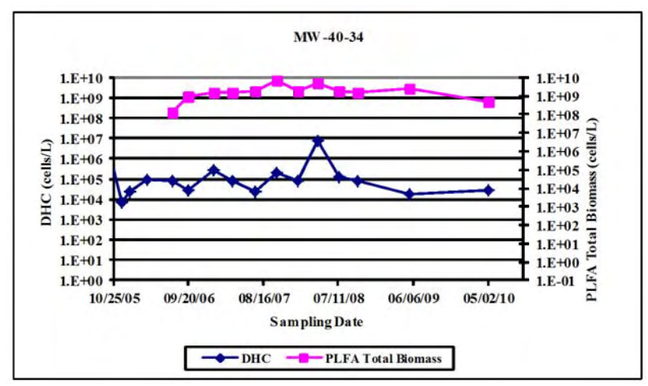

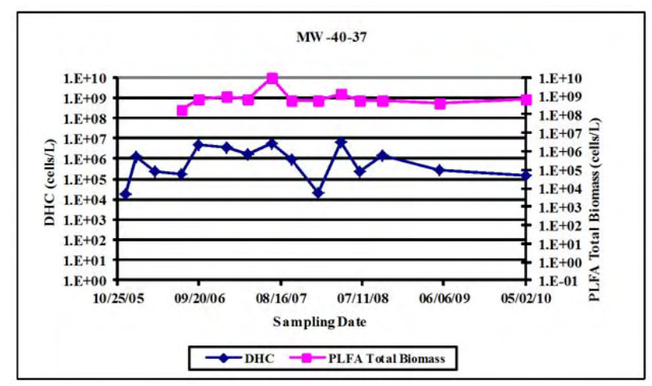

NOTES:

DHC – DEHALOCOCCOIDES ETHENOGENES, SPP.
PLFA – PHOSPHOLIPID FATTY ACID

Figure 4–12
PLFA BIOMASS AND DHC DNA TRENDS IN GROUNDWATER FOR KEY MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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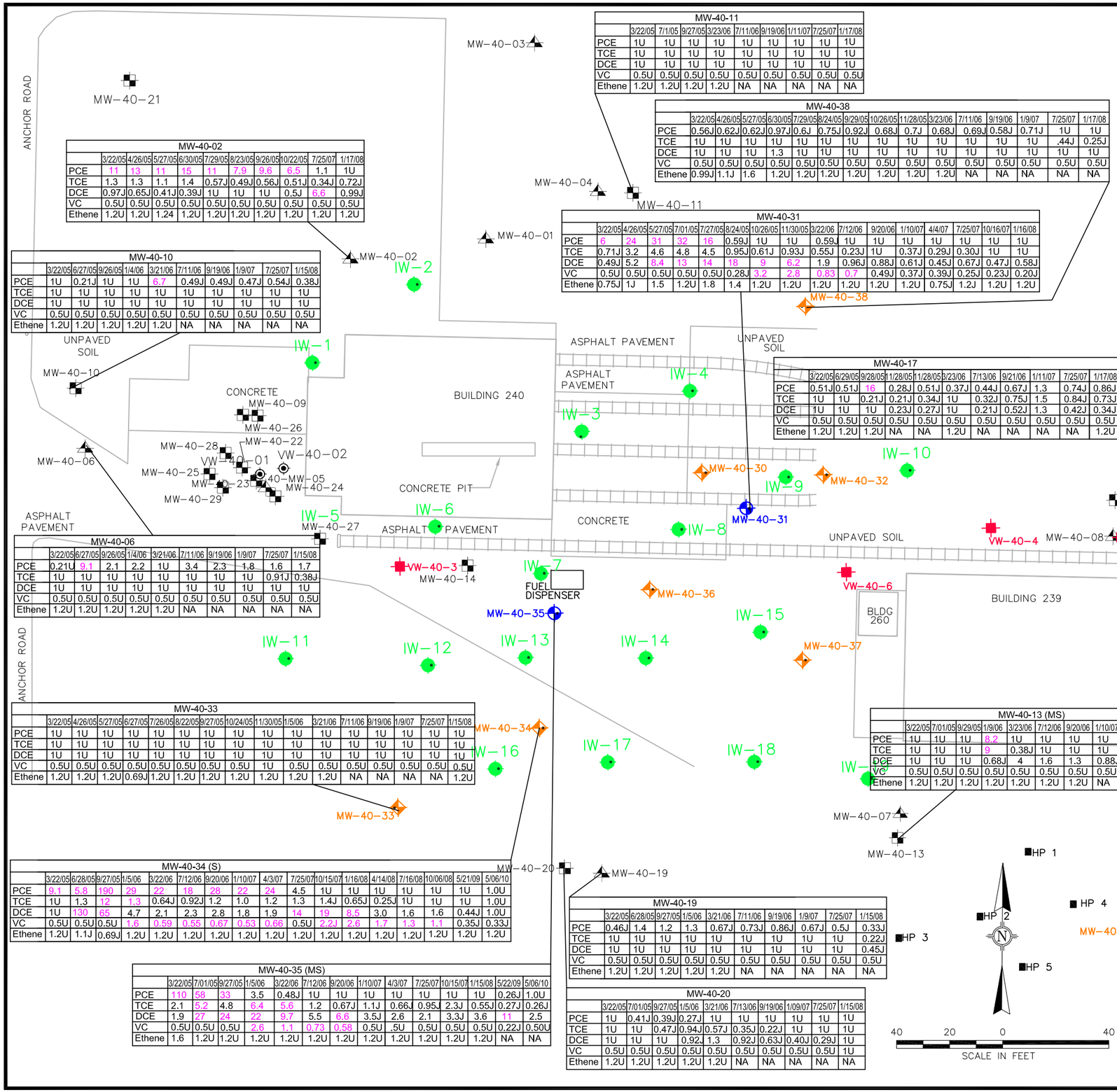


LEGEND

- EXISTING SHALLOW–INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE–INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW–40–01 EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW–40–30 SHALLOW–INTERVAL MONITORING WELL LOCATION (15'–35' BGS)(INSTALLED MARCH 2005)
- MW–40–31 MIDDLE–INTERVAL MONITORING WELL LOCATION (45'–55' BGS)(INSTALLED MARCH 2005)
- VW–40–4 SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW–10 INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 HYDROPUNCH LOCATIONS*

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (μg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA.

BNI BECHTEL NATIONAL INC.
DCE DICHLOROETHENE
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
PCE TETRACHLOROETHENE
TCE TRICHLOROETHENE
TCG TARGET CLEANUP GOAL
U NOT DETECTED AT DETECTION LIMIT GIVEN
VC VINYL CHLORIDE

MW-40-11

	3/22/05	7/1/05	9/27/05	3/23/06	7/11/06	9/19/06	1/11/07	7/25/07	1/17/08
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-38

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/24/05	9/29/05	10/26/05	11/28/05	3/23/06	7/11/06	9/19/06	1/9/07	7/25/07	1/17/08
PCE	0.56J	0.62J	0.62J	0.97J	0.6J	0.75J	0.92J	0.68J	0.7J	0.68J	0.69J	0.58J	0.71J	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	.44J	0.25J
DCE	1U	1U	1U	1.3	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.99J	1.1J	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-02

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/26/05	10/22/05	7/25/07	1/17/08
PCE	11	13	11	15	11	7.9	9.6	6.5	1.1	1U
TCE	1.3	1.3	1.1	1.4	0.57J	0.49J	0.56J	0.51J	0.34J	0.72J
DCE	0.97J	0.65J	0.41J	0.39J	1U	1U	1U	0.5J	6.6	0.99J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.24	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-31

	3/22/05	4/26/05	5/27/05	7/01/05	7/27/05	8/24/05	10/26/05	11/30/05	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/16/08
PCE	6	24	31	32	16	0.59J	1U	1U	0.59J	1U	1U	1U	1U	1U	1U	1U
TCE	0.71J	3.2	4.6	4.8	4.5	0.95J	0.61J	0.93J	0.55J	0.23J	1U	0.37J	0.29J	0.30J	1U	1U
DCE	0.49J	5.2	8.4	13	14	18	9	6.2	1.9	0.96J	0.88J	0.61J	0.45J	0.67J	0.47J	0.58J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.28J	3.2	2.8	0.83	0.7	0.49J	0.37J	0.39J	0.25J	0.23J	0.20J
Ethene	0.75J	1J	1.5	1.2U	1.8	1.4	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.75J	1.2J	1.2U	1.2U

MW-40-10

	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	1U	0.21J	1U	1U	6.7	0.49J	0.49J	0.47J	0.54J	0.38J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-17

	3/22/05	6/29/05	9/28/05	11/28/05	11/28/05	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
PCE	0.51J	0.51J	16	0.28J	0.51J	0.37J	0.44J	0.67J	1.3	0.74J	0.86J
TCE	1U	1U	0.21J	0.21J	0.34J	1U	0.32J	0.75J	1.5	0.84J	0.73J
DCE	1U	1U	1U	0.23J	0.27J	1U	0.21J	0.52J	1.3	0.42J	0.34J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	1.2U	NA	NA	NA	NA	1.2U

MW-40-18

	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
PCE	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U
Ethene	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-06

	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	0.21U	9.1	2.1	2.2	1U	3.4	2.3	1.8	1.6	1.7
TCE	1U	1U	1U	1U	1U	1U	1U	1U	0.91J	0.38J
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-15

	3/22/05	6/30/05	9/28/05	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
	1U	1U	0.26J	0.23J	1U	1U	1U	1U	1U	1U
	1U	1U	0.26J	0.21J	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.1J	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-33

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/27/05	10/24/05	11/30/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	1.2U

MW-40-13 (MS)

	3/22/05	7/01/05	9/29/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	7/25/07	1/15/08	5/21/09	5/06/10
PCE	1U	1U	1U	8.2	1U	1U	1U	1U	1U	1U	1U	1.0U
TCE	1U	1U	1U	9	0.38J	1U	1U	1U	1U	1U	1U	1.0U
DCE	1U	1U	1U	0.68J	4	1.6	1.3	0.88J	1.7	0.40J	1U	1.0U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.50U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-16

	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
PCE	1U	1U	1U	1U	1U	1U	ND
TCE	1U	1U	1U	1U	1U	1U	ND
DCE	1U	1U	1U	1U	1U	1U	ND
VC	0.5U	0.5U	1U	1U	0.5U	0.5U	ND
Ethene	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-39 (S)

	3/22/05	6/30/05	9/29/05	1/6/06	3/21/06	7/11/06	9/21/06	1/9/07	7/25/07	1/15/08	5/22/09	5/06/10
PCE	1U	1U	0.35J	0.71J	0.72J	1.7	2.4	2.5	2.8	1.3	0.29J	0.49J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1.0U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1.0U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.50U
Ethene	0.69J	1.2U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

MW-40-34 (S)

	3/22/05	6/28/05	9/27/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/16/08	4/14/08	7/16/08	10/06/08	5/21/09	5/06/10
PCE	9.1	5.8	190	29	22	18	28	22	24	4.5	1U	1U	1U	1U	1U	1U	1.0U
TCE	1U	1.3	12	1.3	0.64J	0.92J	1.2	1.0	1.2	1.3	1.4J	0.65J	0.25J	1U	1U	1U	1.0U
DCE	1U	130	65	4.7	2.1	2.3	2.8	1.8	1.9	14	19	8.5	3.0	1.6	1.6	0.44J	1.0U
VC	0.5U	0.5U	0.5U	1.6	0.59	0.55	0.67	0.53	0.66	0.5U	2.2J	2.6	1.7	1.3	1.1	0.35J	0.33J
Ethene	1.2U	1.1J	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-35 (MS)

	3/22/05	7/01/05	9/27/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/15/08	5/22/09	5/06/10
PCE	110	58	33	3.5	0.48J	1U	1U	1U	1U	1U	1U	1U	0.26J	1.0U
TCE	2.1	5.2	4.8	6.4	5.6	1.2	0.67J	1.1J	0.66J	0.95J	2.3J	0.55J	0.27J	0.26J
DCE	1.9	27	24	22	9.7	5.5	6.6	3.5J	2.6	2.1	3.3J	3.6	11	2.5
VC	0.5U	0.5U	0.5U	2.6	1.1	0.73	0.58	0.5U	.5U	0.5U	0.5U	0.5U	0.22J	0.50U
Ethene	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA

MW-40-19

	3/22/05	6/28/05	9/27/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	0.46J	1.4	1.2	1.3	0.67J	0.73J	0.86J	0.67J	0.5J	0.33J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	0.22J
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	0.45J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-20

	3/22/05	7/01/05	9/27/05	1/5/06	3/21/06	7/13/06	9/19/06	1/09/07	7/25/07	1/15/08
PCE	1U	0.41J	0.39J	0.27J	1U	1U	1U	1U	1U	1U
TCE	1U	1U	0.47J	0.94J	0.57J	0.35J	0.22J	1U	1U	1U
DCE	1U	1U	1U	0.92J	1.3	0.92J	0.63J	0.40J	0.29J	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

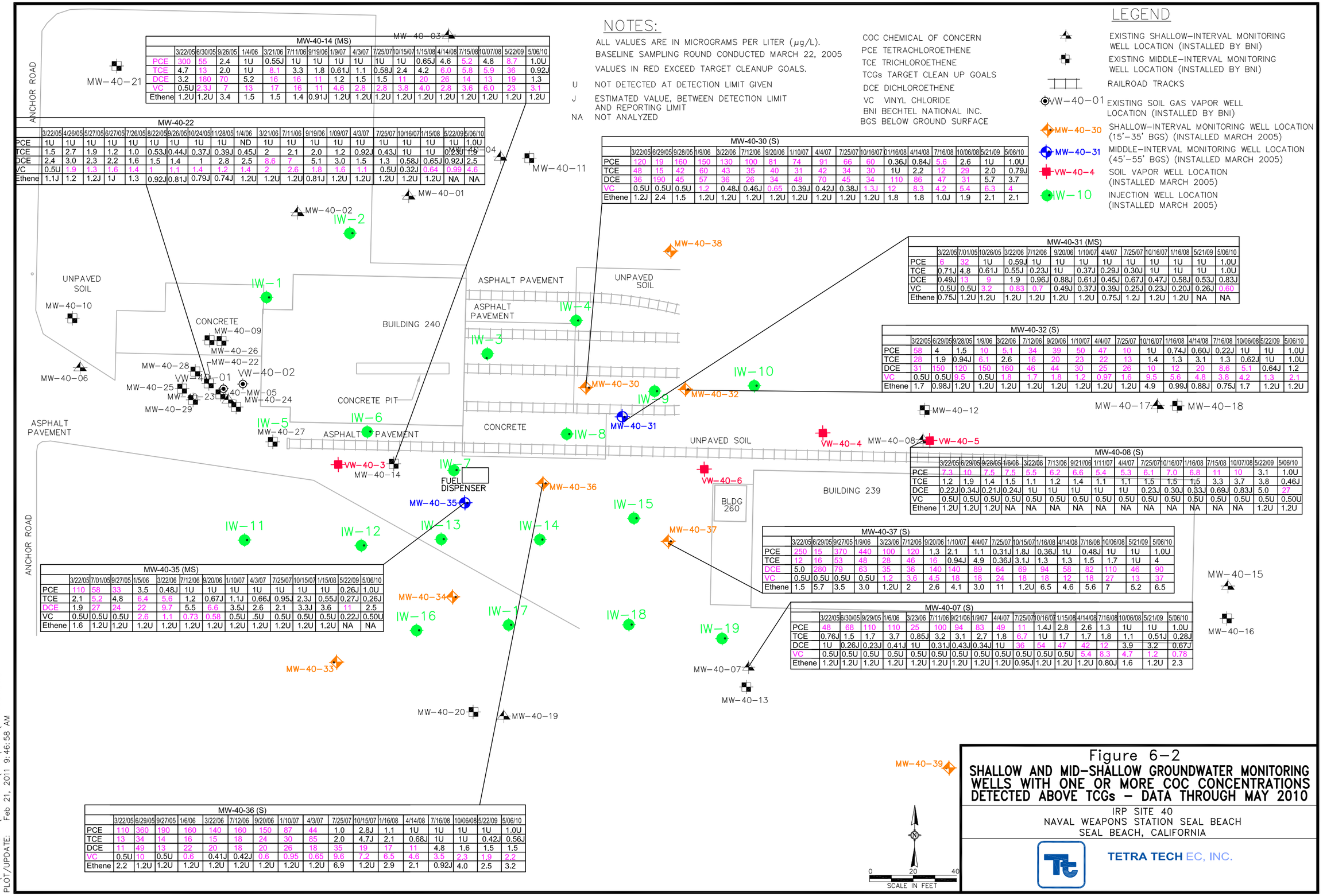
Figure 6–1

SHALLOW AND MID–SHALLOW MONITORING WELLS WITH COCS CONCENTRATIONS BELOW TCGS FOR ONE OR MORE YEARS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

P:\3210–RAC IV\CTO–0010\DWG\0007\0007061.DWG
PLOT/UPDATE: Feb 21, 2011 9:44:53 AM



NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (μg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED TARGET CLEANUP GOALS.

U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED

COC CHEMICAL OF CONCERN
PCE TETRACHLOROETHENE
TCE TRICHLOROETHENE
TCGs TARGET CLEAN UP GOALS
DCE DICHLOROETHENE
VC VINYL CHLORIDE
BNI BECHTEL NATIONAL INC.
BGS BELOW GROUND SURFACE

LEGEND

EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
RAILROAD TRACKS
VW-40-01 EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
MW-40-30 SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS) (INSTALLED MARCH 2005)
MW-40-31 MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS) (INSTALLED MARCH 2005)
VW-40-4 SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
IW-10 INJECTION WELL LOCATION (INSTALLED MARCH 2005)

MW-40-14 (MS)

	3/22/05	6/30/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	4/3/07	7/25/07	10/15/07	1/15/08	4/14/08	7/15/08	10/07/08	5/22/09	5/06/10
PCE	300	55	2.4	1U	0.55J	1U	1U	1U	1U	1U	1U	0.65J	4.6	5.2	4.8	8.7	1.0U
TCE	4.7	13	2.0	1U	8.1	3.3	1.8	0.61J	1.1	0.58J	2.4	4.2	6.0	5.8	5.9	36	0.92J
DCE	3.2	180	70	5.2	16	16	11	1.2	1.5	1.5	11	20	26	14	13	19	1.3
VC	0.5U	2.3J	7	13	17	16	11	4.6	2.8	2.8	3.8	4.0	2.8	3.6	6.0	23	3.1
Ethene	1.2U	1.2U	3.4	1.5	1.5	1.4	0.91J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-22

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/09/07	4/3/07	7/25/07	10/16/07	1/15/08	5/22/09	5/06/10
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	ND	1U	1U	1U	1U	1U	1U	1U	1U	1U	1.0U
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J	0.37J	0.39J	0.45J	2	2.1	2.0	1.2	0.92J	0.43J	1U	1U	0.23J	1.9
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4	1	2.8	2.5	8.6	7	5.1	3.0	1.5	1.3	0.58J	0.65J	0.92J	2.5
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1	1.4	1.2	1.4	2	2.6	1.8	1.6	1.1	0.5U	0.32J	0.64	0.99	4.6
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J	0.79J	0.74J	1.2U	1.2U	1.2U	0.81J	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA

MW-40-30 (S)

	3/22/05	6/29/05	9/28/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	01/16/08	4/14/08	7/16/08	10/06/08	5/21/09	5/06/10
PCE	120	19	160	150	130	100	81	74	91	66	60	0.36J	0.84J	5.6	2.6	1U	1.0U
TCE	48	15	42	60	43	35	40	31	42	34	30	1U	2.2	12	29	2.0	0.79J
DCE	36	190	45	57	36	26	34	48	70	45	34	110	86	47	31	5.7	3.7
VC	0.5U	0.5U	0.5U	1.2	0.48J	0.46J	0.65	0.39J	0.42J	0.38J	1.3J	12	8.3	4.2	5.4	6.3	4
Ethene	1.2J	2.4	1.5	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.8	1.8	1.0J	1.9	2.1	2.1

MW-40-31 (MS)

	3/22/05	7/01/05	10/26/05	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/16/08	5/21/09	5/06/10
PCE	6	32	1U	0.59J	1U	1U	1U	1U	1U	1U	1U	1U	1.0U
TCE	0.71J	4.8	0.61J	0.55J	0.23J	1U	0.37J	0.29J	0.30J	1U	1U	1U	1.0U
DCE	0.49J	13	9	1.9	0.96J	0.88J	0.61J	0.45J	0.67J	0.47J	0.58J	0.53J	0.83J
VC	0.5U	0.5U	3.2	0.83	0.7	0.49J	0.37J	0.39J	0.25J	0.23J	0.20J	0.26J	0.60
Ethene	0.75J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.75J	1.2J	1.2U	1.2U	NA	NA

MW-40-32 (S)

	3/22/05	6/29/05	9/28/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/16/08	4/14/08	7/16/08	10/06/08	5/22/09	5/06/10
PCE	58	4	1.5	10	5.1	34	39	50	47	10	1U	0.74J	0.60J	0.22J	1U	1U	1.0U
TCE	28	1.9	0.94J	6.1	2.6	16	20	23	22	13	1.4	1.3	3.1	1.3	0.62J	1U	1.0U
DCE	31	150	120	150	160	46	44	30	25	26	10	12	20	8.6	5.1	0.64J	1.2
VC	0.5U	0.5U	9.5	0.5U	1.8	1.7	1.8	1.2	0.97	1.6	9.5	5.6	4.8	3.8	4.2	1.3	2.1
Ethene	1.7	0.98J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	4.9	0.99J	0.88J	0.75J	1.7	1.2U	1.2U

MW-40-08 (S)

	3/22/05	6/29/05	9/28/05	1/6/06	3/22/06	7/13/06	9/21/06	1/11/07	4/4/07	7/25/07	10/16/07	1/16/08	7/15/08	10/07/08	5/22/09	5/06/10
PCE	7.3	10	7.5	7.5	5.5	6.2	6.6	5.4	5.3	6.1	7.0	6.8	11	10	3.1	1.0U
TCE	1.2	1.9	1.4	1.5	1.1	1.2	1.4	1.1	1.1	1.5	1.5	1.5	3.3	3.7	3.8	0.46J
DCE	0.22J	0.34J	0.21J	0.24J	1U	1U	1U	1U	1U	0.23J	0.30J	0.33J	0.69J	0.83J	5.0	27
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.50U
Ethene	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.2U	1.2U

MW-40-37 (S)

	3/22/05	6/29/05	9/27/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/15/07	1/16/08	4/14/08	7/16/08	10/06/08	5/21/09	5/06/10
PCE	250	15	370	440	100	120	1.3	2.1	1.1	0.31J	1.8J	0.36J	1U	0.48J	1U	1U	1.0U
TCE	12	16	53	48	28	46	16	0.94J	4.9	0.36J	3.1J	1.3	1.3	1.5	1.7	1U	4
DCE	5.0	280	79	63	35	36	140	140	89	64	69	94	58	82	110	46	90
VC	0.5U	0.5U	0.5U	0.5U	1.2	3.6	4.5	18	18	24	18	18	12	18	27	13	37
Ethene	1.5	5.7	3.5	3.0	1.2U	2	2.6	4.1	3.0	11	1.2U	6.5	4.6	5.6	7	5.2	6.5

MW-40-35 (MS)

	3/22/05	7/01/05	9/27/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/15/08	5/22/09	5/06/10
PCE	110	58	33	3.5	0.48J	1U	1U	1U	1U	1U	1U	1U	0.26J	1.0U
TCE	2.1	5.2	4.8	6.4	5.6	1.2	0.67J	1.1J	0.66J	0.95J	2.3J	0.55J	0.27J	0.26J
DCE	1.9	27	24	22	9.7	5.5	6.6	3.5J	2.6	2.1	3.3J	3.6	11	2.5
VC	0.5U	0.5U	0.5U	2.6	1.1	0.73	0.58	0.5U	.5U	0.5U	0.5U	0.5U	0.22J	0.50U
Ethene	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA

MW-40-07 (S)

	3/22/05	6/30/05	9/29/05	1/6/06	3/23/06	7/11/06	9/21/06	1/9/07	4/4/07	7/25/07	10/16/07	1/15/08	4/14/08	7/16/08	10/06/08	5/21/09	5/06/10
PCE	48	68	110	110	25	100	94	83	49	11	1.4J	2.8	2.6	1.3	1U	1U	1.0U
TCE	0.76J	1.5	1.7	3.7	0.85J	3.2	3.1	2.7	1.8	6.7	1U	1.7	1.7	1.8	1.1	0.51J	0.28J
DCE	1U	0.26J	0.23J	0.41J	1U	0.31J	0.43J	0.34J	1U	36	54	47	42	12	3.9	3.2	0.67J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	5.4	8.3	4.7	1.2	0.78
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.95J	1.2U	1.2U	1.2U	0.80J	1.6	1.2U	2.3

MW-40-36 (S)

	3/22/05	6/29/05	9/27/05	1/6/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/16/08	4/14/08	7/16/08	10/06/08	5/22/09	5/06/10
PCE	110	360	190	160	140	160	150	87	44	1.0	2.8J	1.1	1U	1U	1U	1U	1.0U
TCE	13	34	14	16	15	18	24	30	85	2.0	4.7J	2.1	0.68J	1U	1U	0.42J	0.56J
DCE	11	49	13	22	20	18	20	26	18	35	19	17	11	4.8	1.6	1.5	1.5
VC	0.5U	10	0.5U	0.6	0.41J	0.42J	0.6	0.95	0.65	9.6	7.2	6.5	4.6	3.5	2.3	1.9	2.2
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	6.9	1.2U	2.9	2.1	0.92J	4.0	2.5	3.2

Figure 6-2
SHALLOW AND MID-SHALLOW GROUNDWATER MONITORING WELLS WITH ONE OR MORE COC CONCENTRATIONS DETECTED ABOVE TCGs - DATA THROUGH MAY 2010

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

P:\3210-RAC IV\CTO-0010\DWG\0007\0007064.DWG
PLOT/UPDATE: Feb 21, 2011 9:46:58 AM

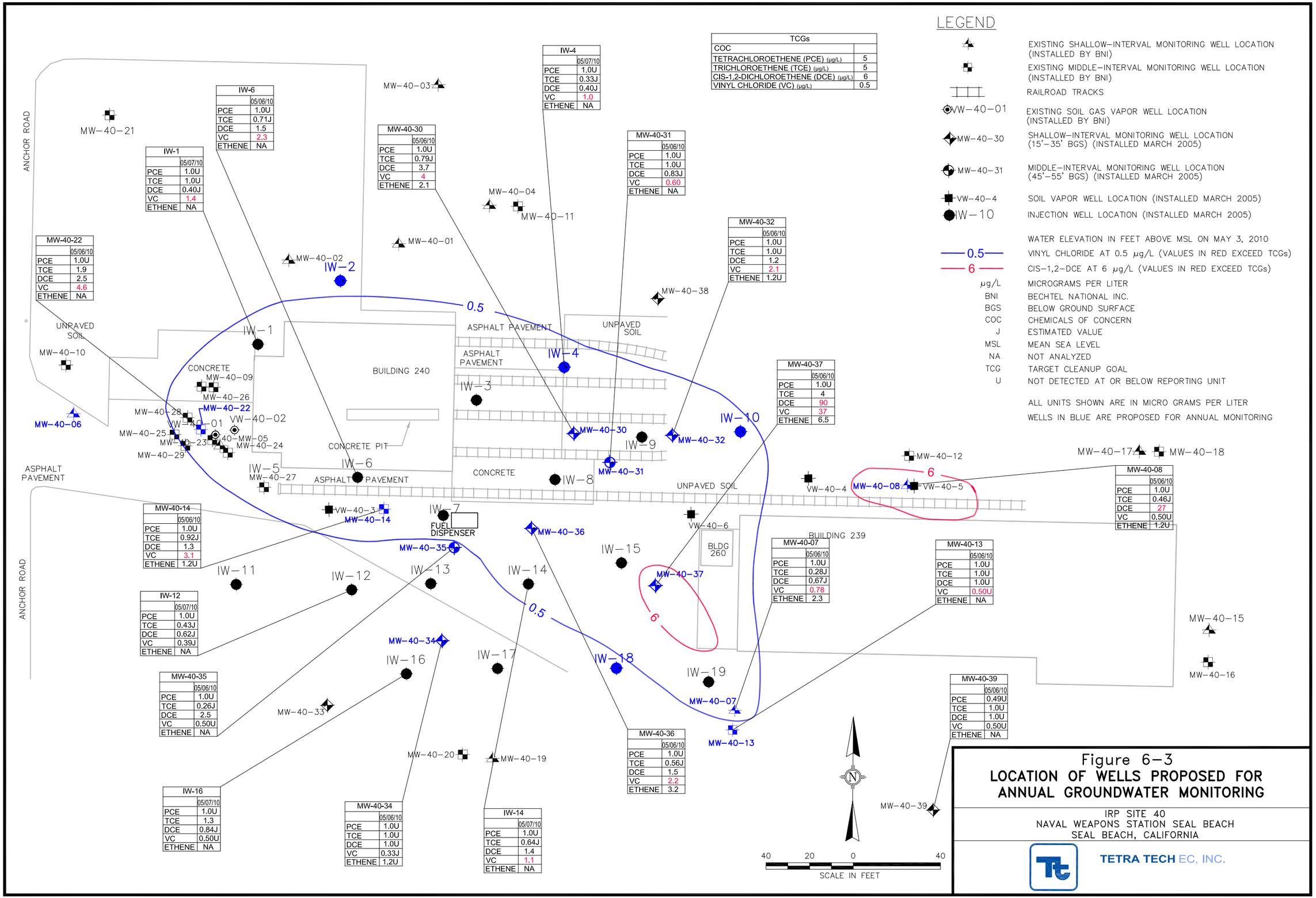


Figure 6-3
LOCATION OF WELLS PROPOSED FOR ANNUAL GROUNDWATER MONITORING

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

P:\3210-RAC IV\CTO-0010\DWG\0007\0007063.DWG
PLOT/UPDATE: Feb 21, 2011 9:46:16 AM

APPENDIX A

GROUNDWATER LEVEL MEASUREMENTS AND WATER LEVEL CONTOUR MAPS

Table A-1 Groundwater Level Measurements from November 2005 to May 2010

Figure A-1 Water Level Contour Map (January 18, 2008)

Figure A-2 Water Level Contour Map (April 10, 2008)

Figure A-3 Water Level Contour Map (July 16, 2008)

Figure A-4 Water Level Contour Map (October 2, 2008)

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TABLE A-1

GROUNDWATER LEVEL MEASUREMENTS FROM NOVEMBER 2005 THROUGH MAY 2010

Well ID	Well Coordinates		Well Elevations (NAVD 29)		Measurement Date and Time			Measurement Date and Time			Measurement Date and Time			Measurement Date and Time			Measurement Date and Time		
					November 1, 2005			November 22, 2005			December 22, 2005			January 17, 2006			February 24, 2006		
Location Number	NORTHING	EASTING	TOP OF PVC CASING	TOP OF VAULT COVER	Time Measured	Depth (ft)	Elevation (Above MSL) 11/1/05	Time Measured	Depth (ft)	Elevation (Above MSL) 11/22/05	Time Measured	Depth (ft)	Elevation (Above MSL) 12/22/05	Time Measured	Depth (ft)	Elevation (Above MSL) 01/17/06	Time Measured	Depth (ft)	Elevation (Above MSL) 02/24/06
40-MW-01	2218901.100	6002213.800	10.09	10.09	1235	7.92		Not Measured			Not Measured			1259	8.01	**2.08**	Not Measured		
40-MW-02	2218893.700	6002163.400	10.11	10.11	Not Measured			Not Measured			Not Measured			1304	7.59	**2.52**	Not Measured		
MW-40-06	2218823.300	6002064.800	10.57	11.00	0926	8.85	**1.72**	0705	8.80	**1.77**	0705	8.87	**1.70**	1113	8.79	**1.78**	0738	8.72	**1.85**
MW-40-07	2218687.300	6002367.900	10.30	10.80	Not Measured			Not Measured			Not Measured			1203	8.62	**1.68**	Not Measured		
MW-40-08	2218790.500	6002447.100	10.32	10.70	Not Measured			Not Measured			Not Measured			1219	8.67	**1.65**	Not Measured		
MW-40-10	2218845.600	6002061.300	10.28	10.94	0927	8.56	**1.72**	0700	8.58	**1.70**	0704	8.62	**1.66**	1110	8.55	**1.73**	0742	8.97	**1.31**
MW-40-11	2218918.300	6002268.600	9.70	10.11	Not Measured			Not Measured			Not Measured			1255	7.94	**1.76**	Not Measured		
MW-40-13	2218678.300	6002367.000	10.27	10.70	Not Measured			Not Measured			Not Measured			1205	8.63	**1.64**	Not Measured		
MW-40-14	2218779.600	6002207.000	10.67	10.95	0925	8.99	**1.68**	0708	8.80	**1.87**	0722	9.06	**1.61**	1128	9.00	**1.67**	0756	9.16	**1.51**
MW-40-15	2218724.100	6002585.400	10.46	10.90	Not Measured			Not Measured			Not Measured			1212	8.84	**1.62**	Not Measured		
MW-40-17	2218806.100	6002553.400	9.73	9.88	Not Measured			Not Measured			Not Measured			1215	8.10	**1.63**	Not Measured		
MW-40-19	2218665.200	6002256.900	11.73	10.20	Not Measured			Not Measured			Not Measured			1151	9.95	**1.78**			
MW-40-20	2218667.000	6002243.200	12.04	10.26	0812	10.44	**1.60**	0708	10.46	**1.58**	0740	10.58	**1.46**	1159	10.47	**1.57**	0814	10.64	**1.40**
MW-40-22	2218816.100	6002123.100	10.58	10.93	0805	8.84	**1.74**	0710	8.72	**1.86**	0705	8.85	**1.73**	1117	8.76	**1.82**	0749	8.94	**1.64**
MW-40-30	2218814.211	6002294.153	10.35	10.99	0858	8.08	**2.27**	8.08	7.94	**2.41**	0821	8.25	**2.10**	1233	8.13	**2.22**	0843	8.21	**2.14**
MW-40-31	2218800.956	6002310.664	10.57	10.75	0849	8.79	**1.78**	805	8.74	**1.83**	0819	8.98	**1.59**	1231	8.93	**1.64**	0841	9.07	**1.50**
MW-40-32	2218813.398	6002339.315	10.20	10.48	0916	8.22	**1.98**	810	8.14	**2.06**	0829	8.44	**1.76**	1227	8.32	**1.88**	0837	8.42	**1.78**
MW-40-33	2218689.587	6002181.107	10.60	10.97	0807	8.61	**1.99**	738	8.44	**2.16**	0738	8.75	**1.85**	1147	8.61	**1.99**	0810	8.70	**1.90**
MW-40-34	2218719.182	6002233.686	10.23	10.92	0908	7.88	**2.35**	743	7.75	**2.48**	0747	8.05	**2.18**	1152	7.92	**2.31**	0819	8.01	**2.22**
MW-40-35	2218761.890	6002239.240	10.78	11.16	0840	8.78	**2.00**	752	8.66	**2.12**	0755	8.92	**1.86**	1132	8.78	**2.00**	0801	8.99	**1.79**
MW-40-36	2218770.714	6002274.762	10.92	11.17	0817	9.03	**1.89**	800	8.84	**2.08**	0803	9.15	**1.77**	1238	9.05	**1.87**	0831	9.10	**1.82**
MW-40-37	2218744.442	6002331.560	10.56	10.96	0848	8.50	**2.06**	814	8.44	**2.12**	0810	8.65	**1.91**	1243	8.54	**2.02**	0825	8.68	**1.88**
MW-40-38	2218876.085	6002332.667	9.62	9.98	0923	7.65	**1.97**	900	7.57	**2.05**	0851	7.84	**1.78**	1252	7.67	**1.95**	0850	7.78	**1.84**
MW-40-39	2218641.568	6002458.916	10.40	10.64	0930	8.45	**1.95**	910	8.48	**1.92**	0813	8.68	**1.72**	1208	8.56	**1.84**	0822	8.64	**1.76**
IW-1	2218855.105	6002149.284	11.48	11.98	0928	9.32	**2.16**	845	9.26	**2.22**	0708	9.36	**2.12**	1115	9.30	**2.18**	0746	9.51	**1.97**
IW-2	2218884.214	6002187.101	10.60	11.31	0900	8.33	**2.27**	714	8.24	**2.36**	0848	8.43	**2.17**	1307	8.33	**2.27**	0853	8.43	**2.17**
IW-3	2218829.508	6002249.471	10.81	11.17	0822	8.86	**1.95**	855	8.70	**2.11**	0840	9.00	**1.81**	1248	8.88	**1.93**	0845	9.00	**1.81**
IW-4	2218844.592	6002289.718	10.51	10.97	0922	8.45	**2.06**	905	8.66	**1.85**	0844	8.58	**1.93**	1250	8.46	**2.05**	0848	8.58	**1.93**
IW-5*	2218789.600	6002152.100	10.52	10.98	0800	9.00	**1.52**	715	8.76	**1.76**	0713	9.08	**1.44**	1123	8.78	**1.74**	0752	9.00	**1.52**
IW-6	2218794.100	6002194.979	10.93	11.33	0905	8.90	**2.03**	725	8.22	**2.71**	0721	8.93	**2.00**	1124	8.84	**2.09**	0754	9.03	**1.90**
IW-7	2218776.633	6002234.281	10.91	11.38	0845	8.84	**2.07**	748	8.68	**2.23**	0727	8.84	**2.07**	1129	8.77	**2.14**	0759	8.95	**1.96**
IW-8	2218793.086	6002285.495	10.94	11.21	0830	9.20	**1.74**	825	8.20	**2.74**	0836	9.42	**1.52**	1236	9.16	**1.78**	0833	9.25	**1.69**
IW-9	2218812.557	6002325.334	10.29	10.66	0915	8.29	**2.00**	817	8.22	**2.07**	0823	8.52	**1.77**	1230	8.38	**1.91**	0839	8.44	**1.85**
IW-10	2218815.015	6002370.534	10.32	10.55	0920	8.41	**1.91**	820	7.77	**2.55**	0826	8.68	**1.64**	1224	8.52	**1.80**	0835	8.61	**1.71**
IW-11	2218744.990	6002139.314	10.40	11.01	0810	8.19	**2.21**	725	7.34	**3.06**	0731	8.34	**2.06**	1145	8.21	**2.19**	0805	8.26	**2.14**
IW-12	2218742.523	6002192.290	10.51	11.05	0815	8.37	**2.14**	730	8.14	**2.37**	0735	8.49	**2.02**	1143	8.38	**2.13**	0807	8.49	**2.02**
IW-13	2218745.301	6002228.749	10.54	10.80	0911	8.59	**1.95**	750	8.30	**2.24**	0752	8.78	**1.76**	1140	8.70	**1.84**	0803	8.77	**1.77**
IW-14	2218745.193	6002273.295	10.50	10.86	0820	8.50	**2.00**	758	8.38	**2.12**	0759	8.62	**1.88**	1246	8.53	**1.97**	0829	8.61	**1.89**
IW-15	2218754.875	6002315.961	10.63	10.93	0833	8.90	**1.73**	825	8.96	**1.67**	0807	9.08	**1.55**	1241	8.86	**1.77**	0827	8.87	**1.76**
IW-16	2218704.004	6002217.355	10.46	11.15	0907	8.12	**2.34**	740	8.05	**2.41**	0744	8.31	**2.15**	1149	8.13	**2.33**	0812	8.22	**2.24**
IW-17	2218706.457	6002259.143	10.19	10.59	0908	8.08	**2.11**	745	8.04	**2.15**	0748	8.28	**1.91**	1153	8.16	**2.03**	0816	8.23	**1.96**
IW-18	2218706.599	6002313.646	10.19	10.35	Not Measured			Not Measured			Not Measured			Not Measured			Not Measured		
IW-19	2218700.322	6002355.946	10.33	10.69	Not Measured			Not Measured			Not Measured			Not Measured			Not Measured		

TABLE A-1

GROUNDWATER LEVEL MEASUREMENTS FROM NOVEMBER 2005 THROUGH MAY 2010

Well ID	Well Coordinates		Well Elevations (NAVD 29)		Measurement Date and Time			Measurement Date and Time			Measurement Date and Time			Measurement Date and Time			Measurement Date and Time		
					March 16, 2006			June 23, 2006			September 13, 2006			January 11, 2007			April 5, 2007		
Location Number	NORTHING	EASTING	TOP OF PVC CASING	TOP OF VAULT COVER	Time Measured	Depth (ft)	Elevation (Above MSL) 03/16/06	Time Measured	Depth (ft)	Elevation (Above MSL) 06/23/06	Time Measured	Depth (ft)	Elevation (Above MSL) 09/13/06	Time Measured	Depth (ft)	Elevation (Above MSL) 01/11/07	Time Measured	Depth (ft)	Elevation (Above MSL) 04/05/07
40-MW-01	2218901.100	6002213.800	10.09	10.09	1010	8.29	**1.80**	1033	8.08	**2.01**	0928	8.02	**2.07**	1313	7.67	**2.42**	Not Measured		
40-MW-02	2218893.700	6002163.400	10.11	10.11	1006	9.48	**0.63**	1035	7.92	**2.19**	0926	8.95	**1.16**	1315	7.43	**2.68**	Not Measured		
MW-40-06	2218823.300	6002064.800	10.57	11.00	0830	8.94	**1.63**	0940	8.74	**1.83**	0848	8.86	**1.71**	1132	8.89	**1.68**	1105	9.13	**1.44**
MW-40-07	2218687.300	6002367.900	10.30	10.80	0919	8.98	**1.32**	1011	8.74	**1.56**	0954	8.64	**1.66**	1218	8.62	**1.68**	1020	8.98	**1.32**
MW-40-08	2218790.500	6002447.100	10.32	10.70	1018	8.93	**1.39**	1020	8.77	**1.55**	0943	8.42	**1.90**	1329	9.62	**0.70**	0954	8.94	**1.38**
MW-40-10	2218845.600	6002061.300	10.28	10.94	0833	9.18	**1.10**	0943	8.95	**1.33**	0846	8.61	**1.67**	1235	8.66	**1.62**	1106	8.96	**1.32**
MW-40-11	2218918.300	6002268.600	9.70	10.11	1013	8.23	**1.47**	1032	8.03	**1.67**	0930	7.96	**1.74**	1309	7.95	**1.75**	1030	8.28	**1.42**
MW-40-13	2218678.300	6002367.000	10.27	10.70	0917	9.05	**1.22**	1012	8.92	**1.35**	0952	8.81	**1.46**	1216	9.03	**1.24**	1021	9.14	**1.13**
MW-40-14	2218779.600	6002207.000	10.67	10.95	0848	9.37	**1.30**	0948	9.15	**1.52**	0858	9.00	**1.67**	1325	9.07	**1.60**	1101	9.27	**1.40**
MW-40-15	2218724.100	6002585.400	10.46	10.90	1026	9.19	**1.27**	1017	8.96	**1.50**	0948	8.85	**1.61**	1346	8.81	**1.65**	0959	9.20	**1.26**
MW-40-17	2218806.100	6002553.400	9.73	9.88	1022	8.73	**1.00**	1019	8.18	**1.55**	0945	8.13	**1.60**	1337	8.07	**1.66**	1111	8.09	**1.64**
MW-40-19	2218665.200	6002256.900	11.73	10.20	1030	10.34	**1.39**	1009	10.12	**1.61**	0921	10.00	**1.73**	1206	10.02	**1.71**	1041	10.34	**1.39**
MW-40-20	2218667.000	6002243.200	12.04	10.26	1033	10.89	**1.15**	1010	10.69	**1.35**	0920	10.57	**1.47**	1208	10.56	**1.48**	1045	10.94	**1.10**
MW-40-22	2218816.100	6002123.100	10.58	10.93	0840	9.11	**1.47**	0944	8.92	**1.66**	0852	8.82	**1.76**	1135	8.87	**1.71**	1103	9.09	**1.49**
MW-40-30	2218814.211	6002294.153	10.35	10.99	0947	8.40	**1.95**	1028	8.17	**2.18**	0934	8.11	**2.24**	1250	8.12	**2.23**	0937	8.36	**1.99**
MW-40-31	2218800.956	6002310.664	10.57	10.75	0950	9.18	**1.39**	1027	9.00	**1.57**	0936	9.03	**1.54**	1247	8.93	**1.64**	0934	9.16	**1.41**
MW-40-32	2218813.398	6002339.315	10.20	10.48	0953	8.59	**1.61**	1024	8.33	**1.87**	0939	8.36	**1.84**	1241	8.33	**1.87**	0948	8.60	**1.60**
MW-40-33	2218689.587	6002181.107	10.60	10.97	0902	8.92	**1.68**	1002	8.73	**1.87**	0912	8.60	**2.00**	1154	8.64	**1.96**	1049	8.92	**1.68**
MW-40-34	2218719.182	6002233.686	10.23	10.92	0906	8.23	**2.00**	1006	8.04	**2.19**	0916	7.92	**2.31**	1201	7.92	**2.31**	1034	8.21	**2.02**
MW-40-35	2218761.890	6002239.240	10.78	11.16	0853	9.24	**1.54**	0951	9.05	**1.73**	0902	9.01	**1.77**	1147	9.06	**1.72**	1057	9.34	**1.44**
MW-40-36	2218770.714	6002274.762	10.92	11.17	0934	9.36	**1.56**	1039	9.15	**1.77**	0958	9.07	**1.85**	1302	9.11	**1.81**	1027	9.30	**1.62**
MW-40-37	2218744.442	6002331.560	10.56	10.96	0922	8.87	**1.69**	1041	8.66	**1.90**	0956	8.56	**2.00**	1231	8.63	**1.93**	1007	8.89	**1.67**
MW-40-38	2218876.085	6002332.667	9.62	9.98	1003	7.94	**1.68**	1031	7.71	**1.91**	0932	7.64	**1.98**	1306	7.70	**1.92**	0943	7.94	**1.68**
MW-40-39	2218641.568	6002458.916	10.40	10.64	0914	8.89	**1.51**	1015	8.71	**1.69**	0950	8.60	**1.80**	1213	8.65	**1.75**	1001	8.96	**1.44**
IW-1	2218855.105	6002149.284	11.48	11.98	0837	9.63	**1.85**	0937	9.43	**2.05**	0850	9.35	**2.13**	1132	9.35	**2.13**	1107	9.63	**1.85**
IW-2	2218884.214	6002187.101	10.60	11.31	1009	8.65	**1.95**	1036	8.34	**2.26**	0924	8.25	**2.35**	1312	8.25	**2.35**	1034	8.57	**2.03**
IW-3	2218829.508	6002249.471	10.81	11.17	0941	9.14	**1.67**	1029	8.95	**1.86**	1014	8.87	**1.94**	1254	8.84	**1.97**	1028	9.13	**1.68**
IW-4	2218844.592	6002289.718	10.51	10.97	0944	8.75	**1.76**	1030	8.56	**1.95**	1018	8.58	**1.93**	1259	8.62	**1.89**	0940	8.74	**1.77**
IW-5*	2218789.600	6002152.100	10.52	10.98	0842	9.12	**1.40**	0948	8.87	**1.65**	0854	8.78	**1.74**	1138	8.73	**1.79**	Not Measured		
IW-6	2218794.100	6002194.979	10.93	11.33	0845	9.21	**1.72**	0947	9.01	**1.92**	0856	8.94	**1.99**	1141	8.97	**1.96**	Not Measured		
IW-7	2218776.633	6002234.281	10.91	11.38	0851	9.15	**1.76**	0949	8.94	**1.97**	0900	8.83	**2.08**	1144	8.91	**2.00**	1059	9.08	**1.83**
IW-8	2218793.086	6002285.495	10.94	11.21	0937	9.40	**1.54**	1037	9.18	**1.76**	1010	9.64	**1.30**	1235	9.11	**1.83**	Not Measured		
IW-9	2218812.557	6002325.334	10.29	10.66	0956	8.77	**1.52**	1022	8.38	**1.91**	0938	8.35	**1.94**	1244	8.30	**1.99**	Not Measured		
IW-10	2218815.015	6002370.534	10.32	10.55	0959	8.86	**1.46**	1025	8.40	**1.92**	0947	8.49	**1.83**	1238	8.51	**1.81**	0950	8.76	**1.56**
IW-11	2218744.990	6002139.314	10.40	11.01	0857	8.51	**1.89**	0954	8.28	**2.12**	0910	8.16	**2.24**	1149	8.19	**2.21**	1050	8.45	**1.95**
IW-12	2218742.523	6002192.290	10.51	11.05	0900	8.65	**1.86**	0958	8.45	**2.06**	0907	8.32	**2.19**	1151	8.31	**2.20**	1054	8.63	**1.88**
IW-13	2218745.301	6002228.749	10.54	10.80	0855	9.00	**1.54**	1000	8.77	**1.77**	0905	8.66	**1.88**	1227	8.84	**1.70**	1055	8.94	**1.60**
IW-14	2218745.193	6002273.295	10.50	10.86	0930	8.84	**1.66**	1057	8.60	**1.90**	1006	8.56	**1.94**	1224	8.75	**1.75**	1025	8.82	**1.68**
IW-15	2218754.875	6002315.961	10.63	10.93	0926	9.61	**1.02**	1053	9.57	**1.06**	1002	9.45	**1.18**	1221	8.81	**1.82**	1016	9.01	**1.62**
IW-16	2218704.004	6002217.355	10.46	11.15	0904	8.45	**2.01**	1004	8.28	**2.18**	0914	8.17	**2.29**	1157	8.12	**2.34**	1047	8.47	**1.99**
IW-17	2218706.457	6002259.143	10.19	10.59	0909	8.50	**1.69**	1008	8.29	**1.90**	0918	8.16	**2.03**	1204	8.16	**2.03**	1039	8.50	**1.69**
IW-18	2218706.599	6002313.646	10.19	10.35	Not Measured			1049	8.67	**1.52**	Not Measured			Not Measured			Not Measured		
IW-19	2218700.322	6002355.946	10.33	10.69	Not Measured			1045	8.82	**1.51**	Not Measured			Not Measured			Not Measured		

TABLE A-1

GROUNDWATER LEVEL MEASUREMENTS FROM NOVEMBER 2005 THROUGH MAY 2010

Well ID	Well Coordinates		Well Elevations (NAVD 29)		Measurement Date and Time			Measurement Date and Time			Measurement Date and Time			Measurement Date and Time			Measurement Date and Time		
					July 12, 2007			October 16, 2007			January 18, 2008			April 10, 2008			July 16, 2008		
Location Number	NORTHING	EASTING	TOP OF PVC CASING	TOP OF VAULT COVER	Time Measured	Depth (ft)	Elevation (Above MSL) 07/12/07	Time Measured	Depth (ft)	Elevation (Above MSL) 10/16/07	Time Measured	Depth (ft)	Elevation (Above MSL) 01/18/08	Time Measured	Depth (ft)	Elevation (Above MSL) 04/10/08	Time Measured	Depth (ft)	Elevation (Above MSL) 07/16/08
40-MW-01	2218901.100	6002213.800	10.09	10.09	Not Measured			1326	8.41	**1.68**		8.24	**1.85**	1559	8.21	**1.88**	1422	8.17	**1.92**
40-MW-02	2218893.700	6002163.400	10.11	10.11	Not Measured			1330	9.75	**0.36**		7.88	**2.23**	1555	7.81	**2.30**	1426	7.83	**2.28**
MW-40-06	2218823.300	6002064.800	10.57	11.00	1056	9.21	**1.36**	1224	9.23	**1.34**		9.30	**1.27**	1603	9.28	**1.29**	1214	9.28	**1.29**
MW-40-07	2218687.300	6002367.900	10.30	10.80	1210	9.01	**1.29**	1333	9.06	**1.24**		9.17	**1.13**	1438	9.15	**1.15**	1330	9.17	**1.13**
MW-40-08	2218790.500	6002447.100	10.32	10.70	1308	9.12	**1.20**	1336	9.12	**1.20**		9.95	**0.37**	1458	9.94	**0.38**	1440	9.08	**1.24**
MW-40-10	2218845.600	6002061.300	10.28	10.94	1052	9.01	**1.27**	1222	8.98	**1.30**		9.06	**1.22**	1551	9.02	**1.26**	1218	9.02	**1.26**
MW-40-11	2218918.300	6002268.600	9.70	10.11	1330	8.34	**1.36**	1324	8.31	**1.39**		8.41	**1.29**	1607	8.37	**1.33**	1435	8.39	**1.31**
MW-40-13	2218678.300	6002367.000	10.27	10.70	1215	9.18	**1.09**	13.02	9.06	**1.21**		9.35	**0.92**	1434	9.32	**0.95**	1326	9.33	**0.94**
MW-40-14	2218779.600	6002207.000	10.67	10.95	1548	9.40	**1.27**	1339	9.51	**1.16**		9.51	**1.16**	1318	9.48	**1.19**	1230	9.45	**1.22**
MW-40-15	2218724.100	6002585.400	10.46	10.90	1319	9.31	**1.15**	1306	9.25	**1.21**		9.31	**1.15**	1449	9.29	**1.17**	1450	9.30	**1.16**
MW-40-17	2218806.100	6002553.400	9.73	9.88	1313	8.57	**1.16**	1308	8.50	**1.23**		8.55	**1.18**	1454	8.54	**1.19**	1445	8.56	**1.17**
MW-40-19	2218665.200	6002256.900	11.73	10.20	1146	10.30	**1.43**	1252	10.31	**1.42**		10.52	**1.21**	1611	10.49	**1.24**	1314	10.48	**1.25**
MW-40-20	2218667.000	6002243.200	12.04	10.26	1151	10.91	**1.13**	1251	10.77	**1.27**		10.96	**1.08**	1616	10.89	**1.15**	1310	10.87	**1.17**
MW-40-22	2218816.100	6002123.100	10.58	10.93	1046	9.24	**1.34**	1407	9.33	**1.25**		9.28	**1.30**	1312	9.26	**1.32**	1510	9.26	**1.32**
MW-40-30	2218814.211	6002294.153	10.35	10.99	1244	8.48	**1.87**	1342	8.62	**1.73**		8.57	**1.78**	1519	8.50	**1.85**	1354	8.59	**1.76**
MW-40-31	2218800.956	6002310.664	10.57	10.75	1249	9.30	**1.27**	1344	9.47	**1.10**		9.41	**1.16**	1514	9.35	**1.22**	1358	9.38	**1.19**
MW-40-32	2218813.398	6002339.315	10.20	10.48	12??8	8.71	**1.49**	1345	8.81	**1.39**		8.86	**1.34**	1504	8.79	**1.41**	1406	8.81	**1.39**
MW-40-33	2218689.587	6002181.107	10.60	10.97	1126	8.98	**1.62**	1244	8.95	**1.65**		9.11	**1.49**	1349	9.08	**1.52**	1254	9.09	**1.51**
MW-40-34	2218719.182	6002233.686	10.23	10.92	1136	8.37	**1.86**	1351	8.38	**1.85**		8.31	**1.92**	1400	8.21	**2.02**	1302	8.42	**1.81**
MW-40-35	2218761.890	6002239.240	10.78	11.16	1106	9.46	**1.32**	1354	9.46	**1.32**		9.53	**1.25**	1329	9.51	**1.27**	1238	9.50	**1.28**
MW-40-36	2218770.714	6002274.762	10.92	11.17	1224	9.48	**1.44**	1356	9.50	**1.42**		9.48	**1.44**	1524	9.39	**1.53**	1338	9.56	**1.36**
MW-40-37	2218744.442	6002331.560	10.56	10.96	1219	8.97	**1.59**	1359	8.90	**1.66**		9.00	**1.56**	1411	8.92	**1.64**	1334	9.09	**1.47**
MW-40-38	2218876.085	6002332.667	9.62	9.98	1325	8.05	**1.57**	1321	8.04	**1.58**		8.09	**1.53**	1547	8.01	**1.61**	1414	8.03	**1.59**
MW-40-39	2218641.568	6002458.916	10.40	10.64	1203	8.98	**1.42**	1304	8.92	**1.48**		9.13	**1.27**	1444	9.10	**1.30**	1500	9.09	**1.31**
IW-1	2218855.105	6002149.284	11.48	11.98	1042	9.75	**1.73**	1225	9.76	**1.72**		9.75	**1.73**	1310	9.86	**1.62**	1210	9.86	**1.62**
IW-2	2218884.214	6002187.101	10.60	11.31	1418	8.65	**1.95**	1328	8.66	**1.94**		8.65	**1.95**	1542	8.68	**1.92**	1418	8.70	**1.90**
IW-3	2218829.508	6002249.471	10.81	11.17	1234	9.25	**1.56**	1318	9.25	**1.56**		9.24	**1.57**	1533	9.39	**1.42**	1346	9.39	**1.42**
IW-4	2218844.592	6002289.718	10.51	10.97	1239	8.87	**1.64**	1319	8.82	**1.69**		8.91	**1.60**	1537	8.97	**1.54**	1350	8.95	**1.56**
IW-5*	2218789.600	6002152.100	10.52	10.98	1337	9.28	**1.24**	1230	9.39	**1.13**		9.51	**1.01**	1313	9.10	**1.42**	1222	9.12	**1.40**
IW-6	2218794.100	6002194.979	10.93	11.33	1055	9.33	**1.60**	1232	9.30	**1.63**		9.27	**1.66**	1315	9.39	**1.54**	1226	9.40	**1.53**
IW-7	2218776.633	6002234.281	10.91	11.38	1102	9.25	**1.66**	1234	9.21	**1.70**		9.20	**1.71**	1324	9.33	**1.58**	1234	9.35	**1.56**
IW-8	2218793.086	6002285.495	10.94	11.21	1229	9.56	**1.38**	1316	9.45	**1.49**		9.42	**1.52**	1528	9.40	**1.54**	1342	9.39	**1.55**
IW-9	2218812.557	6002325.334	10.29	10.66	1302	8.86	**1.43**	1314	8.68	**1.61**		8.90	**1.39**	1509	8.89	**1.40**	1402	8.92	**1.37**
IW-10	2218815.015	6002370.534	10.32	10.55	1254	8.89	**1.43**	1312	8.87	**1.45**		8.86	**1.46**	1500	8.98	**1.34**	1410	9.00	**1.32**
IW-11	2218744.990	6002139.314	10.40	11.01	1116	8.58	**1.82**	1237	8.52	**1.88**		8.48	**1.92**	1340	8.50	**1.90**	1246	8.52	**1.88**
IW-12	2218742.523	6002192.290	10.51	11.05	1121	8.75	**1.76**	1242	8.71	**1.80**		8.66	**1.85**	1344	8.78	**1.73**	1250	8.77	**1.74**
IW-13	2218745.301	6002228.749	10.54	10.80	1111	9.07	**1.47**	1254	9.02	**1.52**		8.99	**1.55**	1334	9.10	**1.44**	1242	9.13	**1.41**
IW-14	2218745.193	6002273.295	10.50	10.86	1347	8.91	**1.59**	1257	8.86	**1.64**		8.87	**1.63**	1416	8.96	**1.54**	1322	8.97	**1.53**
IW-15	2218754.875	6002315.961	10.63	10.93	1353	9.31	**1.32**	1259	9.14	**1.49**		9.06	**1.57**	1420	9.02	**1.61**	1318	9.01	**1.62**
IW-16	2218704.004	6002217.355	10.46	11.15	1131	8.58	**1.88**	1246	8.49	**1.97**		8.45	**2.01**	1354	8.44	**2.02**	1258	8.47	**1.99**
IW-17	2218706.457	6002259.143	10.19	10.59	1141	8.59	**1.60**	1249	8.52	**1.67**		8.47	**1.72**	1406	8.59	**1.60**	1306	8.62	**1.57**
IW-18	2218706.599	6002313.646	10.19	10.35	Not Measured			Not Measured			Not Measured			1424	9.06	**1.13**	Not Measured		
IW-19	2218700.322	6002355.946	10.33	10.69	Not Measured			Not Measured			Not Measured			1429	9.23	**1.10**	Not Measured		

TABLE A-1

GROUNDWATER LEVEL MEASUREMENTS FROM NOVEMBER 2005 THROUGH MAY 2010

Well ID	Well Coordinates		Well Elevations (NAVD 29)		Measurement Date and Time			Measurement Date and Time			Measurement Date and Time		
					October 2, 2008			May 28, 2009			May 3, 2010		
Location Number	NORTHING	EASTING	TOP OF PVC CASING	TOP OF VAULT COVER	Time Measured	Depth (ft)	Elevation (Above MSL) 10/2/08	Time Measured	Depth (ft)	Elevation (Above MSL) 05/28/09	Time Measured	Depth (ft)	Elevation (Above MSL) 05/03/10
40-MW-01	2218901.100	6002213.800	10.09	10.09	1236	8.33	**1.76**	1150	8.75	**1.34**	0753	8.20	**1.89**
40-MW-02	2218893.700	6002163.400	10.11	10.11	1233	7.92	**2.19**	1731	9.41	**0.70**	1238	8.74	**1.37**
MW-40-06	2218823.300	6002064.800	10.57	11.00	1219	9.37	**1.20**	1445	9.65	**0.92**	1030	9.10	**1.47**
MW-40-07	2218687.300	6002367.900	10.30	10.80	1329	9.17	**1.13**	1622	9.10	**1.20**	1300	8.75	**1.55**
MW-40-08	2218790.500	6002447.100	10.32	10.70	1307	9.24	**1.08**	1530	9.15	**1.17**	1324	9.17	**1.15**
MW-40-10	2218845.600	6002061.300	10.28	10.94	1215	9.14	**1.14**	1435	9.45	**0.83**	1026	8.95	**1.33**
MW-40-11	2218918.300	6002268.600	9.70	10.11	1425	8.46	**1.24**	1455	8.84	**0.86**	1312	8.25	**1.45**
MW-40-13	2218678.300	6002367.000	10.27	10.70	1326	9.43	**0.84**	1625	9.36	**0.91**	1302	9.15	**1.12**
MW-40-14	2218779.600	6002207.000	10.67	10.95	1453	9.58	**1.09**	1655	9.80	**0.87**	1135	9.55	**1.12**
MW-40-15	2218724.100	6002585.400	10.46	10.90	1316	9.45	**1.01**	1635	9.55	**0.91**	1332	8.95	**1.51**
MW-40-17	2218806.100	6002553.400	9.73	9.88	1311	8.60	**1.13**	1640	8.85	**0.88**	1350	8.45	**1.28**
MW-40-19	2218665.200	6002256.900	11.73	10.20	1417	10.59	**1.14**	1541	10.67	**1.06**	0925	10.25	**1.48**
MW-40-20	2218667.000	6002243.200	12.04	10.26	1421	10.99	**1.05**	1540	11.10	**0.94**	0927	10.74	**1.30**
MW-40-22	2218816.100	6002123.100	10.58	10.93	1222	9.38	**1.20**	1430	9.54	**1.04**	1250	9.15	**1.43**
MW-40-30	2218814.211	6002294.153	10.35	10.99	1250	8.60	**1.75**	1110	8.90	**1.45**	0826	8.36	**1.99**
MW-40-31	2218800.956	6002310.664	10.57	10.75	1253	9.40	**1.17**	1131	10.65	**-0.08**	0840	9.10	**1.47**
MW-40-32	2218813.398	6002339.315	10.20	10.48	1300	8.77	**1.43**	1115	9.23	**0.97**	1305	8.68	**1.52**
MW-40-33	2218689.587	6002181.107	10.60	10.97	1413	9.15	**1.45**	1547	9.34	**1.26**	0931	8.97	**1.63**
MW-40-34	2218719.182	6002233.686	10.23	10.92	1409	8.43	**1.80**	1544	8.62	**1.61**	0915	8.15	**2.08**
MW-40-35	2218761.890	6002239.240	10.78	11.16	1355	9.61	**1.17**	1100	9.80	**0.98**	0905	9.27	**1.51**
MW-40-36	2218770.714	6002274.762	10.92	11.17	1352	9.46	**1.46**	1038	9.80	**1.12**	0910	9.30	**1.62**
MW-40-37	2218744.442	6002331.560	10.56	10.96	1349	9.09	**1.47**	1125	9.55	**1.01**	1135	8.85	**1.71**
MW-40-38	2218876.085	6002332.667	9.62	9.98	1240	8.13	**1.49**	1500	8.45	**1.17**	1310	7.92	**1.70**
MW-40-39	2218641.568	6002458.916	10.40	10.64	1322	9.25	**1.15**	1628	9.25	**1.15**	1335	8.95	**1.45**
IW-1	2218855.105	6002149.284	11.48	11.98	1226	9.93	**1.55**	1156	10.20	**1.28**	1033	9.75	**1.73**
IW-2	2218884.214	6002187.101	10.60	11.31	1230	8.80	**1.80**	1155	9.00	**1.60**	0820	8.54	**2.06**
IW-3	2218829.508	6002249.471	10.81	11.17	1247	9.49	**1.32**	1649	9.55	**1.26**	0845	9.08	**1.73**
IW-4	2218844.592	6002289.718	10.51	10.97	1244	9.06	**1.45**	1645	9.14	**1.37**	0850	8.67	**1.84**
IW-5*	2218789.600	6002152.100	10.52	10.98	1501	9.18	**1.34**	1715	9.67	**0.85**	1015	10.12	**0.40**
IW-6	2218794.100	6002194.979	10.93	11.33	1447	9.50	**1.43**	1659	9.60	**1.33**	1020	9.65	**1.28**
IW-7	2218776.633	6002234.281	10.91	11.38	1441	9.44	**1.47**	1018	9.55	**1.36**	0857	9.06	**1.85**
IW-8	2218793.086	6002285.495	10.94	11.21	1435	9.53	**1.41**	1702	9.64	**1.30**	0835	9.29	**1.65**
IW-9	2218812.557	6002325.334	10.29	10.66	1303	8.97	**1.32**	1510	9.20	**1.09**	1120	8.62	**1.67**
IW-10	2218815.015	6002370.534	10.32	10.55	1257	9.02	**1.30**	1520	9.40	**0.92**	1110	8.87	**1.45**
IW-11	2218744.990	6002139.314	10.40	11.01	1430	8.61	**1.79**	1606	9.00	**1.40**	0940	8.45	**1.95**
IW-12	2218742.523	6002192.290	10.51	11.05	1405	8.89	**1.62**	1600	9.10	**1.41**	0950	8.61	**1.90**
IW-13	2218745.301	6002228.749	10.54	10.80	1400	9.20	**1.34**	1610	9.35	**1.19**	0907	8.93	**1.61**
IW-14	2218745.193	6002273.295	10.50	10.86	1345	9.04	**1.46**	1614	9.30	**1.20**	1042	8.85	**1.65**
IW-15	2218754.875	6002315.961	10.63	10.93	1341	9.13	**1.50**	1616	9.43	**1.20**	1045	8.92	**1.71**
IW-16	2218704.004	6002217.355	10.46	11.15	1337	8.54	**1.92**	1546	8.87	**1.59**	0921	8.45	**2.01**
IW-17	2218706.457	6002259.143	10.19	10.59	1333	8.67	**1.52**	1543	8.87	**1.32**	1040	8.47	**1.72**
IW-18	2218706.599	6002313.646	10.19	10.35	Not Measured			Not Measured			1054	8.82	**1.37**
IW-19	2218700.322	6002355.946	10.33	10.69	Not Measured			Not Measured			1103	9.15	**1.18**

Notes:

IW-5* - Pilot Test Well MW-40-27 was converted to an injection well and renamed as IW-5.

Wells constructed by Bechtel were surveyed in NAD 29 survey coordinate system.

Wells constructed by TtEC for the full-scale Enhanced In Situ Bioremediation were surveyed in NAVD 88.

Abbreviations and Acronyms:

ft – feet

MSL – mean sea level

PVC – polyvinyl chloride

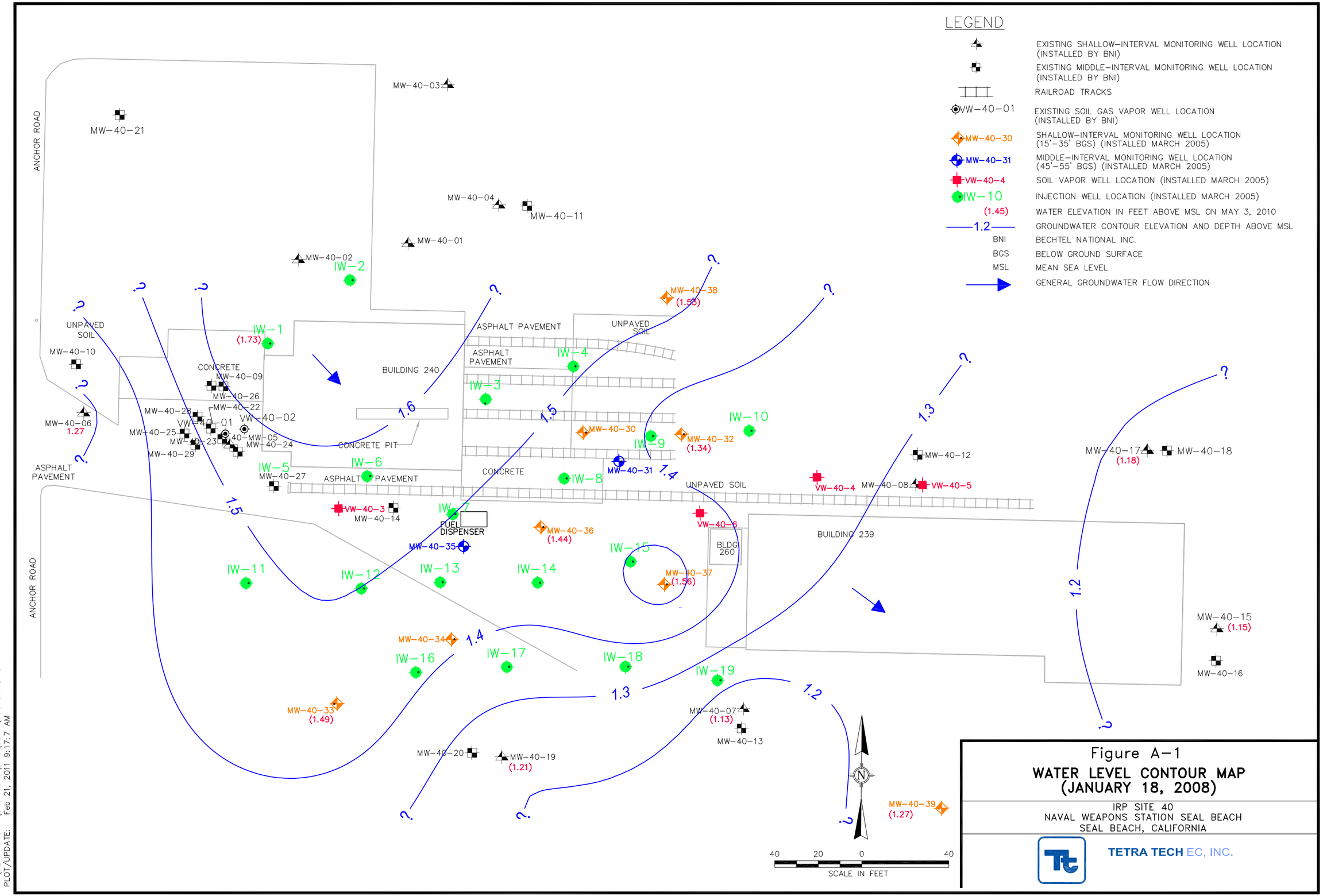

Figure A-1

WATER LEVEL CONTOUR MAP (JANUARY 18, 2008)

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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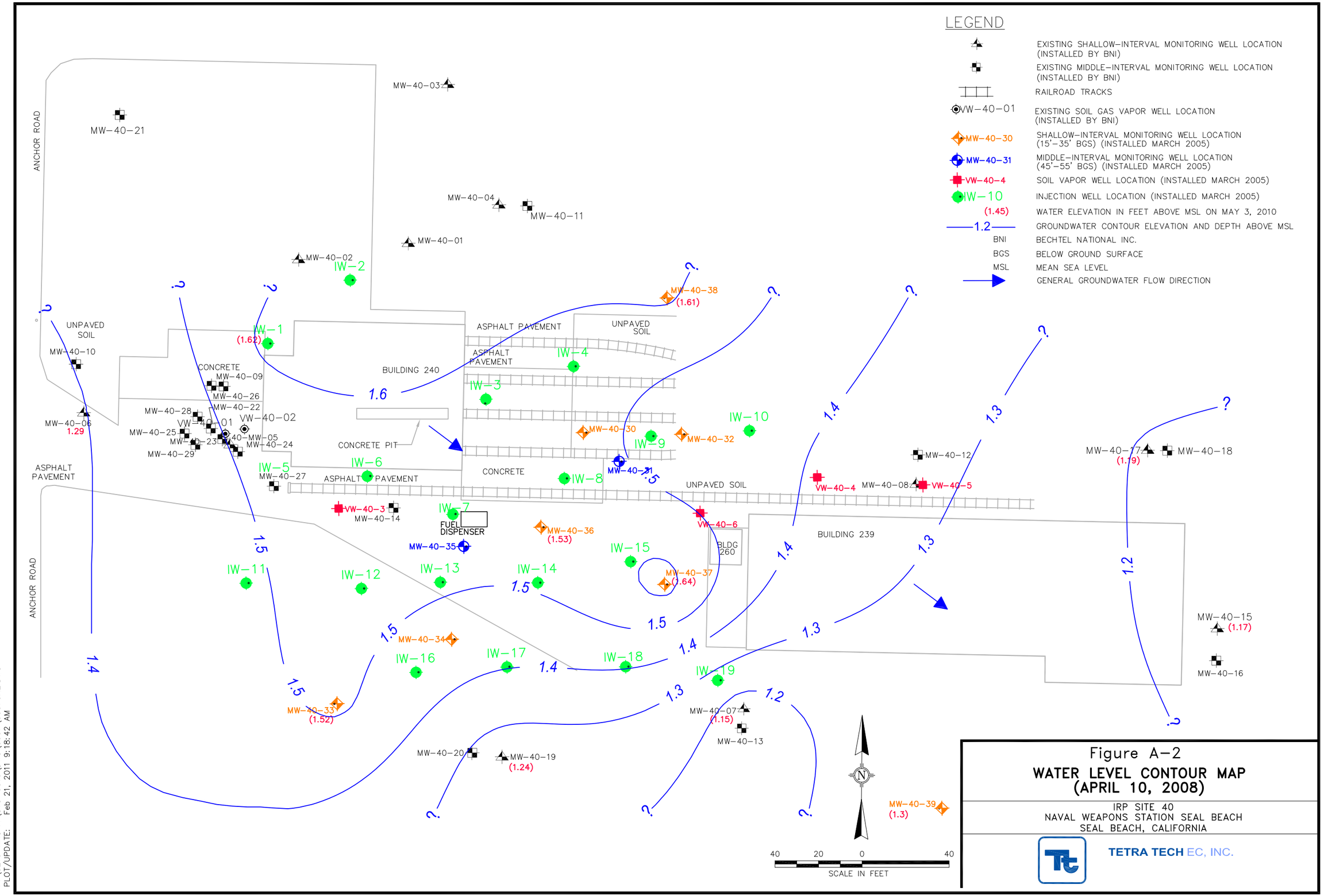

Figure A-2

WATER LEVEL CONTOUR MAP (APRIL 10, 2008)

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

P:\3210-RAC IV\CTO-0010\DWG\0007\00070A2.DWG
PLOT/UPDATE: Feb 21, 2011 9:18:42 AM

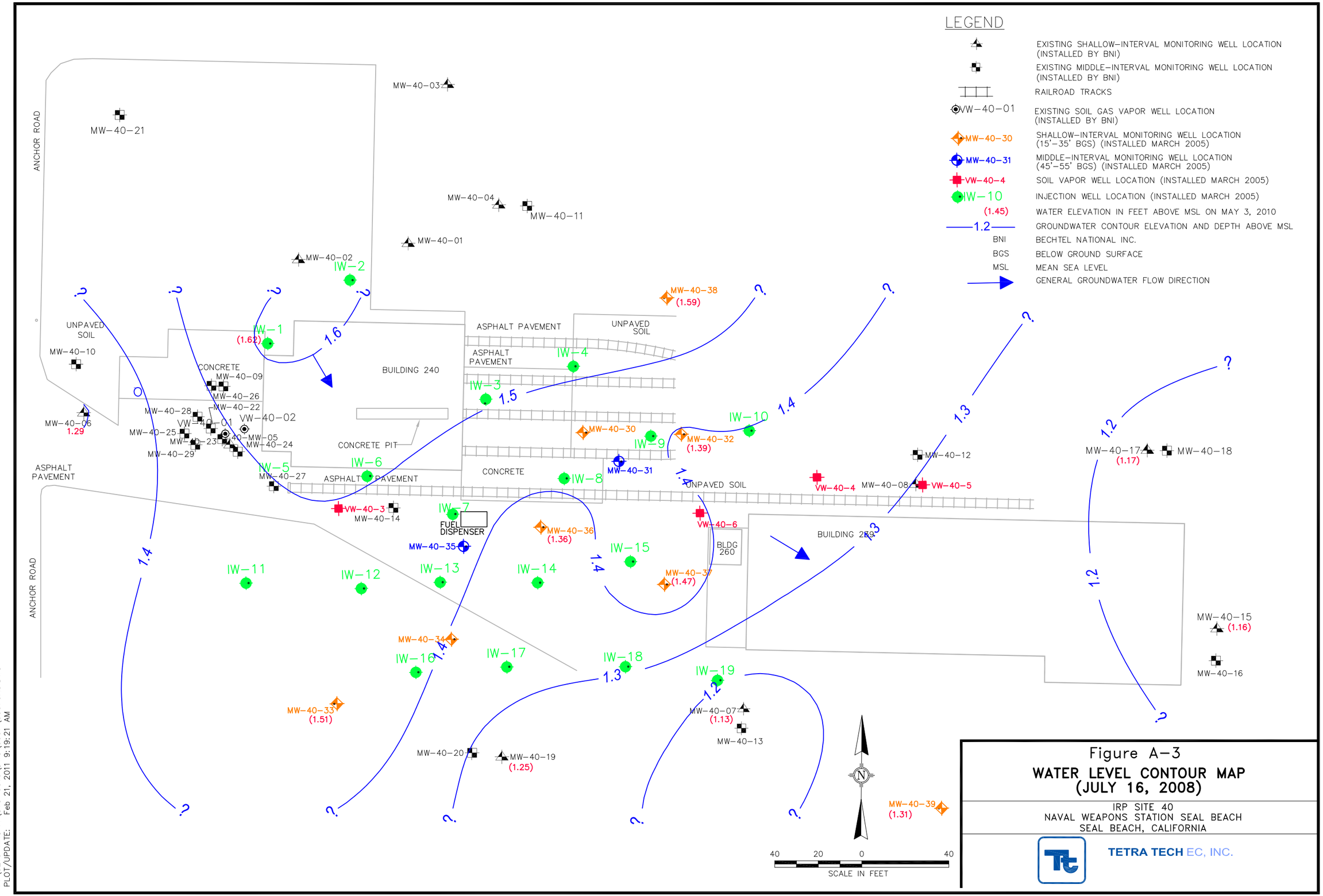

Figure A-3

WATER LEVEL CONTOUR MAP (JULY 16, 2008)

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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PLOT/UPDATE: Feb 21, 2011 9:19:21 AM

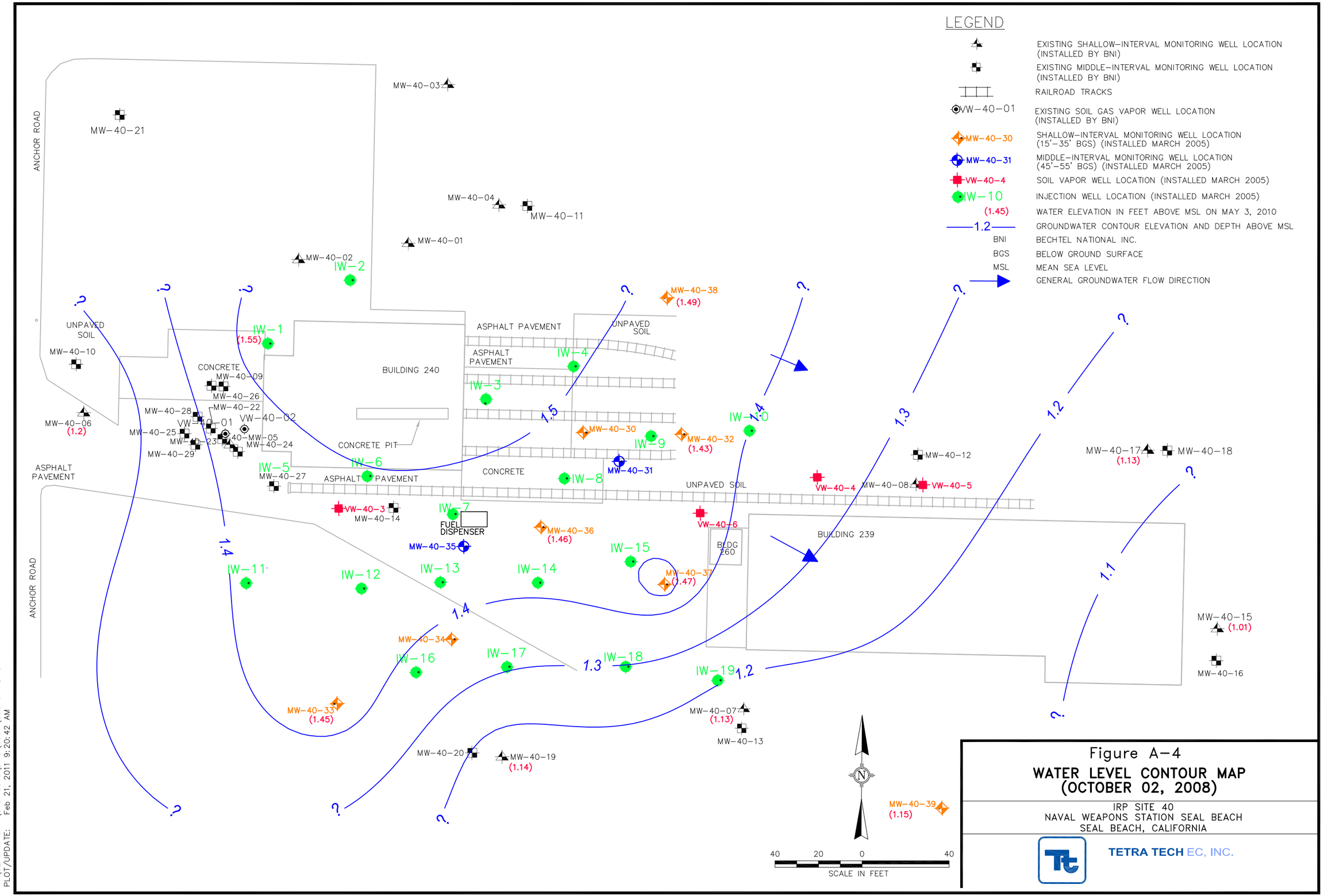

Figure A-4

WATER LEVEL CONTOUR MAP (OCTOBER 02, 2008)

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

P:\3210-RAC IV\CTO-0010\DWG\0007\00070A4.DWG
PLOT/UPDATE: Feb 21, 2011 9:20:42 AM

APPENDIX B

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS

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APPENDIX B1

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN MAY 2010

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	IW-1	IW-12	IW-14	IW-16	IW-16	IW-4	IW-6	MW-40-07	MW-40-08	MW-40-13	MW-40-14	MW-40-22	MW-40-30	MW-40-31
			10-269	10-273	10-274	10-275	10-276	10-271	10-272	10-261	10-265	10-262	10-256A	10-255A	10-266	10-267
			5/7/2010	5/7/2010	5/7/2010	5/7/2010	5/7/2010	5/7/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010
160.1	TOTAL DISSOLVED SOLIDS	MG/L	1140	--	--	--	--	--	--	1900	1110	--	--	2060	--	--
300.0	CHLORIDE	MG/L	303	--	--	--	--	--	143	305	--	--	374	NA	121	--
300.0	NITRATE	MG/L	0.108	--	--	--	--	--	0.119 J	0.0745 J	--	--	0.0878 J	NA	0.0712 J	--
300.0	NITRITE	MG/L	0.200 U	--	--	--	--	--	0.200 U	0.200 U	--	--	0.200 U	NA	0.200 U	--
300.0	SULFATE	MG/L	1.81	--	--	--	--	--	4.34	36.0	--	--	121	NA	1.75	--
310.1	ALKALINITY	MG/L	631	--	--	--	--	--	1380	1320	--	--	1330	NA	1220	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	53.6	406	2580	47.6	63.6	53.6	2070	51.6	21.5	39.6	43.6	23.5	79.6	61.6
6010B	CALCIUM	MG/L	104	--	--	--	--	--	155	271	--	--	329	--	182	--
6010B	IRON	MG/L	67.9	--	--	--	--	--	33.3	7.23	--	--	29.2	--	40.1	--
6010B	MAGNESIUM	MG/L	39.0	--	--	--	--	--	52.8	78.5	--	--	87.5	--	49.5	--
6010B	POTASSIUM	MG/L	2.91 J	--	--	--	--	--	20.6	6.06	--	--	6.27	--	8.33	--
6010B	SODIUM	MG/L	270	--	--	--	--	--	537	282	--	--	360	--	300	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	2-BUTANONE	UG/L	50 U	9.7 J	260 J	50 U	50 U	50 U	18 J	50 U	50 U	50 U	50 U	50 U	11 J	5.9 J
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	8.3 J	28 J	360 J	5.0 J	50 U	5.5 J	230	6.6 J	50 U	50 U	8.1 J	50 U	14 J	8.6 J
8260B	BENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	0.40 J	0.62 J	1.4	0.84 J	0.93 J	0.40 J	1.5	0.67 J	27	1.0 U	1.3	2.5	3.7	0.83 J
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	ETHYLBENZENE	UG/L	0.50 U	0.28 J	0.57	0.50 U	0.50 U	0.50 U	0.32 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TETRACHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TOLUENE	UG/L	0.50 U	0.43 J	0.26 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.36 J	0.30 J
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	0.47 J	1.0 U	0.22 J	1.0 U	1.0 U	1.0 U	2.5	1.0 U	1.0 U	1.0 U	0.44 J	6.3	1.1	1.0 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRICHLOROETHENE	UG/L	1.0 U	0.43 J	0.64 J	1.3	1.4	0.33 J	0.71 J	0.28 J	0.46 J	1.0 U	0.92 J	1.9	0.79 J	1.0 U
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	1.4	0.39 J	1.1	0.50 U	0.50 U	1.0	2.3	0.78	0.50 U	0.50 U	3.1	4.6	4.0	0.60
9060	TOTAL ORGANIC CARBON	MG/L	5.17	--	--	--	--	--	705	5.19	--	--	3.65	--	14.6	11.0
RSK-175	ETHANE	UG/L	--	--	--	--	--	--	--	1.3 U	1.3 U	--	1.3 U	--	1.3 U	--
RSK-175	ETHENE	UG/L	--	--	--	--	--	--	--	2.3	1.2 U	--	1.2 U	--	2.1	--
RSK-175	METHANE	UG/L	--	--	--	--	--	--	--	15000	11000	--	16000	--	13000	--

APPENDIX B1

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN MAY 2010

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-32	MW-40-34	MW-40-35	MW-40-36	MW-40-37	MW-40-39	MW-40-39
			10-268	10-257	10-258	10-259	10-260	10-263	10-264
			5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010
160.1	TOTAL DISSOLVED SOLIDS	MG/L	--	--	--	--	--	2080	2080
300.0	CHLORIDE	MG/L	126	71.6	--	--	461	--	--
300.0	NITRATE	MG/L	0.148	0.0592 J	--	--	0.0555 J	--	--
300.0	NITRITE	MG/L	0.200 U	0.100 U	--	--	0.100 U	--	--
300.0	SULFATE	MG/L	0.880	41.4	--	--	246	--	--
310.1	ALKALINITY	MG/L	1200	501	--	--	719	--	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	61.6	29.5	502	43.6	29.5	21.5	19.5
6010B	CALCIUM	MG/L	241	83.9	--	--	236	--	--
6010B	IRON	MG/L	48.7	17.1	--	--	15.2	--	--
6010B	MAGNESIUM	MG/L	74.3	19.1	--	--	77.3	--	--
6010B	POTASSIUM	MG/L	7.19	5.43	--	--	5.40	--	--
6010B	SODIUM	MG/L	229	153	--	--	270	--	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	2-BUTANONE	UG/L	50 U	5.1 J	35 J	50 U	50 U	50 U	50 U
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	7.3 J	11 J	20 J	50 U	5.1 J	50 U	50 U
8260B	BENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	0.58 J	1.0 U	1.0 U
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	1.2	1.0 U	2.5	1.5	90	1.0 U	1.0 U
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	ETHYLBENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TETRACHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.49 J	0.41 J
8260B	TOLUENE	UG/L	0.50 U	0.50 U	0.37 J	0.50 U	0.50 U	0.50 U	0.50 U
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	0.38 J	2.4	1.0 U	1.0 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRICHLOROETHENE	UG/L	1.0 U	1.0 U	0.26 J	0.56 J	4.0	1.0 U	1.0 U
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	2.1	0.33 J	0.50 U	2.2	37	0.50 U	0.50 U
9060	TOTAL ORGANIC CARBON	MG/L	--	3.41	--	--	3.58	--	--
RSK-175	ETHANE	UG/L	1.3 U	1.3 U	--	2.0	0.61 J	--	--
RSK-175	ETHENE	UG/L	1.2 U	1.2 U	--	3.2	6.5	--	--
RSK-175	METHANE	UG/L	14000	14000	--	10000	3900	--	--

Abbreviations and Acronyms:

µg/L – micrograms per liter

mg/L – milligrams per liter

J – estimated value

U – analyte is not detected at the listed reporting limit

APPENDIX B2

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN MAY 2009

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	IW-1	IW-1	IW-12	IW-14	IW-16	IW-16	IW-4	IW-6	MW-40-07	MW-40-08	MW-40-13	MW-40-14	MW-40-22	MW-40-30	MW-40-31	MW-40-32
			10-248	10-249	10-252	10-253	10-238	10-254	10-250	10-251	10-240	10-244	10-241	10-234	10-233	10-245	10-246	10-247
			5/21/2009	5/21/2009	5/21/2009	5/21/2009	5/21/2009	5/21/2009	5/21/2009	5/21/2009	5/21/2009	5/22/2009	5/21/2009	5/22/2009	5/22/2009	5/21/2009	5/21/2009	5/22/2009
160.1	TOTAL DISSOLVED SOLIDS	MG/L	4420	4210	--	--	--	--	--	--	1960	2140	--	--	2020	--	--	--
300.0	CHLORIDE	MG/L	370	372	--	--	--	--	--	159	323	--	--	299	--	136	--	112
300.0	NITRATE	MG/L	0.100 U	0.100 U	--	--	--	--	--	0.117	0.298	--	--	0.0703 J	--	0.100 U	--	0.100 U
300.0	NITRITE	MG/L	0.100 U	0.100 U	--	--	--	--	--	0.100 U	0.200 U	--	--	0.100 U	--	0.100 U	--	0.100 U
300.0	SULFATE	MG/L	2.16	0.500 U	--	--	--	--	--	21.1	1.55	--	--	79.6	--	0.360 J	--	0.480 J
310.1	ALKALINITY	MG/L	1130	1140	--	--	--	--	--	1350	1350	--	--	1070	--	799	--	1280
410.4	CHEMICAL OXYGEN DEMAND	MG/L	6250	6420	459	45.0	223	237	12.1	94.4	237	18.2	15.6	3350	20.3	1090	32.6	2130
6010B	CALCIUM	MG/L	125	119	--	--	--	--	--	68.6	302	--	--	328	--	121	--	270
6010B	IRON	MG/L	160	146	--	--	--	--	--	3.16	11.0	--	--	44.1	--	68.2	--	128
6010B	MAGNESIUM	MG/L	50.1	48.2	--	--	--	--	--	31.2	81.0	--	--	83.5	--	32.3	--	86.4
6010B	POTASSIUM	MG/L	9.49	8.96	--	--	--	--	--	4.76 J	7.71	--	--	6.68	--	15.7	--	14.1
6010B	SODIUM	MG/L	616	586	--	--	--	--	--	513	317	--	--	328	--	286	--	277
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	2-BUTANONE	UG/L	100	98	24 J	7.7 J	9.5 J	8.5 J	50 U	6.1 J	8.6 J	50 U	50 U	20 J	50 U	65	50 U	46 J
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	160	150	180	19 J	17 J	15 J	17 J	22 J	6.9 J	24 J	8.9 J	41 J	24 J	21 J	24 J	56
8260B	BENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROMETHANE	UG/L	0.23 J	0.26 J	1.0 U	0.23 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.27 J	1.0 U	1.0 U	0.27 J	1.0 U	0.64 J	0.23 J
8260B	CIS-1,2-DICHLOROETHENE	UG/L	0.96 J	0.95 J	0.66 J	0.77 J	0.45 J	0.43 J	2.5	3.6	3.2	1.0 U	1.0 U	19	0.92 J	5.7	0.53 J	0.64 J
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	0.79 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	ETHYLBENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TETRACHLOROETHENE	UG/L	0.28 J	0.26 J	1.0 U	1.0 U	1.0 U	1.0 U	0.23 J	0.23 J	1.0 U	0.29 J	1.0 U	8.7	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TOLUENE	UG/L	0.23 J	0.23 J	0.50 U	0.28 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.70	0.50 U
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.91 J	1.0 U	1.0 U	1.0 U	0.46 J	2.8	0.93 J	1.0 U	1.0 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRICHLOROETHENE	UG/L	0.28 J	0.26 J	0.37 J	1.0 U	0.34 J	0.37 J	1.5	0.57 J	0.51 J	1.0 U	1.0 U	36	0.23 J	2.0	1.0 U	1.0 U
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	0.79	0.76	0.23 J	1.4	0.50 U	0.50 U	1.6	2.6	1.2	0.50 U	0.50 U	23	0.99	6.3	0.26 J	1.3
9060	TOTAL ORGANIC CARBON	MG/L	2060	2060	--	--	--	--	--	17.6	23.2		--	1170	--	376	16.8	
RSK-175	ETHANE	UG/L	--	--	--	--	--	--	--	--	1.3 U	1.3 U	--	1.3 U	--	1.3 U	--	1.3 U
RSK-175	ETHENE	UG/L	--	--	--	--	--	--	--	--	1.2 U	1.2 U	--	1.2 U	--	2.1	--	1.2 U
RSK-175	METHANE	UG/L	--	--	--	--	--	--	--	--	16000	280	--	14000	--	12000	--	16000

APPENDIX B2

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN MAY 2009

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-34	MW-40-35	MW-40-36	MW-40-37	MW-40-39
			10-235	10-236	10-237	10-239	10-242
			5/21/2009	5/22/2009	5/22/2009	5/21/2009	5/22/2009
160.1	TOTAL DISSOLVED SOLIDS	MG/L	--	--	--	--	1050
300.0	CHLORIDE	MG/L	84.6	--	--	406	--
300.0	NITRATE	MG/L	0.123	--	--	0.100 U	--
300.0	NITRITE	MG/L	0.100 U	--	--	0.100 U	--
300.0	SULFATE	MG/L	41.7	--	--	204	--
310.1	ALKALINITY	MG/L	703	--	--	662	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	7.34 J	1300	57.3	30.1	20.3
6010B	CALCIUM	MG/L	111	--	--	210	--
6010B	IRON	MG/L	27.4	--	--	5.35	--
6010B	MAGNESIUM	MG/L	23.5	--	--	67.9	--
6010B	POTASSIUM	MG/L	5.19	--	--	6.73	--
6010B	SODIUM	MG/L	216	--	--	284	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	2-BUTANONE	UG/L	50 U	77	50 U	50 U	50 U
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	12 J	64	27 J	50 U	29 J
8260B	BENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	0.58 J	1.0 U
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROMETHANE	UG/L	1.0 U	0.31 J	0.21 J	1.0 U	1.0 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	0.44 J	11	1.5	46	5.0
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	ETHYLBENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TETRACHLOROETHENE	UG/L	1.0 U	0.26 J	1.0 U	1.0 U	3.1
8260B	TOLUENE	UG/L	0.50 U	0.32 J	0.50 U	0.50 U	0.50 U
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1.0 U	1.0 U	0.37 J	1.0	1.0 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRICHLOROETHENE	UG/L	1.0 U	0.27 J	0.42 J	1.0 U	3.8
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	0.35 J	0.22 J	1.9	13	0.50 U
9060	TOTAL ORGANIC CARBON	MG/L	3.49	--		8.49	--
RSK-175	ETHANE	UG/L	1.3 U	--	1.3 U	1.3 U	--
RSK-175	ETHENE	UG/L	1.2 U	--	2.5	5.2	--
RSK-175	METHANE	UG/L	13000	--	15000	2200	--

Abbreviations and Acronyms:

mg/L – micrograms per liter

mg/L – milligrams per liter

J – estimated value

U – analyte is not detected at the listed reporting limit

APPENDIX B3

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2008

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	CPT-17 10-230 10/22/2008	CPT-17 10-231 10/22/2008	CPT-17 10-232 10/22/2008	CPT-18 10-227 10/22/2008	CPT-18 10-228 10/22/2008	CPT-18 10-229 10/22/2008	CPT-19 10-217 10/21/2008	CPT-19 10-218 10/21/2008	CPT-19 10-219 10/21/2008	CPT-20 10-220 10/21/2008	CPT-20 10-221 10/21/2008	CPT-20 10-222 10/21/2008	CPT-21 10-223 10/21/2008	CPT-21 10-224 10/21/2008	CPT-21 10-225 10/21/2008	IW-1 10-174 4/15/2008
160.1	TOTAL DISSOLVED SOLIDS	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
300.0	CHLORIDE	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
300.0	NITRATE	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
300.0	NITRITE	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
300.0	SULFATE	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
310.1	ALKALINITY	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	31.5	19.1	21.1	14.9	17.0	31.5	59.0	40.3	38.2	38.2	44.5	46.5	34.0	44.5	71.6	10.0 U
6010B	CALCIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	IRON	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	MAGNESIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	POTASSIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	SODIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.40 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	2-BUTANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	BENZENE	UG/L	0.22 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	0.58 J	1.0 U	1.0 U	1.2	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.4	1.0 U	1.0 U
8260B	CHLOROMETHANE	UG/L	1.0 U	1.0 U	0.50 J	1.0 U	1.0 U	1.0 U	1.0 U	0.33 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	28	20	2.2	3.6	0.21 J	0.51 J	37	8.7	0.69 J	36	20	2.8	46	45	2.3	5.0
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	ETHYLBENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.49 J	1.0 U	1.0 U
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	0.55 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TETRACHLOROETHENE	UG/L	0.63 J	7.0	0.92 J	3.7	1.8	0.75 J	21	85	4.4	0.95 J	9.7	6.7	130	140	20	1.0 U
8260B	TOLUENE	UG/L	0.34 J	0.39 J	0.24 J	0.43 J	0.29 J	0.23 J	0.21 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	0.46 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.50 J	1.0 U	1.0 U	2.6	1.0 U	1.0 U	0.57 J	0.57 J	1.0 U	1.1
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRICHLOROETHENE	UG/L	11	7.5	0.67 J	1.2	0.39 J	0.27 J	24	15	1.4	24	5.3	5.3	33	33	3.1	7.3
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 UJ	50 UJ	50 U	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 U
8260B	VINYL CHLORIDE	UG/L	2.4	0.28 J	0.57	0.27 J	0.50 U	0.57	0.89	0.50 U	1.6	5.6	0.61	1.1	1.7	0.27 J	1.7	3.8
RSK-175	ETHANE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RSK-175	ETHENE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RSK-175	METHANE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

APPENDIX B3

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2008

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	IW-10	IW-12	IW-13	IW-14	IW-15	IW-17	IW-18	IW-19	IW-2	IW-3	IW-4	IW-5	IW-6	IW-7	IW-8	IW-9
			10-187	10-177	10-178	10-180	10-181	10-179	10-182	10-183	10-189	10-186	10-188	10-175	10-176	10-190	10-191	10-171
			4/16/2008	4/15/2008	4/15/2008	4/15/2008	4/15/2008	4/15/2008	4/15/2008	4/15/2008	4/16/2008	4/16/2008	4/16/2008	4/15/2008	4/15/2008	4/16/2008	4/16/2008	4/14/2008
160.1	TOTAL DISSOLVED SOLIDS	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
300.0	CHLORIDE	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
300.0	NITRATE	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
300.0	NITRITE	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
300.0	SULFATE	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
310.1	ALKALINITY	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	20.7	10.0 U	10.0 U	10.0 U	610	24.7	16.2	20.5	33.5	31.4	20.7	77.7	10.0 U	22.8	40.0	33.4
6010B	CALCIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	IRON	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	MAGNESIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	POTASSIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	SODIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	2-BUTANONE	UG/L	50 U	50 U	50 U	50 U	50	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	50 U	50 U	50 U	50 U	23 J	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	5.3 J
8260B	BENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	9.5	2.0	24	4.6	3.2	9.6	7.5	3.1	0.60 J	2.6	4.2	0.71 J	32	1.5	1.8	2.8
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	ETHYLBENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TETRACHLOROETHENE	UG/L	1.4	1.0 U	15	0.40 J	1.0 U	1.0 U	1.5	1.0 U	1.0 U	1.0 U	0.25 J	1.0 U	1.1	0.62 J	1.0 U	1.0 U
8260B	TOLUENE	UG/L	0.50 U	0.50 U	0.50 U	0.49 J	0.97	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.80	0.50 U	0.50 U	0.38 J	0.42 J
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1.0 U	1.0 U	0.41 J	0.62 J	0.31 J	25	0.31 J	14	1.0 U	0.21 J	1.0 U	0.31 J	1.4	0.49 J	0.27 J	1.0 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRICHLOROETHENE	UG/L	6.4	2.5	42	8.6	0.69 J	3.8	22	4.4	1.0 U	0.47 J	4.2	0.94 J	4.6	6.0	0.58 J	0.32 J
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	5.8	0.99	12	11	2.4	7.0	13	14	0.33 J	2.2	4.8	1.2	6.9	5.0	3.4	0.50 U
RSK-175	ETHANE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RSK-175	ETHENE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RSK-175	METHANE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

APPENDIX B3

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2008

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-02 10-155 1/17/2008	MW-40-02 10-195 7/15/2008	MW-40-02 10-215 10/7/2008	MW-40-06 10-130 1/15/2008	MW-40-07 10-137 1/15/2008	MW-40-07 10-168 4/14/2008	MW-40-07 10-201 7/16/2008	MW-40-07 10-209 10/6/2008	MW-40-08 10-148 1/16/2008	MW-40-08 10-194 7/15/2008	MW-40-08 10-213 10/7/2008	MW-40-10 10-128 1/15/2008	MW-40-10 10-129 1/15/2008	MW-40-11 10-156 1/17/2008	MW-40-13 10-136 1/15/2008	MW-40-14 10-132 1/15/2008
160.1	TOTAL DISSOLVED SOLIDS	MG/L	--	--	--	--	2560	2440	2230	2280	--	--	--	--	--	--	6400	2150
300.0	CHLORIDE	MG/L	--	--	--	--	394	347	348	395	--	--	--	--	--	--	--	--
300.0	NITRATE	MG/L	--	--	--	--	0.0971 J	0.104	0.287	0.170	--	--	--	--	--	--	--	--
300.0	NITRITE	MG/L	--	--	--	--	0.500 U	0.200 U	0.500 U	0.200 U	--	--	--	--	--	--	--	--
300.0	SULFATE	MG/L	--	--	--	--	1.97	0.983	2.78	1.36	--	--	--	--	--	--	--	--
310.1	ALKALINITY	MG/L	--	--	--	--	1070	1360	1440	1440	--	--	--	--	--	--	--	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	221	112	94.2		1150	1010	624	167	40.9	--	--	--	--	--	49.3	45.2
6010B	CALCIUM	MG/L	--	--	--	--	308	320	368	330	--	--	--	--	--	--	515	202
6010B	IRON	MG/L	--	--	--	--	36.9	29.8	14.1	17.6	--	--	--	--	--	--	2.66	12.6
6010B	MAGNESIUM	MG/L	--	--	--	--	82.3	83.2	94.7	86.4	--	--	--	--	--	--	436	61.9
6010B	POTASSIUM	MG/L	--	--	--	--	11.7	9.51	9.30	7.79	--	--	--	--	--	--	15.8	7.21
6010B	SODIUM	MG/L	--	--	--	--	361	343	340	320	--	--	--	--	--	--	1200	575
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	2-BUTANONE	UG/L	50 U	50 UJ	50 UJ	50 U	500	430 J	320 J	200	50 U	50 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 UJ	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	50 U	50 UJ	50 UJ	50 UJ	68 J	94	110 J	110	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 U	50 UJ	50 UJ
8260B	BENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	0.99 J	2.7	2.9	1.0 U	47	42	12	3.9	0.33 J	0.69 J	0.83 J	1.0 U	1.0 U	1.0 U	0.40 J	20
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	ETHYLBENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	2.0	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TETRACHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.7	2.8	2.6	1.3	1.0 U	6.8	11	10	0.38 J	0.39 J	1.0 U	1.0 U	0.65 J
8260B	TOLUENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.36 J
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1.0 U	0.29 J	1.0 U	1.0 U	0.23 J	1.0 U	0.55 J	0.23 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.48 J
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRICHLOROETHENE	UG/L	0.72 J	0.92 J	0.67 J	0.38 J	1.7	1.7	1.8	1.1	1.5	3.3	3.7	1.0 U	1.0 U	1.0 U	1.0 U	4.2
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	0.50 U	0.22 J	0.50 U	0.50 U	0.50 U	5.4	8.3	4.7	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	4.0
RSK-175	ETHANE	UG/L	--	--	--	--	1.3 U	1.3 U	1.3 U	1.3 U	--	--	--	--	--	--	--	1.3 U
RSK-175	ETHENE	UG/L	--	--	--	--	1.2 U	1.2 U	0.80 J	1.6	--	--	--	--	--	--	--	1.2 U
RSK-175	METHANE	UG/L	--	--	--	--	17000	14000	14000	18000	--	--	--	--	--	--	--	17000

APPENDIX B3

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2008

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-14 10-163 4/14/2008	MW-40-14 10-193 7/15/2008	MW-40-14 10-214 10/7/2008	MW-40-15 10-153 1/17/2008	MW-40-16 10-154 1/17/2008	MW-40-17 10-150 1/17/2008	MW-40-18 10-151 1/17/2008	MW-40-18 10-152 1/17/2008	MW-40-19 10-135 1/15/2008	MW-40-20 10-134 1/15/2008	MW-40-22 10-131 1/15/2008	MW-40-30 10-145 1/16/2008	MW-40-30 10-169 4/14/2008	MW-40-30 10-202 7/16/2008	MW-40-30 10-210 10/6/2008	MW-40-31 10-146 1/16/2008
160.1	TOTAL DISSOLVED SOLIDS	MG/L	--	--	--	--	--	--	--	--	730	7150	2210	1160	1220	1180	1180	4890
300.0	CHLORIDE	MG/L	--	--	--	--	--	--	--	--	--	--	--	155	170	161	172	479
300.0	NITRATE	MG/L	--	--	--	--	--	--	--	--	--	--	--	0.175	0.0686 J	0.0913 J	0.100	0.165
300.0	NITRITE	MG/L	--	--	--	--	--	--	--	--	--	--	--	0.200 U	0.100 U	0.100 U	0.200 U	1.00 U
300.0	SULFATE	MG/L	--	--	--	--	--	--	--	--	--	--	--	27.5	123	136	124	1.39
310.1	ALKALINITY	MG/L	--	--	--	--	--	--	--	--	--	--	--	800	810	570	612	3850
410.4	CHEMICAL OXYGEN DEMAND	MG/L	14.2	31.5	41.4	14.7	51.8	25.0	35.3		55.4	65.7	73.9	67.2	12.1	37.7	33.3	296
6010B	CALCIUM	MG/L	--	--	--	--	--	--	--	--	59.6	635	64.4	36.2	43.7	50.2	58.5	153
6010B	IRON	MG/L	--	--	--	--	--	--	--	--	1.72	19.7	10.8	2.54	10.6	3.28	4.33	16.3
6010B	MAGNESIUM	MG/L	--	--	--	--	--	--	--	--	16.4	361	21.4	10.3	12.1	13.9	16.4	142
6010B	POTASSIUM	MG/L	--	--	--	--	--	--	--	--	2.43 J	18.5	6.11	2.69 J	2.03 J	5.00 U	5.00 U	10.3
6010B	SODIUM	MG/L	--	--	--	--	--	--	--	--	158	1520	807	423	379	337	326	1680
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	2-BUTANONE	UG/L	50 U	50 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	7.0 J	50 U	50 UJ	50 U	42 J
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	50 U	50 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U	50 UJ	50 UJ	50 UJ	16 J	50 U	5.1 J	50 U	48 J
8260B	BENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	26	14	13	1.0 U	1.0 U	0.34 J	1.0 U	1.0 U	0.45 J	1.0 U	0.65 J	110	86	47	31	0.58 J
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	ETHYLBENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TETRACHLOROETHENE	UG/L	4.6	5.2	4.8	1.0 U	1.0 U	0.86 J	1.0 U	1.0 U	0.33 J	1.0 U	1.0 U	0.36 J	0.84 J	5.6	2.6	1.0 U
8260B	TOLUENE	UG/L	0.38 J	0.29 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.36 J
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	0.36 J	0.40 J	0.37 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.97 J	0.82 J	1.1	4.8	0.68 J	1.0 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRICHLOROETHENE	UG/L	6.0	5.8	5.9	1.0 U	1.0 U	0.73 J	1.0 U	1.0 U	0.22 J	1.0 U	1.0 U	1.0 U	2.2	12	29	1.0 U
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	2.8	3.6	6.0	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.64	11	8.3	4.2	5.4	0.20 J
RSK-175	ETHANE	UG/L	1.3 U	1.3 U	1.3 U	--	--	--	--	--	--	--	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
RSK-175	ETHENE	UG/L	1.2 U	1.2 U	1.2 U	--	--	--	--	--	--	--	1.2 U	1.8	1.8	1.0 J	1.9	1.2 U
RSK-175	METHANE	UG/L	15000	15000	17000	--	--	--	--	--	--	--	12000	17000	15000	18000	14000	20000

APPENDIX B3

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2008

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-32 10-147 1/16/2008	MW-40-32 10-170 4/14/2008	MW-40-32 10-203 7/16/2008	MW-40-32 10-211 10/6/2008	MW-40-33 10-133 1/15/2008	MW-40-34 10-140 1/16/2008	MW-40-34 10-164 4/14/2008	MW-40-34 10-165 4/14/2008	MW-40-34 10-197 7/16/2008	MW-40-34 10-205 10/6/2008	MW-40-35 10-141 1/16/2008	MW-40-35 10-142 1/16/2008	MW-40-36 10-143 1/16/2008	MW-40-36 10-166 4/14/2008	MW-40-36 10-198 7/16/2008	MW-40-36 10-199 7/16/2008
160.1	TOTAL DISSOLVED SOLIDS	MG/L	2150	1800	1600	1530	--	2590	1710	--	1490	1330	9420	--	2470	2170	1730	--
300.0	CHLORIDE	MG/L	131	137	127	130	--	--	--	--	138	157	--	--	246	277	250	--
300.0	NITRATE	MG/L	0.140	0.0892 J	0.141	0.0900 J	--	--	--	--	0.0817 J	0.361	--	--	0.156	0.0896 J	0.0931 J	--
300.0	NITRITE	MG/L	0.200 U	0.200 U	0.200 U	0.200 U	--	--	--	--	0.200 U	0.200 U	--	--	0.200 U	0.100 U	0.200 U	--
300.0	SULFATE	MG/L	2.73	1.16	2.24	1.36	--	--	--	--	3.48	3.60	--	--	1.51	0.952	0.799	--
310.1	ALKALINITY	MG/L	1350	1190	1260	1170	--	--	--	--	965	928	--	--	910	970	930	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	735	273	121	49.5	26.7	2810	601	--	228	43.4	3630	--	2360	1090	437	--
6010B	CALCIUM	MG/L	102	117	123	146	--	217	169	--	154	150	110	--	231	219	186	--
6010B	IRON	MG/L	22.7	21.8	19.3	21.7	--	79.8	33.1	--	38.6	30.7	9.39	--	64.1	53.3	32.5	--
6010B	MAGNESIUM	MG/L	30.9	35.9	37.8	45.1	--	42.0	31.8	--	29.7	30.2	140	--	87.5	82.6	74.4	--
6010B	POTASSIUM	MG/L	3.20 J	2.97 J	2.72 J	2.79 J	--	11.9	9.12	--	7.53	6.53	15.8	--	8.82	7.37	7.08	--
6010B	SODIUM	MG/L	616	487	394	360	--	327	328	--	295	283	2880	--	292	284	246	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	2-BUTANONE	UG/L	76	39 J	19 J	50 U	50 U	130 J	90	99	61 J	50 U	370	350	180 J	92 J	70 J	63 J
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	23 J	22 J	50 U	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	15 J	15 J	12 J	7.2 J	50 UJ	60 J	36 J	40 J	25 J	6.5 J	210 J	190 J	92 J	27 J	19 J	20 J
8260B	BENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	12	20	8.6	5.1	1.0 U	8.5	3.0	3.2	1.6	1.6	3.6	3.4	17	11	4.8	3.9
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	ETHYLBENZENE	UG/L	0.50 U	0.50 U	0.21 J	0.50 U	0.50 U	0.20 J	0.25 J	0.26 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TETRACHLOROETHENE	UG/L	0.74 J	0.60 J	0.22 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.1	1.0 U	1.0 U	1.0 U
8260B	TOLUENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.52	0.51	0.50 U	0.50 U	0.50 U	0.50 U
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	0.21 J	0.29 J	0.28 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.30 J	0.50 J	0.34 J	0.33 J
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRICHLOROETHENE	UG/L	1.3	3.1	1.3	0.62 J	1.0 U	0.65 J	0.25 J	0.28 J	1.0 U	1.0 U	0.55 J	0.51 J	2.1	0.68 J	1.0 U	1.0 U
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	5.6	4.8	3.8	4.2	0.50 U	2.6	1.7	1.7	1.3	1.1	0.50 U	0.50 U	6.5	4.6	3.5	3.0
RSK-175	ETHANE	UG/L	1.3 U	1.3 U	1.3 U	1.3 U	--	1.3 U	1.3 U	--	1.3 U	1.3 U	1.3 U	--	1.3 U	1.3 U	1.3 U	--
RSK-175	ETHENE	UG/L	0.99 J	0.88 J	0.75 J	1.7	--	1.2 U	1.2 U	--	1.2 U	1.2 U	1.2 U	--	2.9	2.1	0.92 J	--
RSK-175	METHANE	UG/L	10000	14000	14000	18000	--	12000	15000	--	14000	17000	18000	--	14000	19000	20000	--

APPENDIX B3

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2008

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-36 10-206 10/6/2008	MW-40-36 10-207 10/6/2008	MW-40-37 10-144 1/16/2008	MW-40-37 10-167 4/14/2008	MW-40-37 10-200 7/16/2008	MW-40-37 10-208 10/6/2008	MW-40-38 10-157 1/17/2008	MW-40-39 10-138 1/15/2008
160.1	TOTAL DISSOLVED SOLIDS	MG/L	1370	--	1600	1700	1810	1730	--	--
300.0	CHLORIDE	MG/L	273	--	423	449	448	482	--	--
300.0	NITRATE	MG/L	0.114	--	0.0999 J	0.108	0.100 U	0.0900 J	--	--
300.0	NITRITE	MG/L	0.200 U	--	0.200 U	0.100 U	0.200 U	0.200 U	--	--
300.0	SULFATE	MG/L	1.18	--	170	208	188	193	--	--
310.1	ALKALINITY	MG/L	848	--	670	650	650	671	--	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	41.4	--	40.9	14.2	41.9	37.3	--	24.6
6010B	CALCIUM	MG/L	161	--	224	200	214	210	--	--
6010B	IRON	MG/L	24.7	--	3.85	3.05	6.60	6.55	--	--
6010B	MAGNESIUM	MG/L	63.3	--	73.8	67.7	72.1	70.7	--	--
6010B	POTASSIUM	MG/L	5.68	--	7.05	7.59	6.74	5.78	--	--
6010B	SODIUM	MG/L	231	--	296	297	293	282	--	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	2-BUTANONE	UG/L	50 U	50 U	50 U	50 U	50 UJ	50 U	50 U	50 U
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	50 U	50 U	31 J	50 U	8.0 J	50 U	50 U	50 UJ
8260B	BENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	3.8	1.7	1.8	1.8	1.0 U	1.0 U
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	1.6	1.7	94	58	82	110	1.0 U	1.0 U
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	ETHYLBENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TETRACHLOROETHENE	UG/L	1.0 U	1.0 U	0.36 J	1.0 U	0.48 J	1.0 U	1.0 U	1.3
8260B	TOLUENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	0.30 J	0.31 J	1.0	2.5	3.8	1.4	1.0 U	1.0 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRICHLOROETHENE	UG/L	1.0 U	1.0 U	1.3	1.3	1.5	1.7	0.25 J	1.0 U
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	2.3	2.5	18	12	18	27	0.50 U	0.50 U
RSK-175	ETHANE	UG/L	1.3 U	--	1.3 U	1.3 U	1.3 U	1.3 U	--	--
RSK-175	ETHENE	UG/L	4.0	--	6.5	4.6	5.6	7.0	--	--
RSK-175	METHANE	UG/L	18000	--	5300	2800	3400	6600	--	--

Abbreviations and Acronyms:

µg/L – micrograms per liter

mg/L – milligrams per liter

J – estimated value

U – analyte is not detected at the listed reporting limit

APPENDIX B4

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2007

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	HP-1	HP-4	HP-5	IW-18	IW-18	IW-19	IW-19	IW-19	IW-8	IW-8	IW-9	IW-9	IW-9	MW-40-02	MW-40-06	MW-40-06
			10-039	10-040	10-041	10-069	10-077	10-038	10-068	10-076	10-071	10-078	10-043	10-070	10-080	10-093	10-009	10-010
			2/28/2007	2/28/2007	2/28/2007	5/16/2007	6/14/2007	2/28/2007	5/16/2007	6/14/2007	5/16/2007	6/14/2007	2/28/2007	5/16/2007	6/14/2007	7/10/2007	1/9/2007	1/9/2007
160.1	TOTAL DISSOLVED SOLIDS	MG/L	2140	2460	1520	--	--	1530	--	--	--	--	705	--	--	--	--	--
300.0	CHLORIDE	MG/L	711	711	411	--	--	413	--	--	--	--	40.8	--	--	--	--	--
300.0	NITRATE	MG/L	14.7	17.8	5.08	--	--	0.100 U	--	--	--	--	0.976	--	--	--	--	--
300.0	NITRITE	MG/L	0.100 U	0.100 U	0.100 U	--	--	0.100 U	--	--	--	--	0.288	--	--	--	--	--
300.0	SULFATE	MG/L	525	675	342	--	--	313	--	--	--	--	149	--	--	--	--	--
310.1	ALKALINITY	MG/L	285	338	365	--	--	490	--	--	--	--	370	--	--	--	--	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	99.5	58.6	24.5	48.5	27.0	13.2	52.7	20.8	24158	15100	88.2	5183	2320	13700	--	--
6010B	CALCIUM	MG/L	197	208	130	--	--	116	--	--	--	--	23.2	--	--	--	--	--
6010B	IRON	MG/L	0.125	0.100 U	0.100 U	--	--	7.96	--	--	--	--	1.17	--	--	--	--	--
6010B	MAGNESIUM	MG/L	68.7	74.5	48.1	--	--	47.3	--	--	--	--	4.53 J	--	--	--	--	--
6010B	POTASSIUM	MG/L	5.61	8.94	4.02 J	--	--	5.00 U	--	--	--	--	2.64 J					
6010B	SODIUM	MG/L	502	552	377	--	--	437	--	--	--	--	247	--	--	--	--	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	2-BUTANONE	UG/L	50 U	50 U	50 U	--	--	50 U	--	--	--	--	50 U	--	--	240 J	50 U	50 U
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	--	--	50 U	--	--	--	--	50 U	--	--	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	--	--	50 U	--	--	--	--	50 U	--	--	50 U	50 U	50 U
8260B	ACETONE	UG/L	50 UJ	50 UJ	50 UJ	--	--	50 UJ	--	--	--	--	50 UJ	--	--	31 J	50 U	50 U
8260B	BENZENE	UG/L	0.50 U	0.50 U	0.50 U	--	--	0.50 U	--	--	--	--	0.50 U	--	--	0.50 U	0.50 U	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.2	1.0 U	1.0 U
8260B	CHLOROMETHANE	UG/L	1.0 UJ	1.0 UJ	1.0 UJ	--	--	1.0 UJ	--	--	--	--	1.0 UJ	--	--	1.0 UJ	1.0 U	1.0 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	--	--	2.5	--	--	--	--	1.0 U	--	--	6.6	1.0 U	1.0 U
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	ETHYLBENZENE	UG/L	0.50 U	0.50 U	0.50 U	--	--	0.25 J	--	--	--	--	0.50 U	--	--	0.50 U	0.50 U	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.3	1.0 U	1.0 U
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	TETRACHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.1	1.8	1.6
8260B	TOLUENE	UG/L	0.50 U	0.50 U	0.50 U	--	--	0.20 J	--	--	--	--	0.50 U	--	--	0.50 U	0.50 U	0.50 U
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.1	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	--	--	--	--	1.0 U	--	--	1.0 U	1.0 U	1.0 U
8260B	TRICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	--	--	0.67 J	--	--	--	--	1.0 U	--	--	0.34 J	1.0 U	1.0 U
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	--	--	50 U	--	--	--	--	50 U	--	--	50 UJ	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	0.50 U	0.50 U	0.50 U	--	--	0.50 U	--	--	--	--	0.50 U	--	--	0.50 U	0.50 U	0.50 U
8270C-SIM	1,4-DIOXANE	UG/L	--	--	--	--	--		--	--	--	--		--	--	--	--	--
9060	TOTAL ORGANIC CARBON	MG/L	1.41	2.06	1.45	--	--	2.39	--	--	--	--	9.66	--	--	--	--	--
RSK-175	ETHANE	UG/L	1.3 U	1.3 U	1.3 U	--	--	1.3 U	--	--	--	--	1.3 U	--	--	--	--	--
RSK-175	ETHENE	UG/L	1.2 U	1.2 U	1.2 U	--	--	1.2 U	--	--	--	--	0.81 J	--	--	--	--	--
RSK-175	METHANE	UG/L	1.0 U	12	1.0 U	--	--	11000	--	--	--	--	11000	--	--	--	--	--

APPENDIX B4

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2007

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-06	MW-40-07	MW-40-07	MW-40-07	MW-40-07	MW-40-07	MW-40-07	MW-40-08	MW-40-08	MW-40-08	MW-40-08	MW-40-08	MW-40-08	MW-40-10	MW-40-10	MW-40-10
			10-085	10-017	10-061	10-065	10-075	10-091	10-126	10-030	10-031	10-060	10-107	10-124	10-125	10-008	10-083	10-084
			7/10/2007	1/9/2007	4/4/2007	5/16/2007	6/14/2007	7/10/2007	10/16/2007	1/11/2007	1/11/2007	4/4/2007	7/12/2007	10/16/2007	10/16/2007	1/9/2007	7/10/2007	7/10/2007
160.1	TOTAL DISSOLVED SOLIDS	MG/L	--	1510	1580	--	--	2240	2560	--	--	--	--	--	--	--	--	--
300.0	CHLORIDE	MG/L	--	432	437	--	--	448	--	--	--	--	--	--	--	--	--	--
300.0	NITRATE	MG/L	--	2.21	2.85	--	--	0.0710 J	--	--	--	--	--	--	--	--	--	--
300.0	NITRITE	MG/L	--	0.100 U	0.100 U	--	--	0.100 U	--	--	--	--	--	--	--	--	--	--
300.0	SULFATE	MG/L	--	291	300	--	--	1.47	--	--	--	--	--	--	--	--	--	--
310.1	ALKALINITY	MG/L	--	288	300	--	--	625	--	--	--	--	--	--	--	--	--	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	--	37.1	19.2	3303	2100	2230	1990	--	--	--	--	--	--	--	--	--
6010B	CALCIUM	MG/L	--	207	163	--	--	240	331	--	--	--	--	--	--	--	--	--
6010B	IRON	MG/L	--	0.100 U	0.100 U			46.1	40.0	--	--	--	--	--	--	--	--	--
6010B	MAGNESIUM	MG/L	--	50.2	45.9			65.7	86.6	--	--	--	--	--	--	--	--	--
6010B	POTASSIUM	MG/L		4.14 J	4.25 J			11.5	12.2	--	--	--	--	--	--	--	--	--
6010B	SODIUM	MG/L	--	310	318	--	--	297	354	--	--	--	--	--	--	--	--	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	2-BUTANONE	UG/L	50 U	50 U	50 UJ	--	--	480	790	50 U	50 U	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	--	--	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	--	--	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	50 U	50 U	50 UJ	--	--	16 J	40 J	50 UJ	50 UJ	50 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U
8260B	BENZENE	UG/L	0.50 U	0.50 U	0.50 U	--	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	0.47 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 UJ	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 UJ	1.0 U	1.0 U	1.0 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	1.0 U	0.34 J	1.0 U	--	--	36	48	1.0 U	1.0 U	1.0 U	0.23 J	0.29 J	0.30 J	1.0 U	1.0 U	1.0 U
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	ETHYLBENZENE	UG/L	0.50 U	0.50 U	0.50 U	--	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	0.54 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TETRACHLOROETHENE	UG/L	1.6	83	49	--	--	11	3.0	5.4	5.3	5.3	6.1	6.5	7.0	0.47 J	0.54 J	0.58 J
8260B	TOLUENE	UG/L	0.50 U	0.50 U	0.50 U	--	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	--	--	0.53 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRICHLOROETHENE	UG/L	0.91 J	2.7	1.8	--	--	6.7	1.4	1.1	1.0	1.1	1.5	1.4	1.5	1.0 U	1.0 U	1.0 U
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	--	--	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	0.50 U	0.50 U	0.50 U	--	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8270C-SIM	1,4-DIOXANE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9060	TOTAL ORGANIC CARBON	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RSK-175	ETHANE	UG/L	--	1.3 U	1.3 U	--	--	1.3 U	1.3 U	--	--	--	--	--	--	--	--	--
RSK-175	ETHENE	UG/L	--	1.2 U	1.2 U	--	--	0.95 J	1.2 U	--	--	--	--	--	--	--	--	--
RSK-175	METHANE	UG/L	--	480	650	--	--	9200	9200	--	--	--	--	--	--	--	--	--

APPENDIX B4

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2007

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-11 10-036 1/11/2007	MW-40-11 10-094 7/10/2007	MW-40-13 10-028 1/10/2007	MW-40-13 10-102 7/11/2007	MW-40-14 10-012 1/9/2007	MW-40-14 10-051 4/3/2007	MW-40-14 10-087 7/10/2007	MW-40-14 10-115 10/15/2007	MW-40-15 10-034 1/11/2007	MW-40-15 10-111 7/12/2007	MW-40-16 10-035 1/11/2007	MW-40-16 10-112 7/12/2007	MW-40-17 10-032 1/11/2007	MW-40-17 10-108 7/12/2007	MW-40-17 10-109 7/12/2007	MW-40-18 10-033 1/11/2007
160.1	TOTAL DISSOLVED SOLIDS	MG/L	--	--	6480	6300	2080	--	--	--	1600	1530	7130	7770	1040	980	--	5620
300.0	CHLORIDE	MG/L	--	--	2820	--	--	--	--	--	470	--	4230	--	260	--	--	3230
300.0	NITRATE	MG/L	--	--	0.0788 J	--	--	--	--	--	4.87	--	0.100 U	--	4.77	--	--	0.100 U
300.0	NITRITE	MG/L	--	--	0.100 U	--	--	--	--	--	0.100 U	--	0.100 U	--	0.100 U	--	--	0.100 U
300.0	SULFATE	MG/L	--	--	0.403 J	--	--	--	--	--	265	--	522	--	161	--	--	320
310.1	ALKALINITY	MG/L	--	--	2480	--	--	--	--	--	350	--	180	--	335	--	--	140
410.4	CHEMICAL OXYGEN DEMAND	MG/L	--	--	455	52.3	37.1	49.1	13.5	19.1	27.5	10.0 U	243	44.1	41.4	13.5	--	206
6010B	CALCIUM	MG/L	--	--	356	302	--	--	--	--	237 J	185	661 J	580	190 J	148		627 J
6010B	IRON	MG/L	--	--	13.0	13.8	--	--	--	--	0.100 U	0.100 U	0.466	0.814	0.100 U	0.100 U		0.116
6010B	MAGNESIUM	MG/L	--	--	471	411	--	--	--	--	70.4	62.1	287	264	42.0	35.2		456
6010B	POTASSIUM	MG/L	--	--	15.3	14.6	--	--	--	--	5.80	5.10	14.0	1.56 J	4.49 J	4.29 J		12.0
6010B	SODIUM	MG/L	--	--	1890	1760	--	--	--	--	296	268	1870	1830	188	171		994
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	2-BUTANONE	UG/L	50 U	50 U	39 J	50 U	50 U	50 UJ	50 U	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	50 UJ	50 U	27 J	50 UJ	50 U	50 UJ	50 U	6.6 J	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ
8260B	BENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.36 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.21 J	1.0 U	1.0 U	1.0 U
8260B	CHLOROMETHANE	UG/L	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	1.0 U	1.0 U	0.88 J	1.7	1.2	1.5	0.51 J	11	1.0 U	1.0 U	1.0 U	1.0 U	1.3	0.42 J	0.40 J	1.0 U
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	ETHYLBENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TETRACHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.3	0.74 J	0.75 J	1.0 U
8260B	TOLUENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.72	0.23 J	0.29 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	0.35 J	0.35 J	0.26 J	0.34 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	0.61 J	1.1	0.58 J	2.4	1.0 U	1.0 U	1.0 U	1.0 U	1.5	0.84 J	0.85 J	1.0 U
8260B	VINYL ACETATE	UG/L	50 U	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	4.6	2.8	0.50 U	3.8	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
8270C-SIM	1,4-DIOXANE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9060	TOTAL ORGANIC CARBON	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RSK-175	ETHANE	UG/L	--	--	--	--	1.3 U	1.3 U	1.3 U	1.3 U	--	--	--	--	--	--	--	--
RSK-175	ETHENE	UG/L	--	--	--	--	1.2 U	1.2 U	1.2 U	1.2 U	--	--	--	--	--	--	--	--
RSK-175	METHANE	UG/L	--	--	--	--	16000	9800	15000	8100	--	--	--	--	--	--	--	--

APPENDIX B4

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2007

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-18	MW-40-19	MW-40-19	MW-40-20	MW-40-20	MW-40-22	MW-40-22	MW-40-22	MW-40-22	MW-40-22	MW-40-30	MW-40-30	MW-40-30	MW-40-30	MW-40-30	MW-40-30
			10-110	10-014	10-089	10-015	10-090	10-011	10-049	10-050	10-086	10-114	10-025	10-057	10-066	10-079	10-103	10-121
			7/12/2007	1/9/2007	7/10/2007	1/9/2007	7/10/2007	1/9/2007	4/3/2007	4/3/2007	7/10/2007	10/15/2007	1/10/2007	4/4/2007	5/16/2007	6/14/2007	7/11/2007	10/16/2007
160.1	TOTAL DISSOLVED SOLIDS	MG/L	5050	605	610	9760	7860	--	1630	--	4310	3050	830	905	--	--	955	890
300.0	CHLORIDE	MG/L	--	162	--	1450	--	--	290	--	--	--	159	161	--	--	155	--
300.0	NITRATE	MG/L	--	0.167	--	0.0825 J	--	--	0.0986 J	--	--	--	0.110	0.0661 J	--	--	0.100 U	--
300.0	NITRITE	MG/L	--	0.100 U	--	0.100 U	--	--	0.100 U	--	--	--	0.100 U	0.100 U	--	--	0.100 U	--
300.0	SULFATE	MG/L	--	111	--	2.00	--	--	49.2	--	--	--	148	147	--	--	140	--
310.1	ALKALINITY	MG/L	--	178	--	4760	--	--	970	--	--	--	405	383	--	--	440	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	23.7	13.9	7.36 J	4130	897	--	35.3	--	2270	51.5	14.5	28.4	36.0	10.5	9.40 J	10.0 U
6010B	CALCIUM	MG/L	517	66.0	53.5	135	47.7						113	101			99.8	111
6010B	IRON	MG/L	0.0678 J	0.102	1.22	7.37	5.08						0.835	3.15	--	--	9.27	3.02
6010B	MAGNESIUM	MG/L	398	17.2	14.4	205	174						26.7	23.1	--	--	24.5	26.2
6010B	POTASSIUM	MG/L	12.1	5.00 U	2.27 J	14.7	16.2	--	--	--	--	--	3.53 J	2.47 J	--	--	3.34 J	3.23 J
6010B	SODIUM	MG/L	773	174	155	3100	2650	--	--	--	--	--	206	193	--	--	196	214
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.23 J	--	--	1.0 U	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	2-BUTANONE	UG/L	50 U	50 U	50 U	200	74	50 U	50 UJ	50 UJ	300	5.7 J	50 U	50 UJ	--	--	50 U	50 U
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	--	--	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	--	--	50 U	50 U
8260B	ACETONE	UG/L	50 UJ	50 U	50 U	82	39 J	50 U	50 UJ	50 UJ	22 J	50 UJ	50 U	50 UJ	--	--	50 UJ	50 U
8260B	BENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	--	--	0.50 U	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.28 J	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 UJ
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	CHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 UJ
8260B	CIS-1,2-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	0.40 J	0.29 J	3.0	1.4	1.5	1.3	0.58 J	48	70	--	--	45	32
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	ETHYLBENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.57	0.50 U	0.50 U	0.50 U	--	--	0.50 U	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 UJ
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	0.54 J
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	TETRACHLOROETHENE	UG/L	1.0 U	0.67 J	0.50 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	74	91	--	--	66	60
8260B	TOLUENE	UG/L	0.50 U	0.50 U	0.50 U	0.61	0.42 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	--	--	0.50 U	0.50 U
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.9	2.6	2.6	1.9	0.65 J	2.4	0.30 J	--	--	0.31 J	1.0 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U
8260B	TRICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.2	0.88 J	0.92 J	0.43 J	1.0 U	31	38	--	--	34	28
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	--	--	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	1.6	1.1	1.1	0.50 U	0.32 J	0.39 J	0.42 J	--	--	0.38 J	1.2
8270C-SIM	1,4-DIOXANE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9060	TOTAL ORGANIC CARBON	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RSK-175	ETHANE	UG/L	--	--	--	--	--	1.3 U	1.3 U	--	1.3 U	1.3 U	1.3 U	1.3 U	--	--	1.3 U	1.3 U
RSK-175	ETHENE	UG/L	--	--	--	--	--	1.2 U	1.2 U	--	1.2 U	1.2 U	1.2 U	1.2 U	--	--	1.2 U	1.2 U
RSK-175	METHANE	UG/L	--	--	--	--	--	14000	8500	--	14000	6800	16000	14000	--	--	16000	11000

APPENDIX B4

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2007

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-31 10-026 1/10/2007	MW-40-31 10-058 4/4/2007	MW-40-31 10-104 7/11/2007	MW-40-31 10-122 10/16/2007	MW-40-32 10-027 1/10/2007	MW-40-32 10-059 4/4/2007	MW-40-32 10-067 5/16/2007	MW-40-32 10-081 6/14/2007	MW-40-32 10-105 7/12/2007	MW-40-32 10-123 10/16/2007	MW-40-33 10-013 1/9/2007	MW-40-33 10-088 7/10/2007	MW-40-34 10-020 1/10/2007	MW-40-34 10-052 4/3/2007	MW-40-34 10-062 5/16/2007	MW-40-34 10-072 6/14/2007
160.1	TOTAL DISSOLVED SOLIDS	MG/L	4470	4490	4510	4770	995	1060	--	--	1130	1120	--	--	1030	930	--	--
300.0	CHLORIDE	MG/L	667	596	557	--	134	125	--	--	116	--	--	--	251	192	--	--
300.0	NITRATE	MG/L	0.134 J	0.127	0.100 U	--	0.100 U	0.100 U	--	--	0.100 U	--	--	--	0.100 U	0.0931 J	--	--
300.0	NITRITE	MG/L	0.200 U	0.100 U	0.200 U	--	0.100 U	0.100 U	--	--	0.100 U	--	--	--	0.100 U	0.100 U	--	--
300.0	SULFATE	MG/L	4.18	6.31	1.64	--	70.9	67.2	--	--	4.96	--	--	--	170	129	--	--
310.1	ALKALINITY	MG/L	3640	3650	3750	--	715	645	--	--	730	--	--	--	375	350	--	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	84.4	109	880	380	26.1	37.6	17.2	43.5	78.8	118		11.4	28.5	12.3	4295	4660
6010B	CALCIUM	MG/L	216	230	231	208	177	154	--	--	151	190	--	--	103	73.4		
6010B	IRON	MG/L	17.2	24.6	20.3	20.0	12.4	11.6	--	--	9.13	14.4	--	--	2.38	4.26		
6010B	MAGNESIUM	MG/L	152	136	144	143	50.3	44.4	--	--	46.5	57.0	--	--	23.7	16.2		
6010B	POTASSIUM	MG/L	7.77	7.00	8.44	7.26	3.76 J	3.27 J	--	--	3.47 J	2.78 J	--	--	2.80 J	2.39 J		
6010B	SODIUM	MG/L	1610	1520	1670	1730	226	199	--	--	209	207	--	--	275	267		
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	2-BUTANONE	UG/L	50 U	50 UJ	100 J	35 J	50 U	50 UJ	--	--	50 U	13 J	50 U	50 U	50 U	50 UJ	--	--
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	--	--	50 U	50 U	50 U	50 U	50 U	50 U	--	--
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	--	--	50 U	50 U	50 U	50 U	50 U	50 U	--	--
8260B	ACETONE	UG/L	50 U	50 UJ	10 J	50 U	50 U	50 UJ	--	--	50 UJ	50 U	50 U	50 U	50 U	50 UJ	--	--
8260B	BENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	--	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	--	--
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	--	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	0.24 J	0.27 J	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	CHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	--	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	CIS-1,2-DICHLOROETHENE	UG/L	0.61 J	0.45 J	0.67 J	0.47 J	30	25	--	--	26	10	1.0 U	1.0 U	1.8	1.9	--	--
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	ETHYLBENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	--	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	--	--
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	--	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	--	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	TETRACHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	50	47	--	--	10	1.0 U	1.0 U	1.0 U	22	24	--	--
8260B	TOLUENE	UG/L	0.29 J	0.81	0.48 J	0.51	0.50 U	0.50 U	--	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	--	--
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	0.99 J	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--
8260B	TRICHLOROETHENE	UG/L	0.37 J	0.29 J	0.30 J	1.0 U	23	22	--	--	13	1.4	1.0 U	1.0 U	1.0	1.2	--	--
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	--	--	50 U	50 U	50 U	50 U	50 U	50 U	--	--
8260B	VINYL CHLORIDE	UG/L	0.37 J	0.39 J	0.25 J	0.23 J	1.2	0.97	--	--	1.6	9.5	0.50 U	0.50 U	0.53	0.66	--	--
8270C-SIM	1,4-DIOXANE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9060	TOTAL ORGANIC CARBON	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RSK-175	ETHANE	UG/L	1.3 U	1.3 U	1.3 U	--	--	--	--	--	--	--	--	--	--	1.3 U	--	--
RSK-175	ETHENE	UG/L	1.2 U	0.75 J	1.2 U	1.2 U	1.2 U	1.2 U	--	--	1.2 U	4.9	--	--	1.2 U	1.2 U	--	--
RSK-175	METHANE	UG/L	22000	14000	21000	15000	15000	12000	--	--	13000	9000	--	--	16000	9600	--	--

APPENDIX B4

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2007

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-34 10-097 7/11/2007	MW-40-34 10-116 10/15/2007	MW-40-35 10-021 1/10/2007	MW-40-35 10-022 1/10/2007	MW-40-35 10-053 4/3/2007	MW-40-35 10-098 7/11/2007	MW-40-35 10-099 7/11/2007	MW-40-35 10-117 10/15/2007	MW-40-36 10-023 1/10/2007	MW-40-36 10-054 4/3/2007	MW-40-36 10-063 5/16/2007	MW-40-36 10-073 6/14/2007	MW-40-36 10-100 7/11/2007	MW-40-36 10-118 10/15/2007	MW-40-37 10-024 1/10/2007	MW-40-37 10-056 4/4/2007
160.1	TOTAL DISSOLVED SOLIDS	MG/L	2230	2570	10200	--	9280	7590	--	8320	1190	1240	--	--	2100	2770	1490	1720
300.0	CHLORIDE	MG/L	--	--	442	--	460	--	--	--	272	277	--	--	268	--	425	450
300.0	NITRATE	MG/L	--	--	0.123 J	--	0.254	--	--	--	0.100 U	0.0991 J	--	--	0.0840 J	--	0.0828 J	0.100 U
300.0	NITRITE	MG/L	--	--	0.200 U	--	0.200 U	--	--	--	0.100 U	0.100 U	--	--	0.100 U	--	0.100 U	0.100 U
300.0	SULFATE	MG/L	--	--	0.787 J	--	1.93	--	--	--	176	188	--	--	1.20	--	252	261
310.1	ALKALINITY	MG/L	--	--	6130	--	6250	--	--	--	538	535	--	--	630	--	463	530
410.4	CHEMICAL OXYGEN DEMAND	MG/L	4960	3090	6970	--	4240	794	--	2460	14.5	53.7	859	1010	1830	2720	21.5	13.3
6010B	CALCIUM	MG/L	140	276	192	--	106	58.2	--	105	149	132	--	--	168	300	223	210
6010B	IRON	MG/L	45.4	69.6	22.1	--	10.7	4.54	--	9.84	2.14	2.72	--	--	50.8	87.1	1.66	1.99
6010B	MAGNESIUM	MG/L	31.5	48.0	129	--	108	102	--	124	51.0	46.6	--	--	62.1	94.6	75.7	72.2
6010B	POTASSIUM	MG/L	14.3	14.4	13.6	--	11.1	13.1	--	11.0	4.81 J	4.06 J	--	--	5.89	7.33	6.42	6.11
6010B	SODIUM	MG/L	296	333	3550	--	3110	2800	--	2690	310	295	--	--	281	316	301	278
8260B	1,1,1-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	2-BUTANONE	UG/L	140 J	150 J	290	260	200 J	170 J	160 J	240 J	50 U	50 UJ	--	--	940 J	390 J	50 U	50 UJ
8260B	2-HEXANONE	UG/L	50 U	50 U	10 J	10 J	9.1 J	10 J	11 J	17 J	50 U	50 U	--	--	5.3 J	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	--	--	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	13 J	39 J	93	100	70 J	64 J	66 J	140 J	50 U	50 UJ	--	--	35 J	61 J	50 U	50 UJ
8260B	BENZENE	UG/L	0.50 U	0.50 U	0.50 UJ	0.50 UJ	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	--	--	0.50 U	0.50 U	0.50 U	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	BROMOMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CARBON TETRACHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROBENZENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	0.32 J	0.26 J
8260B	CHLOROFORM	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	14	17	3.5	3.4	2.6	2.1	2.0	3.5	26	17	--	--	35	19	140	89
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	ETHYLBENZENE	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	--	--	0.50 U	0.50 U	0.50 U	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	METHYLENE CHLORIDE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	STYRENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TETRACHLOROETHENE	UG/L	4.5	0.31 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.29 J	87	43	--	--	1.0	2.6	2.1	1.1
8260B	TOLUENE	UG/L	0.50 U	0.50 U	0.92	0.86	0.64	0.43 J	0.45 J	0.33 J	0.50 U	0.50 U	--	--	0.50 U	0.50 U	0.50 U	0.50 U
8260B	TOTAL XYLENES	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	0.29 J	0.23 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.42 J	0.30 J	1.9	--	--	0.58 J	0.54 J	1.7	0.58 J
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	--	1.0 U	1.0 U	1.0 U	1.0 U
8260B	TRICHLOROETHENE	UG/L	1.3	1.2	0.64 J	0.62 J	0.66 J	0.95 J	0.94 J	2.2	30	85	--	--	2.0	4.6	0.94 J	4.9
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	--	--	50 U	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	0.50 U	2.2	0.25 J	0.25 J	0.50 U	0.50 U	0.50 U	0.50 U	0.95	0.65	--	--	9.6	6.4	18	18
8270C-SIM	1,4-DIOXANE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9060	TOTAL ORGANIC CARBON	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RSK-175	ETHANE	UG/L	1.3 U	1.3 U	1.3 U	--	1.3 U	1.3 U	--	1.3 U	1.3 U	1.3 U	--	--	1.3 U	1.3 U	1.3 U	1.3 U
RSK-175	ETHENE	UG/L	1.2 U	1.2 U	1.2 U	--	1.2 U	1.2 U	--	1.2 U	1.2 U	1.2 U	--	--	6.9	4.2	4.1	3.0
RSK-175	METHANE	UG/L	12000	14000	18000	--	16000	21000	--	9800	8300	7400	--	--	13000	14000	2600	2000

APPENDIX B4

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2007

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-37 10-064 5/16/2007	MW-40-37 10-074 6/14/2007	MW-40-37 10-101 7/11/2007	MW-40-37 10-119 10/15/2007	MW-40-38 10-018 1/9/2007	MW-40-38 10-095 7/10/2007	MW-40-39 10-016 1/9/2007	MW-40-39 10-042 2/28/2007	MW-40-39 10-092 7/10/2007
160.1	TOTAL DISSOLVED SOLIDS	MG/L	--	--	1630	1630	--	--	--	--	--
300.0	CHLORIDE	MG/L	--	--	437	--	--	--	--	--	--
300.0	NITRATE	MG/L	--	--	0.0964 J	--	--	--	--	--	--
300.0	NITRITE	MG/L	--	--	0.100 U	--	--	--	--	--	--
300.0	SULFATE	MG/L	--	--	185	--	--	--	--	--	--
310.1	ALKALINITY	MG/L	--	--	565	--	--	--	--	--	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	15.1	18.7	38.0	15.1	--	--	--	24.5	10.0 U
6010B	CALCIUM	MG/L	--	--	201	266	--	--	--	--	--
6010B	IRON	MG/L			0.853	3.71	--	--	--	--	--
6010B	MAGNESIUM	MG/L			72.6	81.9	--	--	--	--	--
6010B	POTASSIUM	MG/L	--	--	6.36	6.47	--	--	--	--	--
6010B	SODIUM	MG/L	--	--	278	305	--	--	--	--	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	1,1-DICHLOROETHANE	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	1,1-DICHLOROETHENE	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	1,2-DICHLOROETHANE	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	1,2-DICHLOROPROPANE	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	2-BUTANONE	UG/L	--	--	50 U	50 UJ	50 UJ	50 U	50 U	--	50 U
8260B	2-HEXANONE	UG/L	--	--	50 U	50 U	50 UJ	50 U	50 U	--	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	--	--	50 U	50 UJ	50 UJ	50 U	50 U	--	50 U
8260B	ACETONE	UG/L	--	--	50 UJ	50 UJ	50 UJ	50 U	50 U	--	50 U
8260B	BENZENE	UG/L	--	--	0.50 U	0.50 U	0.50 UJ	0.50 U	0.50 U	--	0.50 U
8260B	BROMODICHLOROMETHANE	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	BROMOFORM	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	BROMOMETHANE	UG/L	--	--	1.0 U	1.0 UJ	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	CARBON TETRACHLORIDE	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	CHLOROBENZENE	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	CHLOROETHANE	UG/L	--	--	1.0 U	3.0	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	CHLOROFORM	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	CHLOROMETHANE	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 UJ	1.0 U	--	1.0 UJ
8260B	CIS-1,2-DICHLOROETHENE	UG/L	--	--	64	69	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	DIBROMOCHLOROMETHANE	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	ETHYLBENZENE	UG/L	--	--	0.50 U	0.50 U	0.50 UJ	0.50 U	0.50 U	--	0.50 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	METHYLENE CHLORIDE	UG/L	--	--	1.0 U	0.78 J	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	STYRENE	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	TETRACHLOROETHENE	UG/L	--	--	0.31 J	1.6	0.71 J	1.0 U	2.5	--	2.8
8260B	TOLUENE	UG/L	--	--	0.50 U	0.50 U	0.50 UJ	0.50 U	0.50 U	--	0.50 U
8260B	TOTAL XYLENES	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	--	--	0.81 J	1.6	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	--	--	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	--	1.0 U
8260B	TRICHLOROETHENE	UG/L	--	--	0.36 J	3.0	1.0 UJ	0.44 J	1.0 U	--	1.0 U
8260B	VINYL ACETATE	UG/L	--	--	50 U	50 U	50 UJ	50 UJ	50 U	--	50 UJ
8260B	VINYL CHLORIDE	UG/L	--	--	24	16	0.50 UJ	0.50 U	0.50 U	--	0.50 U
8270C-SIM	1,4-DIOXANE	UG/L	--	--	--	--	--	--	--	--	--
9060	TOTAL ORGANIC CARBON	MG/L	--	--	--	--	--	--	--	--	--
RSK-175	ETHANE	UG/L	--	--	1.3 U	1.3 U	--	--	--	--	--
RSK-175	ETHENE	UG/L	--	--	11	6.2	--	--	--	--	--
RSK-175	METHANE	UG/L	--	--	2400	3700	--	--	--	--	--

Abbreviations and Acronyms:

mg/L – micrograms per liter

mg/L – milligrams per liter

J – estimated value

U – analyte is not detected at the listed reporting limit

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APPENDIX B5

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2006

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	IW-1	IW-10	IW-11	IW-12	IW-13	IW-14	IW-15	IW-16	IW-17	IW-18	IW-19	IW-2	IW-3	IW-4	IW-5	IW-6
			90-304	90-291	90-302	90-303	90-286	90-287	90-288	90-294	90-295	90-292	90-296	90-305	90-297	90-298	90-300	90-301
			2/21/2006	2/2/2006	2/21/2006	2/21/2006	2/2/2006	2/2/2006	2/2/2006	2/3/2006	2/3/2006	2/2/2006	2/3/2006	2/21/2006	2/3/2006	2/3/2006	2/21/2006	2/21/2006
160.1	TOTAL DISSOLVED SOLIDS	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
300.0	CHLORIDE	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
300.0	NITRATE	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
300.0	NITRITE	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
300.0	SULFATE	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
310.1	ALKALINITY	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	68	1630	57.1	76.2	29.9	68	5440	21.8	24.5	68	185	65.6	114	78.9	4350	32.7
6010B	CALCIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	IRON	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	MAGNESIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	POTASSIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	SODIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,1-DICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,1-DICHLOROETHENE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,2-DICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,2-DICHLOROPROPANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	2-BUTANONE	UG/L	50 UJ	24 J	7.1 J	50 UJ	50 U	50 U	140 J	50 U	50 U	43 J	46 J	19 J	6.8 J	12 J	930 J	50 UJ
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	500 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	5.2 J	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	500 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	50 UJ	6.9 J	50 UJ	50 UJ	50 UJ	50 UJ	500 UJ	50 UJ	50 UJ	5.2 J	7.8 J	50 UJ	50 UJ	50 UJ	58 J	50 UJ
8260B	BENZENE	UG/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
8260B	BROMODICHLOROMETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	BROMOFORM	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	BROMOMETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	CARBON TETRACHLORIDE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	CHLOROBENZENE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	CHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	CHLOROFORM	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	CHLOROMETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	15	3.4	1.2	7.6	11	12 J	2 J	0.96 J	6.5	26	11	1.3	15	8.1	0.54 J	38
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	ETHYLBENZENE	UG/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	METHYLENE CHLORIDE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	STYRENE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	TETRACHLOROETHENE	UG/L	0.59 J	1 U	1 U	1 U	1 U	0.22 J	10 U	0.26 J	0.41 J	1 U	0.87 J	1 U	0.37 J	1 U	1 U	0.3 J
8260B	TOLUENE	UG/L	1.1	0.24 J	0.4 J	2.3	2.3	110	270	0.72	0.49 J	2.3	0.92	1.2	0.5 U	160	16	0.46 J
8260B	TOTAL XYLENES	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1 U	1 U	1 U	1 U	0.75 J	0.26 J	10 U	1 U	1 U	0.43 J	1 U	1 U	0.32 J	1 U	1 U	0.32 J
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	TRICHLOROETHENE	UG/L	1.2	1.6	1.2	0.46 J	1.4	0.7 J	10 U	0.46 J	13	1 U	0.22 J	0.28 J	2.2	0.35 J	0.69 J	0.84 J
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	500 U	50 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	4.1	5.1	0.74	1.9	19	9.4 J	3.3 J	0.5 U	0.5 U	9.2	0.5 U	0.5 U	0.5 U	0.5 U	0.5	5.4
8260B	XYLENES, TOTAL	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	0.62 J	1 U	1 U	1 U	1 U	1 U
9060	TOTAL ORGANIC CARBON	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GC-SCD	HYDROGEN SULFIDE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RSK-175	CARBON DIOXIDE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RSK-175	ETHANE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RSK-175	ETHENE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RSK-175	METHANE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

APPENDIX B5

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2006

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	IW-7	IW-7	IW-8	IW-9	MW-40-01	MW-40-02	MW-40-06	MW-40-06	MW-40-06	MW-40-06	MW-40-06	MW-40-06	MW-40-06	MW-40-07	MW-40-07	MW-40-07
			90-284	90-285	90-289	90-290	90-281	90-282	90-250	90-251	90-307	90-308	90-342	90-343	90-372	90-273	90-328	90-350
			2/2/2006	2/2/2006	2/2/2006	2/2/2006	1/10/2006	1/10/2006	1/4/2006	1/4/2006	3/21/2006	3/21/2006	7/11/2006	7/11/2006	9/19/2006	1/9/2006	3/23/2006	7/11/2006
160.1	TOTAL DISSOLVED SOLIDS	MG/L	--	--	--	--	800	920	1370	--	--	--	--	--	--	1570	1080	1580
300.0	CHLORIDE	MG/L	--	--	--	--	217	147	455	--	--	--	--	--	--	394	--	428
300.0	NITRATE	MG/L	--	--	--	--	3.46	1.83	0.427	--	--	--	--	--	--	1.35	--	1.64
300.0	NITRITE	MG/L	--	--	--	--	0.1 U	0.1 U	1 U	--	--	--	--	--	--	0.1 U	--	0.1
300.0	SULFATE	MG/L	--	--	--	--	85.4	72.6	232	--	--	--	--	--	--	278	--	288
310.1	ALKALINITY	MG/L	--	--	--	--	178	363	252	--	--	--	--	--	--	292	--	282
410.4	CHEMICAL OXYGEN DEMAND	MG/L	35.4		2720	305	10 U	26.8	11.1	--	--	--	--	--	--	25	43.5 J	24.9
6010B	CALCIUM	MG/L	--	--	--	--	79.9	94.1	119	--	--	--	--	--	--	183	93.9	182
6010B	IRON	MG/L	--	--	--	--	0.1 U	0.578	0.1 U	--	--	--	--	--	--	0.1 U	0.1 U	0.1
6010B	MAGNESIUM	MG/L	--	--	--	--	22.9	31.8	37.8	--	--	--	--	--	--	47	27	48.3
6010B	POTASSIUM	MG/L	--	--	--	--	5 U	2.26 J	5 J	--	--	--	--	--	--	4.22 J	3.16 J	5.47
6010B	SODIUM	MG/L	--	--	--	--	166	207	312	--	--	--	--	--	--	326	225	326
8260B	1,1,1-TRICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	1,1,2-TRICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	1,1-DICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	1,1-DICHLOROETHENE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	1,2-DICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	1,2-DICHLOROPROPANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	2-BUTANONE	UG/L	50 U	50 U	120 J	42 J	50 U	50 U	50 UJ	50 UJ	50 U	50 U	50	50	50 U	50 U	50 UJ	500
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50	50	50 U	50 U	50 U	500
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50	50	50 U	50 U	50 U	500
8260B	ACETONE	UG/L	50 UJ	50 UJ	24 J	9.7 J	50 U	50 U	50 UJ	50 UJ	50 UJ	50 UJ	50	50	50 U	50 UJ	50 UJ	500
8260B	BENZENE	UG/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5	0.5 U	0.5 U	0.5 U	5
8260B	BROMODICHLOROMETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	BROMOFORM	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	BROMOMETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	CARBON TETRACHLORIDE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	CHLOROBENZENE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	CHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	CHLOROFORM	UG/L	1 U	1 U	1 U	1 U	1 U	0.43 J	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	CHLOROMETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	CIS-1,2-DICHLOROETHENE	UG/L	67	66	12 J	1.1	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	0.41 J	1 U	10
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	DIBROMOCHLOROMETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	ETHYLBENZENE	UG/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5	0.5 U	0.5 U	0.5 U	5
8260B	METHYL TERT-BUTYL ETHER	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	METHYLENE CHLORIDE	UG/L	1 U	1 U	1 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	STYRENE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	TETRACHLOROETHENE	UG/L	1 U	1 U	1 U	1 U	1.4	6.6	2.2	2.1	1 U	1 U	3.4	3.3	2.3	110	25	100
8260B	TOLUENE	UG/L	2.8	2.9	260	4.3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5	0.5 U	0.5 U	0.5 U	5
8260B	TOTAL XYLENES	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1.3	1.5	0.45 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
8260B	TRICHLOROETHENE	UG/L	0.7 J	0.73 J	0.37 J	0.28 J	1 U	0.35 J	1 U	1 U	1 U	1 U	1	1	1 U	3.7 J	0.85 J	3.3
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50	50	50 U	50 U	50 U	500
8260B	VINYL CHLORIDE	UG/L	51	52	4.8 J	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5	0.5 U	0.5 U	0.5 U	5
8260B	XYLENES, TOTAL	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U	1 U	1 U	10
9060	TOTAL ORGANIC CARBON	MG/L	--	--	--	--	1.36	3.87	1.16	--	--	--	--	--	--	1.76	--	--
GC-SCD	HYDROGEN SULFIDE	UG/L	--	--	--	--	0.42	0.42	0.42	--	--	--	--	--	--	0.42	--	--
RSK-175	CARBON DIOXIDE	UG/L	--	--	--	--	23000	130000	18000	--	--	--	--	--	--	27000	27000	
RSK-175	ETHANE	UG/L	--	--	--	--	1.3 U	1.3 U	1.3 U	--	--	--	--	--	--	1.3 U	1.3 U	65
RSK-175	ETHENE	UG/L	--	--	--	--	1.2 U	1.2 U	1.2 U	--	--	--	--	--	--	1.2 U	1.2 U	60
RSK-175	METHANE	UG/L	--	--	--	--	3400	7100	3700	--	--	--	--	--	--	2600	410	730

APPENDIX B5

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2006

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-07	MW-40-08	MW-40-08	MW-40-08	MW-40-08	MW-40-08	MW-40-08	MW-40-10	MW-40-10	MW-40-10	MW-40-10	MW-40-10	MW-40-11	MW-40-11	MW-40-11	MW-40-11
			90-398	90-263	90-264	90-324	90-363	90-391	90-392	90-249	90-309	90-341	90-370	90-371	90-280	90-334	90-348	90-378
			9/21/2006	1/6/2006	1/6/2006	3/22/2006	7/13/2006	9/21/2006	9/21/2006	1/4/2006	3/21/2006	7/11/2006	9/19/2006	9/19/2006	1/10/2006	3/23/2006	7/11/2006	9/19/2006
160.1	TOTAL DISSOLVED SOLIDS	MG/L	1550	995	--	--	--	--	--	4640	--	--	--	--	7300	--	--	--
300.0	CHLORIDE	MG/L	420	210	--	--	--	--	--	2270	--	--	--	--	3450	--	--	--
300.0	NITRATE	MG/L	1.47	6.03	--	--	--	--	--	0.1 U	--	--	--	--	0.1 U	--	--	--
300.0	NITRITE	MG/L	0.1 U	0.1 U	--	--	--	--	--	1 U	--	--	--	--	1 U	--	--	--
300.0	SULFATE	MG/L	281	155	--	--	--	--	--	344	--	--	--	--	451	--	--	--
310.1	ALKALINITY	MG/L	248	333	--	--	--	--	--	129	--	--	--	--	135	--	--	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	40.8	23.6	--	--	--	--	--	58.2	--	--	--	--	126	--	--	--
6010B	CALCIUM	MG/L	196	89.9	--	--	--	--	--	577	--	--	--	--	803	--	--	--
6010B	IRON	MG/L	0.1 U	0.158	--	--	--	--	--	0.677	--	--	--	--	0.0972 J	--	--	--
6010B	MAGNESIUM	MG/L	51.2	27.4	--	--	--	--	--	236	--	--	--	--	298	--	--	--
6010B	POTASSIUM	MG/L	5.82 U	2.96 J	--	--	--	--	--	13.9	--	--	--	--	19.9	--	--	--
6010B	SODIUM	MG/L	334	223	--	--	--	--	--	646	--	--	--	--	1250	--	--	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	1,1-DICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	1,1-DICHLOROETHENE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	1,2-DICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	1,2-DICHLOROPROPANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	2-BUTANONE	UG/L	50 U	50 UJ	50 UJ	50 UJ	50	50 U	50 U	50 UJ	50 U	50	50 U	50 U	50 U	50 UJ	50	50 U
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50	50 U	50 U	50 U	50 U	50	50 U	50 U	50 U	50 U	50	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50	50 U	50 U	50 U	50 U	50	50 U	50 U	50 U	50 U	50	50 U
8260B	ACETONE	UG/L	50 U	50 UJ	50 UJ	50 U	50	50 U	50 U	50 UJ	50 UJ	50	50 U	50 U	50 U	50 UJ	50	50 U
8260B	BENZENE	UG/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U
8260B	BROMODICHLOROMETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	BROMOFORM	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	BROMOMETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	CARBON TETRACHLORIDE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	CHLOROBENZENE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	CHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	CHLOROFORM	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	CHLOROMETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	0.43 J	0.24 J	0.23 J	1 U	1	1 U	0.2 J	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	ETHYLBENZENE	UG/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	METHYLENE CHLORIDE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	STYRENE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	TETRACHLOROETHENE	UG/L	94	7.5	7.5	5.5	6.2	6.6	6.2	1 U	6.7	0.49	0.49 J	0.5 J	1 U	1 U	1	1 U
8260B	TOLUENE	UG/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U
8260B	TOTAL XYLENES	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	TRICHLOROETHENE	UG/L	3.1	1.5	1.5	1.1	1.2	1.4	1.3	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
8260B	VINYL ACETATE	UG/L	50 UJ	50 U	50 U	50 UJ	50	50 U	50 U	50 U	50 U	50	50 U	50 U	50 U	50 U	50	50 U
8260B	VINYL CHLORIDE	UG/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U
8260B	XYLENES, TOTAL	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1	1 U
9060	TOTAL ORGANIC CARBON	MG/L	--	2.53	--	--	--	--	--	0.966 J	--	--	--	--	0.824 J	--	--	--
GC-SCD	HYDROGEN SULFIDE	UG/L	--	0.42	--	--	--	--	--	0.42	--	--	--	--	0.42	--	--	--
RSK-175	CARBON DIOXIDE	UG/L		32000	--	--	--	--	--	19000	--	--	--	--	18000	--	--	--
RSK-175	ETHANE	UG/L	1.3 U	1.3 U	--	--	--	--	--	1.3 U	--	--	--	--	1.3 U	--	--	--
RSK-175	ETHENE	UG/L	1.2 U	1.2 U	--	--	--	--	--	1.2 U	--	--	--	--	1.2 U	--	--	--
RSK-175	METHANE	UG/L	400	1.2 U	--	--	--	--	--	110	--	--	--	--	25	--	--	--

APPENDIX B5

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2006

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-12	MW-40-13	MW-40-13	MW-40-13	MW-40-13	MW-40-13	MW-40-14	MW-40-14	MW-40-14	MW-40-14	MW-40-15	MW-40-15	MW-40-15	MW-40-15	MW-40-16	MW-40-16
			90-265	90-272	90-326	90-327	90-361	90-389	90-253	90-311	90-345	90-374	90-268	90-332	90-366	90-395	90-269	90-333
			1/6/2006	1/9/2006	3/23/2006	3/23/2006	7/12/2006	9/20/2006	1/4/2006	3/21/2006	7/11/2006	9/19/2006	1/6/2006	3/23/2006	7/13/2006	9/21/2006	1/6/2006	3/23/2006
160.1	TOTAL DISSOLVED SOLIDS	MG/L	--	13800	7780	--	7510	3840	6220	3180	2130	2080	1580	1640	1730	1720	--	8500
300.0	CHLORIDE	MG/L	--	1500	--	--	2120	1200	274	--	316	304	420	--	459	464	--	--
300.0	NITRATE	MG/L	--	0.1 U	--	--	2.14	0.5 UJ	0.1 U	--	0.0844	0.2 U	3.8	--	4.83	0.447	--	--
300.0	NITRITE	MG/L	--	1 UJ	--	--	0.2	0.5 UJ	1 U	--	0.1	0.2 U	0.1 U	--	0.1	0.1 U	--	--
300.0	SULFATE	MG/L	--	1.1	--	--	0.679	44.3	0.848	--	34.8	17.7	241	--	272	254	--	--
310.1	ALKALINITY	MG/L	--	2490	--	--	2890	1520	3230	--	1440	1300	335	--	324	328	--	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	2230	9980	4140 J	--	3010	1920	4160	597 J	30.1	56.2	21	163 J	17.2	16.6	136	2340 J
6010B	CALCIUM	MG/L	--	727	519	--	359	294	384	--	231	--	195	195	227	244	--	567
6010B	IRON	MG/L	--	94.3	28.3	--	15.9	13.5	37.4	--	11.7	--	0.1 U	0.1 U	0.1	0.1 U	--	0.388
6010B	MAGNESIUM	MG/L	--	372	286	--	394	443	91	--	62.9	--	59.6	62	69.7	77.1	--	250
6010B	POTASSIUM	MG/L	--	15.6	15.9	--	14.7	14.3 J	8.54	--	6.19	--	5.2	7.09	5.63	6.87 U	--	17.6
6010B	SODIUM	MG/L	--	2970	1600	--	1920	2170	1330	--	572	--	251	265	278	328	--	1810
8260B	1,1,1-TRICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,1-DICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,1-DICHLOROETHENE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,2-DICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,2-DICHLOROPROPANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	2-BUTANONE	UG/L		77	62 J	56 J	60	69	49 J	25 J	50	50 U	50 UJ	50 UJ	50	50 U	50 UJ	50 UJ
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50	50 U	50 U	50 U	50	50 U	50 U	50 U	50	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50	50 U	50 U	50 U	50	50 U	50 U	50 U	50	50 U	50 U	50 U
8260B	ACETONE	UG/L	55 J	50 J	29 J	31 J	37	40 J	24 J	11 J	50	50 U	50 UJ	50 UJ	50	50 U	50 UJ	50 UJ
8260B	BENZENE	UG/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U
8260B	BROMODICHLOROMETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	BROMOFORM	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	BROMOMETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CARBON TETRACHLORIDE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CHLOROBENZENE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	0.24 J	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CHLOROFORM	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CHLOROMETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	0.44 J	0.68 J	4	3.7	1.6	1.3	5.2	16	16	11	1 U	1 U	1	1 U	1 U	1 U
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	ETHYLBENZENE	UG/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	METHYLENE CHLORIDE	UG/L	1 U	0.64 J	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	STYRENE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	TETRACHLOROETHENE	UG/L	0.53 J	8.2	1 U	1 U	1	1 U	1 U	0.55 J	1	1 U	0.23 J	1 U	1	1 U	1 U	1 U
8260B	TOLUENE	UG/L	0.77	0.5 U	0.5 U	0.5 U	0.5	0.5 U	2.9	1.9	0.58	0.45 J	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U
8260B	TOTAL XYLENES	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1 U	1 U	1 U	1 U	1	1 U	0.36 J	0.59 J	0.61	0.55 J	1 U	1 U	1	1 U	1 U	1 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	TRICHLOROETHENE	UG/L	0.3 J	9 J	0.38 J	0.37 J	1	1 U	1 U	8.1	3.3	1.8	0.21 J	1 U	1	1 U	1 U	1 U
8260B	VINYL ACETATE	UG/L	50 U	50 U	50 U	50 U	50	50 UJ	50 U	50 U	50	50 U	50 U	50 U	50	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U	13	17	16	11	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U
8260B	XYLENES, TOTAL	UG/L	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
9060	TOTAL ORGANIC CARBON	MG/L	--	3400	--	--	--	--	1320	--	--	--	1.27	--	--	--	--	--
GC-SCD	HYDROGEN SULFIDE	UG/L	--	1	--	--	--	--	0.92	--	--	--	0.42	--	--	--	--	--
RSK-175	CARBON DIOXIDE	UG/L	--	930000	--	--	--	--	840000	480000	--	--	43000	--	--	--	--	--
RSK-175	ETHANE	UG/L	--	1.3 U	--	--	1300	--	1.3 U	1.3 U	520	1.3 U	1.3 U	--	--	--	--	--
RSK-175	ETHENE	UG/L	--	1.2 U	--	--	1200	--	1.5	1.4	480	0.91 J	1.2 U	--	--	--	--	--
RSK-175	METHANE	UG/L	--	8400	--	--	17000	--	11000	11000	14000	15000	3.2	--	--	--	--	--

APPENDIX B5

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2006

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-16	MW-40-16	MW-40-17	MW-40-17	MW-40-17	MW-40-17	MW-40-18	MW-40-18	MW-40-18	MW-40-18	MW-40-19	MW-40-19	MW-40-19	MW-40-19	MW-40-20	MW-40-20
			90-367	90-396	90-266	90-330	90-364	90-393	90-267	90-331	90-365	90-394	90-255	90-312	90-347	90-376	90-256	90-257
			7/13/2006	9/21/2006	1/6/2006	3/23/2006	7/13/2006	9/21/2006	1/6/2006	3/23/2006	7/13/2006	9/21/2006	1/5/2006	3/21/2006	7/11/2006	9/19/2006	1/5/2006	1/5/2006
160.1	TOTAL DISSOLVED SOLIDS	MG/L	8200	8770	1100	1050	1010	1080	--	5650	6180	7250	625	650	640	670	10100	--
300.0	CHLORIDE	MG/L	3630	3820	243	--	228	243	--	--	2800	2980	164	--	159	153	2040	--
300.0	NITRATE	MG/L	0.1	0.1 U	5.03	--	4.73	4.86 J	--	--	0.1	0.1 UJ	2.64	--	1.38	1.03	0.5 U	--
300.0	NITRITE	MG/L	0.1	0.1 U	0.1 U	--	0.1	0.1 UJ	--	--	0.2	0.1 UJ	0.5 U	--	0.1	0.1 U	0.5 U	--
300.0	SULFATE	MG/L	520	507	168	--	157	157	--	--	287	283	103	--	101	99.4	3.6	--
310.1	ALKALINITY	MG/L	175	175	333	--	314	325	--	--	125	130	163	--	171	175	3720	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	17.2	108	23.6	283 J	17.2	18.8	89.2	2120 J	86.7	77.2	13.1	10 U	19.8	21	4980	--
6010B	CALCIUM	MG/L	637	660	154	137	163	174	--	542	597	577	51.6	46.5	--	59.8	864	--
6010B	IRON	MG/L	0.481	0.419	0.0429 J	0.1 U	0.1	0.1 U	--	0.0414 J	0.1	0.083 J	0.1 U	0.1 U	--	0.1 U	49.2	--
6010B	MAGNESIUM	MG/L	280	299	36.3	33.1	38.3	40.4	--	379	425	432	13.8	12.1	--	15.5	321	--
6010B	POTASSIUM	MG/L	15.7	16.7	4.34 J	5.61	5.2	4.92 U	--	11.9	12.4	12.3	2.09 J	2.68 J	--	5 U	15.7	--
6010B	SODIUM	MG/L	1760	1740	174	176	184	189	--	881	902	936	160	163	--	165	1990	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,1-DICHLOROETHANE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,1-DICHLOROETHENE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,2-DICHLOROETHANE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,2-DICHLOROPROPANE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	2-BUTANONE	UG/L	50	50 U	50 UJ	50 U	50	50 U	50 UJ	50 UJ	50	50 U	50 UJ	50 U	50	50 U	270 J	330 J
8260B	2-HEXANONE	UG/L	50	50 U	50 U	50 U	50	50 U	50 U	50 U	50	50 U	50 U	50 U	50	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50	50 U	50 U	50 U	50	50 U	50 U	50 U	50	50 U	50 U	50 U	50	50 U	50 U	50 U
8260B	ACETONE	UG/L	50	50 U	50 UJ	50 UJ	50	50 U	50 UJ	50 UJ	50	50 U	50 UJ	50 UJ	50	50 U	76 J	84 J
8260B	BENZENE	UG/L	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U
8260B	BROMODICHLOROMETHANE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	BROMOFORM	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	BROMOMETHANE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CARBON TETRACHLORIDE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CHLOROBENZENE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CHLOROETHANE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CHLOROFORM	UG/L	1	1 U	0.25 J	1 U	1	0.21 J	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CHLOROMETHANE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	1	1 U	0.27 J	1 U	0.21	0.52 J	1 U	1 U	1	1 U	1 U	1 U	1	1 U	0.92 J	0.86 J
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	ETHYLBENZENE	UG/L	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	METHYLENE CHLORIDE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	STYRENE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	TETRACHLOROETHENE	UG/L	1	1 U	0.51 J	0.37 J	0.44	0.67 J	1 U	1 U	1	1 U	1.3	0.67 J	0.73	0.86 J	0.27 J	0.26 J
8260B	TOLUENE	UG/L	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	1.2	1.2
8260B	TOTAL XYLENES	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	TRICHLOROETHENE	UG/L	1	1 U	0.34 J	1 U	0.32	0.75 J	1 U	1 U	1	1 U	1 U	1 U	1	1 U	0.94 J	0.89 J
8260B	VINYL ACETATE	UG/L	50	50 U	50 U	50 U	50	50 U	50 U	50 U	50	50 U	50 U	50 U	50	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U
8260B	XYLENES, TOTAL	UG/L	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U
9060	TOTAL ORGANIC CARBON	MG/L	--	--	2.9	--	--	--	--	--	--	--	2.11	--	--	--	1680	--
GC-SCD	HYDROGEN SULFIDE	UG/L	--	--	0.42	--	--	--	--	--	--	--	0.42	--	--	--	4.6	--
RSK-175	CARBON DIOXIDE	UG/L	--	--	33000	--	--	--	--	--	--	--	9500	--	--	--	420000	--
RSK-175	ETHANE	UG/L	--	--	1.3 U	--	--	--	--	--	--	--	1.3 U	--	--	--	1.3 U	--
RSK-175	ETHENE	UG/L	--	--	1.2 U	--	--	--	--	--	--	--	1.2 U	--	--	--	1.2 U	--
RSK-175	METHANE	UG/L	--	--	1100	--	--	--	--	--	--	--	520	--	--	--	15000	--

APPENDIX B5

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2006

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-20	MW-40-20	MW-40-20	MW-40-22	MW-40-22	MW-40-22	MW-40-22	MW-40-30	MW-40-30	MW-40-30	MW-40-30	MW-40-31	MW-40-31	MW-40-31	MW-40-31	MW-40-32
			90-313	90-368	90-377	90-252	90-310	90-344	90-373	90-275	90-322	90-357	90-386	90-276	90-323	90-358	90-387	90-277
			3/21/2006	7/13/2006	9/19/2006	1/4/2006	3/21/2006	7/11/2006	9/19/2006	1/9/2006	3/22/2006	7/12/2006	9/20/2006	1/9/2006	3/22/2006	7/12/2006	9/20/2006	1/9/2006
160.1	TOTAL DISSOLVED SOLIDS	MG/L	12600	11500	10700	2040	--	--	--	965	890	845	830	8660	8720	6690	5860	1000
300.0	CHLORIDE	MG/L	--	1390	1460	256	--	--	--	159	--	149	153	891	--	737	673	154
300.0	NITRATE	MG/L	--	0.2	0.5 U	0.1 U	--	--	--	0.935	--	1.74	0.256 J	0.1 U	--	0.2	0.5 UJ	0.1 U
300.0	NITRITE	MG/L	--	0.2	0.5 U	0.1 U	--	--	--	0.1 U	--	0.1	0.1 UJ	1 UJ	--	0.2	0.5 UJ	0.1 U
300.0	SULFATE	MG/L	--	1.36	3.24	68.3	--	--	--	138	--	138	143	1.02	--	1.11	2.15 J	18.3
310.1	ALKALINITY	MG/L	--	4490	4450	1430	--	--	--	330	--	349	393	4040	--	3590	4050	614
410.4	CHEMICAL OXYGEN DEMAND	MG/L	7620 J	17.2	6840	36.1	--	--	--	33.3	48.9 J	24.9	36.4	5550	5450 J	3780	1790	30.5
6010B	CALCIUM	MG/L	694	394	270	46.2	--	--	--	108	95.8	110	111	736	538	356	250	156
6010B	IRON	MG/L	46.3	23.6	14.2	9.6	--	--	--	0.345	0.1 U	0.1	0.1 U	69.3	55.6	32.9	20	9.22
6010B	MAGNESIUM	MG/L	286	238	248	15.2	--	--	--	26.3	22.9	24.8	26.4	261	230	220	191	41.2
6010B	POTASSIUM	MG/L	15.9	17.6	17.5 J	4.39 J	--	--	--	3.73 J	3.28 J	4.18	2.6 J	10.2	9.03	8.87	9.34 J	5.59
6010B	SODIUM	MG/L	2630	2860	3140	748	--	--	--	217	193	196	220	1380	1860	1810	1920	160
8260B	1,1,1-TRICHLOROETHANE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	1,1-DICHLOROETHANE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	0.34 J	0.29 J	5	0.24 J	1 U	1 U	10	1 U	0.22 J
8260B	1,1-DICHLOROETHENE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	1,2-DICHLOROETHANE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	1,2-DICHLOROPROPANE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	2-BUTANONE	UG/L	360 J	270	230 J	50 UJ	50 U	50	50 U	50 U	50 UJ	250	50 U	320	280 J	190	160 J	50 U
8260B	2-HEXANONE	UG/L	50 U	250	9.1 J	50 U	50 U	50	50 U	50 U	50 U	250	50 U	50 U	50 U	500	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	250	50 U	50 U	50 U	50	50 U	50 U	50 U	250	50 U	50 U	50 U	500	50 U	50 U
8260B	ACETONE	UG/L	83 J	60	67	50 UJ	50 UJ	50	50 U	50 UJ	50 U	250	50 U	110 J	94	74	75	50 UJ
8260B	BENZENE	UG/L	0.5 U	2.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	2.5	0.5 U	0.5 U	0.5 U	5	0.5 U	0.5 U
8260B	BROMODICHLOROMETHANE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	BROMOFORM	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	BROMOMETHANE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	CARBON TETRACHLORIDE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	CHLOROBENZENE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	CHLOROETHANE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	CHLOROFORM	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	0.9 J	0.7 J	5	0.27 J	1 U	1 U	10	1 U	0.38 J
8260B	CHLOROMETHANE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	0.3 J	1 U	10	1 U	1 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	1.3	5	0.63 J	2.5	8.6	7	5.1	57	36	24	34	4.5	1.9	10	0.88 J	150
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	ETHYLBENZENE	UG/L	0.5 U	2.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	2.5	0.5 U	0.5 U	0.5 U	5	0.5 U	0.5 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	METHYLENE CHLORIDE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1.1	1 U	10	1 U	1 U
8260B	STYRENE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	TETRACHLOROETHENE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	150	130	100	81	1 U	0.59 J	10	1 U	10
8260B	TOLUENE	UG/L	1.5	1.2	0.95	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	2.5	0.5 U	2.4	1.7	5	1.2	0.5 U
8260B	TOTAL XYLENES	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1 U	5	1 U	1 U	0.36 J	1.2	1.3	0.38 J	0.29 J	5	0.37 J	1 U	1 U	10	1 U	0.52 J
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
8260B	TRICHLOROETHENE	UG/L	0.57 J	5	0.22 J	0.45 J	2	2.1	2	60	43	37	40	0.84 J	0.55 J	10	1 U	6.1 J
8260B	VINYL ACETATE	UG/L	50 U	250	50 U	50 U	50 U	50	50 U	50 U	50 UJ	250	50 UJ	50 U	50 UJ	500	50 UJ	50 U
8260B	VINYL CHLORIDE	UG/L	0.5 U	2.5	0.5 U	1.4	2	2.6	1.8	1.2	0.48 J	2.5	0.65	2.6	0.83	5	0.49 J	0.5 U
8260B	XYLENES, TOTAL	UG/L	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U	5	1 U	1 U	1 U	10	1 U	1 U
9060	TOTAL ORGANIC CARBON	MG/L	--	--	--	4.57	--	--	--	2.69	--	--	--	1810	--	--	--	7.55
GC-SCD	HYDROGEN SULFIDE	UG/L	--	--	--	0.42	--	--	--	0.42	--	--	--	0.9	--	--	--	2.2
RSK-175	CARBON DIOXIDE	UG/L	--	--	--	310000	210000			450000	250000	--	--	610000	740000			300000
RSK-175	ETHANE	UG/L	--	--	--	1.3 U	1.3 U	520	1.3 U	1.3 U	1.3 U	650	1.3 U	1.3 U	1.3 U	1300	1.3 U	1.3 U
RSK-175	ETHENE	UG/L	--	--	--	1.2 U	1.2 U	480	0.81 J	1.2 U	1.2 U	600	1.2 U	1.2 U	1.2 U	1200	1.2 U	1.2 U
RSK-175	METHANE	UG/L	--	--	--	11000	8600	12000	12000	9200	12000	16000	11000	12000	15000	23000	15000	11000

APPENDIX B5

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2006

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-32	MW-40-32	MW-40-32	MW-40-33	MW-40-33	MW-40-33	MW-40-33	MW-40-34	MW-40-34	MW-40-34	MW-40-34	MW-40-34	MW-40-34	MW-40-35	MW-40-35	MW-40-35
			90-321	90-359	90-388	90-258	90-314	90-346	90-375	90-259	90-317	90-353	90-354	90-381	90-382	90-260	90-318	90-319
			3/22/2006	7/12/2006	9/20/2006	1/5/2006	3/21/2006	7/11/2006	9/19/2006	1/5/2006	3/22/2006	7/12/2006	7/12/2006	9/20/2006	9/20/2006	1/5/2006	3/22/2006	3/22/2006
160.1	TOTAL DISSOLVED SOLIDS	MG/L	960	980	945	425	--	--	--	970	990	960	--	1090	--	24400	20200	--
300.0	CHLORIDE	MG/L	--	154	163	56.7	--	--	--	170	--	187	--	239	--	252	--	--
300.0	NITRATE	MG/L	--	0.1	0.1 UJ	1.53	--	--	--	0.784	--	0.906	--	0.1 UJ	--	0.5 U	--	--
300.0	NITRITE	MG/L	--	0.1	0.1 UJ	0.5 U	--	--	--	0.1 U	--	0.1	--	0.1 UJ	--	0.5 U	--	--
300.0	SULFATE	MG/L	--	68.4	69.4	91.7	--	--	--	139	--	149	--	183	--	7.84	--	--
310.1	ALKALINITY	MG/L	--	584	560	143	--	--	--	410	--	354	--	348	--	7510	--	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	35.3 J	14.7	32	10.5	--	--	--	42	40.8 J	17.2	--	25.4	--	35200	19600 J	--
6010B	CALCIUM	MG/L	154	179	170	23	--	--	--	65.8	61	77.6	--	97.2	--	525	527	--
6010B	IRON	MG/L	7.55	5.59	6.43	0.1 U	--	--	--	0.219	0.0437 J	0.0459	--	2.5	--	352	204	--
6010B	MAGNESIUM	MG/L	41.5	44	44.9	6.14	--	--	--	16.1	13.9	17.1	--	21.7	--	105	109	--
6010B	POTASSIUM	MG/L	5.9	6.02	5.59	5 U	--	--	--	3.81 J	2.19 J	4.26	--	2.41 J	--	16.2	15.5	--
6010B	SODIUM	MG/L	167	167	193 J	110	--	--	--	267	245	283	--	274	--	5160	4000	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	1,1-DICHLOROETHANE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	1,1-DICHLOROETHENE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	1,2-DICHLOROETHANE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	1,2-DICHLOROPROPANE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	2-BUTANONE	UG/L	50 UJ	50	50 U	50 UJ	50 U	50	50 U	50 UJ	50 UJ	50	50	50 U	50 U	66 J	370 J	360 J
8260B	2-HEXANONE	UG/L	50 U	50	50 U	50 U	50 U	50	50 U	50 U	50 U	50	50	50 U	50 U	50 U	14 J	13 J
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50	50 U	50 U	50 U	50	50 U	50 U	50 U	50	50	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	50 U	50	50 U	50 UJ	50 UJ	50	50 U	50 UJ	50 U	50	50	50 U	50 U	50 UJ	100 J	92 J
8260B	BENZENE	UG/L	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
8260B	BROMODICHLOROMETHANE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	BROMOFORM	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	BROMOMETHANE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	CARBON TETRACHLORIDE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	CHLOROBENZENE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	CHLOROETHANE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	CHLOROFORM	UG/L	0.28 J	0.25	0.28 J	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1.1	1 U	1 U
8260B	CHLOROMETHANE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	160	46	44	1 U	1 U	1	1 U	4.7	2.1	2.3	2.2	2.8	2.8	22	9.7	10
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	ETHYLBENZENE	UG/L	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	METHYLENE CHLORIDE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	8.9	4.1	4.4
8260B	STYRENE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	TETRACHLOROETHENE	UG/L	5.1	34	39	1 U	1 U	1	1 U	29	22	18	18	28	28	3.5	0.48 J	0.6 J
8260B	TOLUENE	UG/L	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5	0.5	0.5 U	0.5 U	5.2	2	2.3
8260B	TOTAL XYLENES	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	0.43 J	0.82	1.4	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
8260B	TRICHLOROETHENE	UG/L	2.6	16	20	1 U	1 U	1	1 U	1.3	0.64 J	0.89	0.92	1.2	1.2	6.4	5.6	6.2
8260B	VINYL ACETATE	UG/L	50 UJ	50	50 UJ	50 U	50 U	50	50 U	50 U	50 UJ	50	50	50 UJ	50 UJ	50 U	50 UJ	50 UJ
8260B	VINYL CHLORIDE	UG/L	1.8	1.7	1.8	0.5 U	0.5 U	0.5	0.5 U	1.6	0.59	0.54	0.55	0.67	0.67	2.6	1.1	0.99
8260B	XYLENES, TOTAL	UG/L	1 U	1	1 U	1 U	1 U	1	1 U	1 U	1 U	1	1	1 U	1 U	1 U	1 U	1 U
9060	TOTAL ORGANIC CARBON	MG/L	--	--	--	2.48	--	--	--	2.84	--	--	--	--	--	7490	--	--
GC-SCD	HYDROGEN SULFIDE	UG/L	--	--	--	0.42	--	--	--	0.42	--	--	--	--	--	11	--	--
RSK-175	CARBON DIOXIDE	UG/L	310000			2100	--	--	--	490000	410000	--	--	--	--	780000	740000	--
RSK-175	ETHANE	UG/L	1.3 U	650	1.3 U	1.3 U	--	--	--	1.3 U	1.3 U	520	--	1.3 U	--	1.3 U	1.3 U	--
RSK-175	ETHENE	UG/L	1.2 U	600	1.2 U	1.2 U	--	--	--	1.2 U	1.2 U	480	--	1.2 U	--	1.2 U	1.2 U	--
RSK-175	METHANE	UG/L	12000	13000	11000	320	--	--	--	11000	11000	13000	--	12000	--	5200	8600	--

APPENDIX B5

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2006

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-35	MW-40-35	MW-40-36	MW-40-36	MW-40-36	MW-40-36	MW-40-37	MW-40-37	MW-40-37	MW-40-37	MW-40-38	MW-40-38	MW-40-38	MW-40-38	MW-40-39	MW-40-39
			90-355	90-383	90-261	90-320	90-356	90-384	90-274	90-329	90-360	90-385	90-279	90-335	90-349	90-379	90-270	90-315
			7/12/2006	9/20/2006	1/5/2006	3/22/2006	7/12/2006	9/20/2006	1/9/2006	3/23/2006	7/12/2006	9/20/2006	1/10/2006	3/23/2006	7/11/2006	9/19/2006	1/6/2006	3/21/2006
160.1	TOTAL DISSOLVED SOLIDS	MG/L	12900	12500	1170	1230	1210	1180	1640	1560	1500	1550	970	--	--	--	2060	--
300.0	CHLORIDE	MG/L	487	482	327	--	263	280	407	--	408	419	234	--	--	--	657	--
300.0	NITRATE	MG/L	1	1 UJ	0.487	--	0.572	0.441 J	0.1 U	--	0.1	0.1 UJ	4.14	--	--	--	3.89	--
300.0	NITRITE	MG/L	1	1 UJ	0.1 U	--	0.1	0.1 UJ	0.1 U	--	0.1	0.1 UJ	0.1 U	--	--	--	0.1 U	--
300.0	SULFATE	MG/L	2.61	11.8	152	--	169	177	277	--	256	248	123	--	--	--	301	--
310.1	ALKALINITY	MG/L	5040	5650	304	--	464	490	315	--	394	438	192	--	--	--	261	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	9950	10000	28.9	68 J	22.4	14.4	19.4	392 J	14.7	16.6	24.1	--	--	--	31.5	--
6010B	CALCIUM	MG/L	435	446	135	120	138	137	204	180	228	210	108	--	--	--	240	--
6010B	IRON	MG/L	101	88	0.0677 J	0.1 U	0.0583	0.2	0.271	0.957	1.57	1.81	0.1 U	--	--	--	0.0687 J	--
6010B	MAGNESIUM	MG/L	122	137	40.7	37.5	43.7	45.9	54.9	60.2	71.6	70.4	31.9	--	--	--	60.1	--
6010B	POTASSIUM	MG/L	17.2	14.9 J	6.12	5.04	6.49	4.26 J	9.14	8.53	9.02	6.85 J	5.56	--	--	--	7.8	--
6010B	SODIUM	MG/L	3280	3550	230	248	277	279	282	272	277	297	173	--	--	--	340	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,1-DICHLOROETHANE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,1-DICHLOROETHENE	UG/L	10	1 U	1 U	1 U	5	1 U	0.25 J	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,2-DICHLOROETHANE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	1,2-DICHLOROPROPANE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	2-BUTANONE	UG/L	310	390	50 UJ	50 UJ	250	50 U	50 U	50 UJ	250	50 U	50 U	50 UJ	50	50 U	50 UJ	50 U
8260B	2-HEXANONE	UG/L	500	23 J	50 U	50 U	250	50 U	50 U	50 U	250	50 U	50 U	50 U	50	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	500	50 U	50 U	50 U	250	50 U	50 U	50 U	250	50 U	50 U	50 U	50	50 U	50 U	50 U
8260B	ACETONE	UG/L	110	140 J	50 UJ	50 U	250	50 U	50 UJ	50 UJ	250	50 U	50 U	50 UJ	50	50 U	50 UJ	50 UJ
8260B	BENZENE	UG/L	5	0.5 U	0.5 U	0.5 U	2.5	0.5 U	0.5 U	0.5 U	2.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U
8260B	BROMODICHLOROMETHANE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	BROMOFORM	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	BROMOMETHANE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CARBON TETRACHLORIDE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CHLOROBENZENE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CHLOROETHANE	UG/L	10	1 U	0.38 J	1 U	5	1 U	1 U	1 U	5	0.41 J	1 U	1 U	1	1 U	1 U	1 U
8260B	CHLOROFORM	UG/L	10	1 U	0.33 J	0.35 J	5	1 U	0.33 J	0.24 J	5	1 U	0.23 J	1 U	1	1 U	1 U	1 U
8260B	CHLOROMETHANE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	4.8	6.6	22	20	18	20	63	35	36	140	1 U	1 U	1	1 U	1 U	1 U
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	DIBROMOCHLOROMETHANE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	ETHYLBENZENE	UG/L	5	0.5 U	0.5 U	0.5 U	2.5	0.5 U	0.5 U	0.5 U	2.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	METHYLENE CHLORIDE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	STYRENE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	TETRACHLOROETHENE	UG/L	10	1 U	160	140	160	150	440	100	120	1.3	0.73 J	0.68 J	0.69	0.58 J	0.71 J	0.72 J
8260B	TOLUENE	UG/L	5	2	0.5 U	0.5 U	2.5	0.5 U	0.5 U	0.5 U	2.5	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U
8260B	TOTAL XYLENES	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	10	1 U	0.22 J	0.21 J	5	0.32 J	0.41 J	0.28 J	5	1.8	1 U	1 U	1	1 U	1 U	1 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
8260B	TRICHLOROETHENE	UG/L	10	0.67 J	16	15	20	24	48 J	28	46	16	1 U	1 U	1	1 U	1 U	1 U
8260B	VINYL ACETATE	UG/L	500	50 UJ	50 U	50 UJ	250	50 UJ	50 U	50 U	250	50 UJ	50 U	50 U	50	50 U	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	5	0.58	0.6	0.41 J	2.5	0.6	0.5 U	1.2	3.6	4.5	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U
8260B	XYLENES, TOTAL	UG/L	10	1 U	1 U	1 U	5	1 U	1 U	1 U	5	1 U	1 U	1 U	1	1 U	1 U	1 U
9060	TOTAL ORGANIC CARBON	MG/L	--	--	1.56	--	--	--	2.07	--	--	--	3.04	--	--	--	1.33	--
GC-SCD	HYDROGEN SULFIDE	UG/L	--	--	0.42	--	--	--	0.42	--	--	--	0.42	--	--	--	0.42	--
RSK-175	CARBON DIOXIDE	UG/L	--	--	110000	160000	--	--	17000	36000	--	--	13000	--	--	--	22000	--
RSK-175	ETHANE	UG/L	520	0.75 J	1.3 U	1.3 U	650	1.3 U	1.3 U	1.3 U	130	1.3 U	1.3 U	--	--	--	1.3 U	--
RSK-175	ETHENE	UG/L	480	1.2 U	1.2 U	1.2 U	600	1.2 U	3	1.2 U	120	2.6	1.2 U	--	--	--	1.2 U	--
RSK-175	METHANE	UG/L	8300	14000	4700	5800	14000	9700	920	1.2 U	1900	1600	11000	--	--	--	1.2 U	--

APPENDIX B5

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2006

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-39	MW-40-39
			90-351	90-397
			7/11/2006	9/21/2006
160.1	TOTAL DISSOLVED SOLIDS	MG/L	--	--
300.0	CHLORIDE	MG/L	--	--
300.0	NITRATE	MG/L	--	--
300.0	NITRITE	MG/L	--	--
300.0	SULFATE	MG/L	--	--
310.1	ALKALINITY	MG/L	--	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	--	--
6010B	CALCIUM	MG/L	--	--
6010B	IRON	MG/L	--	--
6010B	MAGNESIUM	MG/L	--	--
6010B	POTASSIUM	MG/L	--	--
6010B	SODIUM	MG/L	--	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1	1 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1	1 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1	1 U
8260B	1,1-DICHLOROETHANE	UG/L	1	1 U
8260B	1,1-DICHLOROETHENE	UG/L	1	1 U
8260B	1,2-DICHLOROETHANE	UG/L	1	1 U
8260B	1,2-DICHLOROPROPANE	UG/L	1	1 U
8260B	2-BUTANONE	UG/L	50	50 U
8260B	2-HEXANONE	UG/L	50	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50	50 U
8260B	ACETONE	UG/L	50	50 U
8260B	BENZENE	UG/L	0.5	0.5 U
8260B	BROMODICHLOROMETHANE	UG/L	1	1 U
8260B	BROMOFORM	UG/L	1	1 U
8260B	BROMOMETHANE	UG/L	1	1 U
8260B	CARBON TETRACHLORIDE	UG/L	1	1 U
8260B	CHLOROBENZENE	UG/L	1	1 U
8260B	CHLOROETHANE	UG/L	1	1 U
8260B	CHLOROFORM	UG/L	1	1 U
8260B	CHLOROMETHANE	UG/L	1	1 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	1	1 U
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1	1 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1	1 U
8260B	ETHYLBENZENE	UG/L	0.5	0.5 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1	1 U
8260B	METHYLENE CHLORIDE	UG/L	1	1 U
8260B	STYRENE	UG/L	1	1 U
8260B	TETRACHLOROETHENE	UG/L	1.7	2.4
8260B	TOLUENE	UG/L	0.5	0.5 U
8260B	TOTAL XYLENES	UG/L	--	--
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1	1 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1	1 U
8260B	TRICHLOROETHENE	UG/L	1	1 U
8260B	VINYL ACETATE	UG/L	50	50 U
8260B	VINYL CHLORIDE	UG/L	0.5	0.5 U
8260B	XYLENES, TOTAL	UG/L	1	1 U
9060	TOTAL ORGANIC CARBON	MG/L	--	--
GC-SCD	HYDROGEN SULFIDE	UG/L	--	--
RSK-175	CARBON DIOXIDE	UG/L	--	--
RSK-175	ETHANE	UG/L	--	--
RSK-175	ETHENE	UG/L	--	--
RSK-175	METHANE	UG/L	--	--

Abbreviations and Acronyms:

µg/L – micrograms per liter

mg/L – milligrams per liter

J – estimated value

U – analyte is not detected at the listed reporting limit

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APPENDIX B6

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2005

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	HP-1	HP-2	HP-3	IW-13	IW-14	IW-14	IW-14	IW-6	IW-9	MW-40-02	MW-40-07	MW-40-07	MW-40-14	MW-40-14	MW-40-14	MW-40-14	MW-40-17	MW-40-22	MW-40-22
			90-212A	90-211A	90-210A	90-229	90-228	90-228DL1	90-228DL2	90-222	90-227	90-226	90-220	90-238	90-209	90-210	90-232	90-233	90-237	90-208	90-231
			10/19/2005	10/19/2005	10/19/2005	10/26/2005	10/26/2005	10/26/2005	10/26/2005	10/25/2005	10/26/2005	10/26/2005	10/25/2005	11/28/2005	10/24/2005	10/24/2005	11/28/2005	11/28/2005	11/28/2005	10/19/2005	11/28/2005
160.1	TOTAL DISSOLVED SOLIDS	MG/L	--	--	--	--	--	--	--	--	--	820	1560	--	4190	--	5620	--	--	2150	2050
300.0	CHLORIDE	MG/L	--	--	--	--	--	--	--	--	--	157	422	--	378	--	315	--	--	273	260
300.0	NITRATE	MG/L	--	--	--	--	--	--	--	--	--	3.09	2.79	--	0.1 U	--	0.5 U	--	--	0.1 U	0.1 U
300.0	NITRITE	MG/L	--	--	--	--	--	--	--	--	--	0.1 U	0.1 U	--	0.5 U	--	0.5 UJ	--	--	0.5 U	0.1 UJ
300.0	SULFATE	MG/L	--	--	--	--	--	--	--	--	--	77.5	295	--	77.1	--	10.2	--	--	61.7	67.1
310.1	ALKALINITY	MG/L	--	--	--	--	--	--	--	--	--	325	237	--	1720	--	2370	--	--	1310	1310
410.4	CHEMICAL OXYGEN DEMAND	MG/L	--	--	--	--	--	--	--	--	--	23.1	15.3	--	3050	--	5160	--	--	50.8	28.4
6010B	ANTIMONY	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.300	--
6010B	ARSENIC	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.013	--
6010B	BARIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.737	--
6010B	BERYLLIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.003	--
6010B	CADMIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.163	--
6010B	CALCIUM	MG/L	--	--	--	--	--	--	--	--	--	80.9	173	--	398	--	364	--	--	53.6	48.9
6010B	CHROMIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.070	--
6010B	COBALT	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.070	--
6010B	COPPER	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.060	--
6010B	IRON	MG/L	--	--	--	--	--	--	--	--	--	2.8	0.0741 J	--	36.9	--	32	--	--	12.6	13.4
6010B	LEAD	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.040	--
6010B	MAGNESIUM	MG/L	--	--	--	--	--	--	--	--	--	28.8	45.2	--	97.7	--	88.4	--	--	18.8	16.3
6010B	MOLYBDENUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.050	--
6010B	NICKEL	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.050	--
6010B	POTASSIUM	MG/L	--	--	--	--	--	--	--	--	--	3.89 J	4.9 J	--	8.57	--	8.24	--	--	4.31 J	4.5 J
6010B	SELENIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.750	--
6010B	SILVER	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.070	--
6010B	SODIUM	MG/L	--	--	--	--	--	--	--	--	--	182	307	--	748	--	1220	--	--	797	754
6010B	THALLIUM/THALLIUM-201/230	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.400	--
6010B	VANADIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.016	--
6010B	ZINC	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.085	--
7470A	MERCURY	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,1-DICHLOROETHANE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,1-DICHLOROETHENE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,2-DICHLOROETHANE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,2-DICHLOROPROPANE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	2-BUTANONE	UG/L	50	50	50	7.7 J	6.8 J	--	--	110 J	19 J	50 UJ	50 UJ	50 U	10 J	11 J	50	53	50 U	50 U	50 U
8260B	2-HEXANONE	UG/L	50	50	50	50 U	50 U	--	--	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50	50	50	50 U	50 U	--	--	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	50	50	50	5.1 J	12 J	--	--	25 J	26 J	50 UJ	50 U	50 UJ	7.9 J	8.2 J	15 J	15 J	50 UJ	50 UJ	50 U
8260B	BENZENE	UG/L	0.5	0.5	0.5	0.5 U	0.5 U	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
8260B	BROMODICHLOROMETHANE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	BROMOFORM	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U
8260B	BROMOMETHANE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
8260B	CARBON TETRACHLORIDE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	CHLOROBENZENE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	CHLOROETHANE	UG/L	0.27	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	CHLOROFORM	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	0.7 J	1 U	1 U	1 U	1 U	1 U	1 U	0.23 J	1 U	1 U
8260B	CHLOROMETHANE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L		1	--	80	--	87	--	170	1.1 J	0.5 J	0.28 J	0.34 J	66	65	38	37	0.23 J	1.4	2.8
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	ETHYLBENZENE	UG/L	0.5	0.5	0.5	0.5 U	0.5 U	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	METHYLENE CHLORIDE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1.1 J	1.2 J	1 U	1 U	1 U	1 U	1 U
8260B	STYRENE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	TETRACHLOROETHENE	UG/L	1	1	1	1 U	0.23 J	--	--	4.1	1 U	6.5	85	90	1.1	1.1	1 U	1 U	0.28 J	1 U	1 U
8260B	TOLUENE	UG/L	0.5	0.5	0.5	160	--	--	1100	2.1	360	0.5 U	0.5 U	0.5 U	3.6	3.4	3.9	3.8	0.5 U	0.5 U	0.5 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1	1	1	0.8 J	0.42 J	--	--	0.94 J	1 U	1 U	1 U	1 U	0.77 J	0.73 J	0.66 J	0.63 J	1 U	0.21 J	0.24 J
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1	1	1	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	TRICHLOROETHENE	UG/L	1	1	1	1 U	0.24 J	--	--	2.7	0.23 J	0.51 J	2	2.4	1	0.95 J	0.37 J	0.33 J	0.21 J	0.37 J	0.39 J
8260B	VINYL ACETATE	UG/L	50	50	50	50 U	50 U	--	--	50 UJ	50 U	50 U	50 UJ	50 U	50 UJ	50 UJ	50 UJ	50 UJ	50 U	50 UJ	50 U
8260B	VINYL CHLORIDE	UG/L	0.5	0.5	0.5	19	8.3 J	--	--	8.9	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5	4.9	0.5 U	1	1.2
8260B	XYLENES, TOTAL	UG/L	1	1	1	1 U	1 U	--	--	1 U	0.28 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
9060	TOTAL ORGANIC CARBON	MG/L	--	--	--	--	--	--	--	--	--	2.99	1.55	--	772	--	1190	--	--	4.38	4.19
GC-SCD	HYDROGEN SULFIDE	UG/L	--	--	--	--	--	--	--	--	--	--	--	--		--	0.64	--	--		7.4
RSK-175	CARBON DIOXIDE	UG/L	--	--	--	--	--	--	--	--	--	96000	25000	--	370000	--	740000	--	--	240000	220000
RSK-175	ETHANE	UG/L	--	--	--	--	--	--	--	--	--	1.3 U	1.3 U	--	1.3 U	--	1.3 U	--	--	1.3 U	1.3 U
RSK-175	ETHENE	UG/L	--	--	--	--	--	--	--	--	--	1.2 U	1.2 U	--	1.7	--	1.2 U	--	--	0.79 J	0.74 J
RSK-175	METHANE	UG/L	--	--	--	--	--	--	--	--	--	3700	730	--	9000	--	9800	--	--	9800	12000

APPENDIX B6

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2005

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-30 90-214 10/24/2005	MW-40-30 90-244 11/30/2005	MW-40-31 90-224 10/26/2005	MW-40-31 90-245 11/30/2005	MW-40-32 90-217 10/25/2005	MW-40-32 90-218 10/25/2005	MW-40-32 90-246 11/30/2005	MW-40-33 90-211 10/24/2005	MW-40-33 90-234 11/28/2005	MW-40-34 90-212 10/24/2005	MW-40-34 90-235 11/28/2005	MW-40-35 90-216 10/25/2005	MW-40-35 90-240 11/30/2005	MW-40-35 90-241 11/30/2005	MW-40-36 90-213 10/24/2005	MW-40-36 90-242 11/30/2005	MW-40-37 90-219 10/25/2005	MW-40-37 90-243 11/30/2005	MW-40-38 90-225 10/26/2005
160.1	TOTAL DISSOLVED SOLIDS	MG/L	910	900	11500	11400	885	--	905	450	655	920	1200	21900	19800	--	1240	1540	1580	1160	920
300.0	CHLORIDE	MG/L	179	167	1090	938	165	--	158	84.6	161	120	261	225	297	--	336	424	417	339	250
300.0	NITRATE	MG/L	0.1 U	0.445	0.1 U	0.2 U	0.1 U	--	0.144	0.901	1.23	0.1 U	0.59	0.1 U	0.2 U	--	0.788	0.1 U	0.1 U	1.11	4.08
300.0	NITRITE	MG/L	0.1 U	0.1 U	0.5 U	0.2 U	0.1 U	--	0.1 U	0.1 U	0.24 J	0.1 U	0.1 UJ	0.5 U	0.2 U	--	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
300.0	SULFATE	MG/L	162	143	1.17	1.72	52.7	--	65.8	84.9	108	94.5	201	6.08	2.72	--	168	288	286	154	134
310.1	ALKALINITY	MG/L	302	369	4160	4780	443	--	521	101	140	428	408	5860	8680	--	231	214	237	293	185
410.4	CHEMICAL OXYGEN DEMAND	MG/L	22.9	49	7680	5290	30.5	--	54.1	35	20.6	40.7	25.8	18300	24200	--	15.3	82.5	10.2	51.6	30.7
6010B	ANTIMONY	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	ARSENIC	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	BARIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	BERYLLIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	CADMIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	CALCIUM	MG/L	97.7	99.2	1030	914	125	--	129	44.2	81.8	57.1	116	627	593	--	134	185	182	136	105
6010B	CHROMIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	COBALT	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	COPPER	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	IRON	MG/L	0.926	0.667	127	123	10	--	9.48	0.1 U	0.091 J	13.7	0.825	169	202	--	0.0653 J	0.185	0.29	0.0807 J	0.1 U
6010B	LEAD	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	MAGNESIUM	MG/L	25.7	25.7	331	295	36.5	--	34.9	11.7	21.9	14.6	27.2	124	122	--	37.1	50.8	53.9	38.2	30.6
6010B	MOLYBDENUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	NICKEL	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	POTASSIUM	MG/L	2.71 J	4.2 J	11.1	10.6	5.7	--	4.88 J	2.11 J	3.35 J	3.88 J	4.51 J	17.6	16.7	--	6.23	9.54	8.47	5.58	6.89
6010B	SELENIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	SILVER	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	SODIUM	MG/L	209	200	1580	1920	163	--	150	113	151	273	304	3480	4000	--	219	258	271	211	156
6010B	THALLIUM/THALLIUM-201/230	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	VANADIUM	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6010B	ZINC	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7470A	MERCURY	UG/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,1-DICHLOROETHANE	UG/L	0.32 J	0.26 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,1-DICHLOROETHENE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,2-DICHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	1,2-DICHLOROPROPANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	2-BUTANONE	UG/L	50 U	50 U	480 J	330 J	50 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U	130 J	74 J	71 J	50 U	50 U	50 UJ	50 U	50 UJ
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
8260B	ACETONE	UG/L	50 UJ	50 UJ	99 J	73 J	50 U	50 U	50 UJ	50 UJ	50 U	50 UJ	50 U	50 U	50 UJ	50 UJ	50 UJ	50 UJ	50 U	50 UJ	50 UJ
8260B	BENZENE	UG/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
8260B	BROMODICHLOROMETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	BROMOFORM	UG/L	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 UJ	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U
8260B	BROMOMETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	CARBON TETRACHLORIDE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	CHLOROBENZENE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	CHLOROETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.28 J	1 U
8260B	CHLOROFORM	UG/L	0.68 J	0.62 J	1 U	1 U	0.34 J	0.36 J	0.38 J	1 U	1 U	1 U	1 U	1.9	1	1	0.3 J	0.28 J	0.29 J	0.29 J	0.4 J
8260B	CHLOROMETHANE	UG/L	1 U	1 U	1 U	0.23 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.25 J	0.46 J	0.48 J	1 U	1 U	1 U	1 U	1 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	44	37	9 J	6.2	150	150	82	1 U	1 U	74	7.5	22	20	21	20	48	58	17	1 U
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	ETHYLBENZENE	UG/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	METHYLENE CHLORIDE	UG/L	1 U	1 U	2.5 J	1.9 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	6.9	7	7.4	1 U	1 U	1 U	1 U	1 U
8260B	STYRENE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	TETRACHLOROETHENE	UG/L	130	110	1 U	1 U	1.3 J	2	19	1 U	1 U	33	31	13	7	6.6	160	390	380	150	0.68 J
8260B	TOLUENE	UG/L	0.5 U	0.5 U	1.2 J	1.5 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 J	3.5 J	3.5 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	0.28 J	0.31 J	1 U	1 U	0.5 J	0.67 J	0.39 J	1 U	1 U	0.24 J	1 U	0.25 J	1 U	1 U	0.23 J	0.26 J	0.46 J	1 U	1 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
8260B	TRICHLOROETHENE	UG/L	44	42	0.61 J	0.93 J	1.4	1.9	9.6	1 U	1 U	6.5	2.1	4.4	5.6	5.8	14	29	38	13	1 U
8260B	VINYL ACETATE	UG/L	50 UJ	50 U	50 U	50 U	50 UJ	50 UJ	50 U	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 U	50 U	50 UJ	50 U	50 UJ	50 U	50 U
8260B	VINYL CHLORIDE	UG/L	0.85	0.83	3.2 J	2.8	8.5	8.8	5.7	0.5 U	0.5 U	0.79	1.1	0.65	2.1	4.2	0.5 U	0.5 U	0.5 U	0.23 J	0.5 U
8260B	XYLENES, TOTAL	UG/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
9060	TOTAL ORGANIC CARBON	MG/L	2.9	2.68	2580	2760	3.83	--	3.62	3.02	2.57	3.39	2.74	6320	6230	--	1.77	2.14	2.2	1.75	3.33
GC-SCD	HYDROGEN SULFIDE	UG/L		0.42		2.1	--	--	0.42	--	0.42	--	0.42	--	5.7	--	--	0.42	--	0.42	--
RSK-175	CARBON DIOXIDE	UG/L	250000	300000	790000	670000	290000	--	270000	4000	10000	380000	420000	1000000	880000	--	37000	14000	15000	48000	11000
RSK-175	ETHANE	UG/L	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	--	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	--	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
RSK-175	ETHENE	UG/L	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	--	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	--	1.2 U	2.9	2.9	1.2 U	1.2 U
RSK-175	METHANE	UG/L	13000	9900	13000	11000	11000		9200	1.7	140	11000	9700	6700	6800	--	1700	520	330	1600	240

APPENDIX B6

SUMMARY OF LABORATORY ANALYSIS RESULTS FOR SAMPLES COLLECTED IN 2005

Lab Analysis Reference/ Method ID	AnalyteName	Result Units	MW-40-38 90-236 11/28/2005	MW-40-39 90-221 10/25/2005	MW-40-39 90-247 11/30/2005
160.1	TOTAL DISSOLVED SOLIDS	MG/L	975	2280	--
300.0	CHLORIDE	MG/L	246	676	--
300.0	NITRATE	MG/L	4.1	4.19	--
300.0	NITRITE	MG/L	0.164 J	0.1 U	--
300.0	SULFATE	MG/L	119	328	--
310.1	ALKALINITY	MG/L	222	216	--
410.4	CHEMICAL OXYGEN DEMAND	MG/L	20.6	10.2	--
6010B	ANTIMONY	MG/L	--	--	--
6010B	ARSENIC	MG/L	--	--	--
6010B	BARIUM	MG/L	--	--	--
6010B	BERYLLIUM	MG/L	--	--	--
6010B	CADMIUM	MG/L	--	--	--
6010B	CALCIUM	MG/L	109	248	--
6010B	CHROMIUM	MG/L	--	--	--
6010B	COBALT	MG/L	--	--	--
6010B	COPPER	MG/L	--	--	--
6010B	IRON	MG/L	0.05 J	0.1 U	--
6010B	LEAD	MG/L	--	--	--
6010B	MAGNESIUM	MG/L	31.9	64.2	--
6010B	MOLYBDENUM	MG/L	--	--	--
6010B	NICKEL	MG/L	--	--	--
6010B	POTASSIUM	MG/L	5	8.36	--
6010B	SELENIUM	MG/L	--	--	--
6010B	SILVER	MG/L	--	--	--
6010B	SODIUM	MG/L	173	360	--
6010B	THALLIUM/THALLIUM-201/230	MG/L	--	--	--
6010B	VANADIUM	MG/L	--	--	--
6010B	ZINC	MG/L	--	--	--
7470A	MERCURY	UG/L	--	--	--
8260B	1,1,1-TRICHLOROETHANE	UG/L	1 U	1 U	1 U
8260B	1,1,2,2-TETRACHLOROETHANE	UG/L	1 U	1 U	1 U
8260B	1,1,2-TRICHLOROETHANE	UG/L	1 U	1 U	1 U
8260B	1,1-DICHLOROETHANE	UG/L	1 U	1 U	1 U
8260B	1,1-DICHLOROETHENE	UG/L	1 U	1 U	1 U
8260B	1,2-DICHLOROETHANE	UG/L	1 U	1 U	1 U
8260B	1,2-DICHLOROPROPANE	UG/L	1 U	1 U	1 U
8260B	2-BUTANONE	UG/L	50 U	50 UJ	50 U
8260B	2-HEXANONE	UG/L	50 U	50 U	50 U
8260B	4-METHYL-2-PENTANONE	UG/L	50 U	50 U	50 U
8260B	ACETONE	UG/L	50 U	50 U	50 UJ
8260B	BENZENE	UG/L	0.5 U	0.5 U	0.5 U
8260B	BROMODICHLOROMETHANE	UG/L	1 U	1 U	1 U
8260B	BROMOFORM	UG/L	1 U	1 U	1 U
8260B	BROMOMETHANE	UG/L	1 UJ	1 U	1 U
8260B	CARBON TETRACHLORIDE	UG/L	1 U	1 U	1 U
8260B	CHLOROBENZENE	UG/L	1 U	1 U	1 U
8260B	CHLOROETHANE	UG/L	1 U	1 U	1 U
8260B	CHLOROFORM	UG/L	0.33 J	1 U	1 U
8260B	CHLOROMETHANE	UG/L	1 U	1 U	1 U
8260B	CIS-1,2-DICHLOROETHENE	UG/L	1 U	1 U	1 U
8260B	CIS-1,3-DICHLOROPROPENE	UG/L	1 U	1 U	1 U
8260B	DIBROMOCHLOROMETHANE	UG/L	1 U	1 U	1 U
8260B	ETHYLBENZENE	UG/L	0.5 U	0.5 U	0.5 U
8260B	METHYL TERT-BUTYL ETHER	UG/L	1 U	1 U	1 U
8260B	METHYLENE CHLORIDE	UG/L	1 U	1 U	1 U
8260B	STYRENE	UG/L	1 U	1 U	1 U
8260B	TETRACHLOROETHENE	UG/L	0.7 J	0.33 J	0.49 J
8260B	TOLUENE	UG/L	0.5 U	0.5 U	0.5 U
8260B	TRANS-1,2-DICHLOROETHENE	UG/L	1 U	1 U	1 U
8260B	TRANS-1,3-DICHLOROPROPENE	UG/L	1 U	1 U	1 U
8260B	TRICHLOROETHENE	UG/L	1 U	1 U	1 U
8260B	VINYL ACETATE	UG/L	50 U	50 UJ	50 U
8260B	VINYL CHLORIDE	UG/L	0.5 U	0.5 U	0.5 U
8260B	XYLENES, TOTAL	UG/L	1 U	1 U	1 U
9060	TOTAL ORGANIC CARBON	MG/L	2.89	1.46	--
GC-SCD	HYDROGEN SULFIDE	UG/L	0.42	--	--
RSK-175	CARBON DIOXIDE	UG/L	11000	22000	--
RSK-175	ETHANE	UG/L	1.3 U	1.3 U	--
RSK-175	ETHENE	UG/L	1.2 U	1.2 U	--
RSK-175	METHANE	UG/L	1100	0.67 J	--

Abbreviations and Acronyms:

mg/L – micrograms per liter

mg/L – milligrams per liter

J – estimated value

U – analyte is not detected at the listed reporting limit

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APPENDIX C

CHAIN OF CUSTODY AND LABORATORY ANALYTICAL RESULTS

(ON CD ONLY)

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TETRA TECH
1230 Columbia Street, Suite 750
San Diego, CA 92101 (619) 234-8696

CHAIN-OF-CUSTODY RECORD

NUMBER 40888

PROJECT NAME: Seal Beach NWS
PURCHASE ORDER NO.: 069630
PROJECT LOCATION: IRP Site 40
PROJECT NO.: 3210.010
SAMPLER NAME: Wendy Bryant
AIRBILL NUMBER: Courier
PROJECT CONTACT: J. Sodoku
PROJECT CONTACT PHONE NUMBER: 949-509-5022

LABORATORY NAME: EMAX
LABORATORY ID (FOR LABORATORY): 10E098

Project Information Section
Do not submit to Laboratory

ANALYSES REQUIRED

SAMPLE ID	DATE COLLECTED	TIME COLLECTED	NO. OF CONTAINER	LEVEL 3	LEVEL 4	TYPE	TAT	VOCs 8260B	TOC 9060	RSK-175	TDS 160.1	Cations 6010B	COD 410.4	Anions 300.0	Alkalinity 310.1	COMMENTS	LOCATION	DEPTH START	DEPTH END	QC
10-258	5/6/10	1522	4	X		W	5	X					X				MW-40-32 (MS 5)			N
10-259	5/6/10	1556	7		X	W	5	X		X			X				MW-40-35 (MS 6)			N
10-255A	5/6/10	1039	5	X		W	5	X			X		X				MW-40-22			N
10-262	5/6/10	1715	4	X		W	5	X					X				MW-40-13			N
10-263	5/6/10	1742	5	X		W	5	X			X		X				MW-40-39			N
10-264	5/6/10	1747	5	X		W	5	X			X		X				MW-40-39			FD
10-265	5/6/10	1815	~~5~~ 8	X		W	5	X		✓	X		X			*	MW-40-08			N
10-268	5/6/10	1854	9	X		W	5	X		X		X	X	X	X		MW-40-32			N

RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)
	5/7/10	Kevin Steel
COMPANY: TEEC	TIME: 8:10	COMPANY: Emax
RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)
COMPANY	TIME	COMPANY
RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)
COMPANY	TIME	COMPANY

LABORATORY INSTRUCTIONS/COMMENTS
* added RSK175 - 5/7/10 Sudoku
# of containers chg to "8"

COMPOSITE DESCRIPTION

SAMPLE CONDITION UPON RECEIPT (FOR LABORATORY)
TEMPERATURE: _____ SAMPLE CONDITION: ☐ INTACT ☐ BROKEN
COOLER SEAL: ☐ INTACT ☐ BROKEN

SAMPLING COMMENT:

0036769

White - Laboratory; Pink - Laboratory; Canary - Project File; Manila - Data Management

TETRA TECH
1230 Columbia Street, Suite 750
San Diego, CA 92101 (619) 234-8696

NUMBER 40889

CHAIN-OF-CUSTODY RECORD

ENTERED

PROJECT NAME: Seal Beach NWS.
PROJECT LOCATION: IRP Site 40
SAMPLER NAME: Wendy Bryant
PROJECT CONTACT: J. Jodoku

PURCHASE ORDER NO.: 061630
PROJECT NO.: 3210.010
AIRBILL NUMBER: Courier
PROJECT CONTACT PHONE NUMBER: 949-809-5022

LABORATORY NAME: EMAX
LABORATORY ID (FOR LABORATORY): 10E098

Project Information Section
Do not submit to Laboratory
5-13

ANALYSES REQUIRED

SAMPLE ID	DATE COLLECTED	TIME COLLECTED	NO. OF CONTAINER	LEVEL 3	LEVEL 4	TYPE	TAT	VOCs 8260B	TOC 9060	RSK-175	TDS 160.1	Cations 6010B	CN 4104	Anions 300.0	Alkalinity 310.1	COMMENTS	LOCATION	DEPTH START	DEPTH END	QC
10-277	5/6/10	0840	8	X		W	5 Day	X	X		X	X	X	X	X		QCSB Source Blank			SB
10-278	5/6/10	0850	3	X		W	5 Day	X									QCTB Trip Blank			TB
10-279	5/6/10	0900	8	X		W	5 Day	X	X			X	X	X	X		QCEB Equip Blank			EB
10-257	5/6/10	0920	11	X		W	5 Day	X	X	X	X	X	X	X	X		MW-4034			N
10-260	5/6/10	1008	11	X		W	5 Day	X	X	X	X	X	X	X	X		MW-4037			N
10-261	5/6/10	1243	11	X		W	5 Day	X	X	X	X	X	X	X	X		MW-40-07			N
10-266	5/6/10	1140	11		X	W	5 Day	X	X	X		X	X	X	X		MW-40-30			N
10-272	5/6/10	1346	8	X		W	5 Day	X	X			X	X	X	X		IW-6			N
10-267	5/6/10	1112	6	X		W	5 Day	X	X				X				MW-40-31			N
10-256	5/6/10	1425	32	X		W	5 Day	X	X	X		X	X	X	X	MS/MSD	MW-40-14			MS

RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)
	5/7/10	Keith Stout
COMPANY: TEC	TIME: 8:10	COMPANY: Emax
RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)
COMPANY	TIME	COMPANY
RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)
COMPANY	TIME	COMPANY

LABORATORY INSTRUCTIONS/COMMENTS

COMPOSITE DESCRIPTION

SAMPLE CONDITION UPON RECEIPT (FOR LABORATORY)
TEMPERATURE: _____ SAMPLE CONDITION: ☐ INTACT ☐ BROKEN
COOLER SEAL: ☐ INTACT ☐ BROKEN

SAMPLING COMMENT:

0036769

White - Laboratory; Pink - Laboratory; Canary - Project File; Manila - Data Management

LABORATORY DATA CONSULTANTS, INC.
7750 El Camino Real, Suite 2L Carlsbad, CA 92009 Phone: 760/634-0437 Fax: 760/634-0439

Tetra Tech EC, Inc.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
ATTN: Ms. Sabina Sudoko

June 8, 2010

SUBJECT: NWS Seal Beach CTO 010, Data Validation

Dear Ms. Sudoko,

Enclosed is the final validation report and Excel qualification sheet for the fractions listed below. These SDGs were received on June 3rd, 2010.

LDC project# 23272:

SDG #	Fraction
10E098, 10E119	Volatiles (EPA SW 846 Method 8260B) Metals (EPA SW 846 Method 6010B) Dissolved Gases (Method RSK-175) Wet Chemistry (EPA Method 160.1, 310.1, 410.4, 300.0, and EPA SW 846 Method 9060)

The following deliverables are submitted under this report:

- Attachment I — Sample ID Cross Reference and Data Review Level
- Attachment II — Overall Data Qualification Summary
- Attachment III — Tetra Tech EC Database Qualification Summary
- Attachment IV — Field Blank Summary
- Enclosure I — EPA Level III ADR Outliers (including manual review outliers)
- Enclosure II — EPA Level IV Validation Reports

The data validation was performed in accordance to the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, June 2008 and for Inorganic Data Review, October 2004. Where specific guidance is not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience. The following items were evaluated during the review:

- Holding Times
- Sample Preservation
- Cooler Temperatures
- Initial Calibration (Manual Review)
- Continuing Calibration (Manual Review)
- Blanks
- Surrogates
- Internal Standards (Manual Review)

- Matrix Spike/Matrix Spike Duplicates
- Laboratory Control Samples
- Detection and Quantitation Limits
- Field QC Samples

Please feel free to contact us if you have any questions.

Sincerely,

Andrew Kong
Project Manager/Chemist

Attachment I

Sample ID Cross Reference and Data Review Level

Sample Cross Reference

Date Collected	Field Sample ID	Lab Sample ID	Sample Type	Prep Method	Analytical Method	Review Level
06-May-2010	10-277	E098-01	SB	3010A	6010B	3
06-May-2010	10-277	E098-01	SB	5030B	8260B	3
06-May-2010	10-277	E098-01	SB	GEN PREP	160.1	3
06-May-2010	10-277	E098-01	SB	GEN PREP	300.0	3
06-May-2010	10-277	E098-01	SB	GEN PREP	300.0 N	3
06-May-2010	10-277	E098-01	SB	GEN PREP	310.1	3
06-May-2010	10-277	E098-01	SB	GEN PREP	410.4	3
06-May-2010	10-277	E098-01	SB	GEN PREP	9060	3
06-May-2010	10-278	E098-02	TB	5030B	8260B	3
06-May-2010	10-279	E098-03	EB	3010A	6010B	3
06-May-2010	10-279	E098-03	EB	5030B	8260B	3
06-May-2010	10-279	E098-03	EB	GEN PREP	300.0	3
06-May-2010	10-279	E098-03	EB	GEN PREP	300.0 N	3
06-May-2010	10-279	E098-03	EB	GEN PREP	310.1	3
06-May-2010	10-279	E098-03	EB	GEN PREP	410.4	3
06-May-2010	10-279	E098-03	EB	GEN PREP	9060	3
06-May-2010	10-257	E098-04	N	3010A	6010B	3
06-May-2010	10-257	E098-04	N	5030B	8260B	3
06-May-2010	10-257	E098-04	N	GEN PREP	300.0	3
06-May-2010	10-257	E098-04	N	GEN PREP	300.0 N	3
06-May-2010	10-257	E098-04	N	GEN PREP	310.1	3
06-May-2010	10-257	E098-04	N	GEN PREP	410.4	3
06-May-2010	10-257	E098-04	N	GEN PREP	9060	3
06-May-2010	10-257	E098-04	N	GEN PREP	RSK-175	3
06-May-2010	10-257	E098-04T	N	GEN PREP	RSK-175	3
06-May-2010	10-260	E098-05	N	3010A	6010B	3

III = EPA Level 3 Data Review *N = Normal Sample* *TB = Trip Blank* *MS = Matrix Spike*
IV = EPA Level 4 Data Validation *FD = Field Duplicate* *FB = Field Blank* *MSD = Matrix Spike Duplicate*

Sample Cross Reference

Date Collected	Field Sample ID	Lab Sample ID	Sample Type	Prep Method	Analytical Method	Review Level
06-May-2010	10-260	E098-05	N	5030B	8260B	3
06-May-2010	10-260	E098-05	N	GEN PREP	300.0	3
06-May-2010	10-260	E098-05	N	GEN PREP	300.0 N	3
06-May-2010	10-260	E098-05	N	GEN PREP	310.1	3
06-May-2010	10-260	E098-05	N	GEN PREP	410.4	3
06-May-2010	10-260	E098-05	N	GEN PREP	9060	3
06-May-2010	10-260	E098-05	N	GEN PREP	RSK-175	3
06-May-2010	10-260	E098-05T	N	5030B	8260B	3
06-May-2010	10-260	E098-05T	N	GEN PREP	RSK-175	3
06-May-2010	10-267	E098-09	N	5030B	8260B	3
06-May-2010	10-267	E098-09	N	GEN PREP	410.4	3
06-May-2010	10-267	E098-09	N	GEN PREP	9060	3
06-May-2010	10-266	E098-07	N	3010A	6010B	4
06-May-2010	10-266	E098-07	N	5030B	8260B	4
06-May-2010	10-266	E098-07	N	GEN PREP	300.0	3
06-May-2010	10-266	E098-07	N	GEN PREP	300.0 N	3
06-May-2010	10-266	E098-07	N	GEN PREP	310.1	3
06-May-2010	10-266	E098-07	N	GEN PREP	410.4	3
06-May-2010	10-266	E098-07	N	GEN PREP	9060	3
06-May-2010	10-266	E098-07	N	GEN PREP	RSK-175	4
06-May-2010	10-266	E098-07T	N	GEN PREP	RSK-175	4
06-May-2010	10-261	E098-06	N	3010A	6010B	3
06-May-2010	10-261	E098-06	N	GEN PREP	160.1	3
06-May-2010	10-261	E098-06	N	GEN PREP	300.0	3
06-May-2010	10-261	E098-06	N	GEN PREP	300.0 N	3
06-May-2010	10-261	E098-06	N	GEN PREP	310.1	3

III = EPA Level 3 Data Review *N = Normal Sample* *TB = Trip Blank* *MS = Matrix Spike*
IV = EPA Level 4 Data Validation *FD = Field Duplicate* *FB = Field Blank* *MSD = Matrix Spike Duplicate*

Sample Cross Reference

Date Collected	Field Sample ID	Lab Sample ID	Sample Type	Prep Method	Analytical Method	Review Level
06-May-2010	10-261	E098-06	N	GEN PREP	410.4	3
06-May-2010	10-261	E098-06	N	GEN PREP	9060	3
06-May-2010	10-261	E098-06	N	GEN PREP	RSK-175	3
06-May-2010	10-261	E098-06R	N	5030B	8260B	3
06-May-2010	10-261	E098-06T	N	GEN PREP	RSK-175	3
06-May-2010	10-272	E098-08	N	3010A	6010B	3
06-May-2010	10-272	E098-08	N	5030B	8260B	3
06-May-2010	10-272	E098-08	N	GEN PREP	300.0	3
06-May-2010	10-272	E098-08	N	GEN PREP	300.0 N	3
06-May-2010	10-272	E098-08	N	GEN PREP	310.1	3
06-May-2010	10-272	E098-08	N	GEN PREP	410.4	3
06-May-2010	10-272	E098-08R	N	GEN PREP	9060	3
06-May-2010	10-256	E098-10	N	3010A	6010B	3
06-May-2010	10-256	E098-10	N	5030B	8260B	3
06-May-2010	10-256	E098-10	N	GEN PREP	300.0	3
06-May-2010	10-256	E098-10	N	GEN PREP	300.0 N	3
06-May-2010	10-256	E098-10	N	GEN PREP	310.1	3
06-May-2010	10-256	E098-10	N	GEN PREP	410.4	3
06-May-2010	10-256	E098-10	N	GEN PREP	RSK-175	3
06-May-2010	10-256DUP	E098-10D	DUP	GEN PREP	300.0	3
06-May-2010	10-256DUP	E098-10D	DUP	GEN PREP	300.0 N	3
06-May-2010	10-256DUP	E098-10D	DUP	GEN PREP	310.1	3
06-May-2010	10-256DUP	E098-10D	DUP	GEN PREP	410.4	3
06-May-2010	10-256MS	E098-10G	MS	GEN PREP	9060	3
06-May-2010	10-256MS	E098-10M	MS	3010A	6010B	3
06-May-2010	10-256MS	E098-10M	MS	5030B	8260B	3

III = EPA Level 3 Data Review *N = Normal Sample* *TB = Trip Blank* *MS = Matrix Spike*
IV = EPA Level 4 Data Validation *FD = Field Duplicate* *FB = Field Blank* *MSD = Matrix Spike Duplicate*

Sample Cross Reference

Date Collected	Field Sample ID	Lab Sample ID	Sample Type	Prep Method	Analytical Method	Review Level
06-May-2010	10-256MS	E098-10M	MS	GEN PREP	300.0	3
06-May-2010	10-256MS	E098-10M	MS	GEN PREP	300.0 N	3
06-May-2010	10-256MS	E098-10M	MS	GEN PREP	410.4	3
06-May-2010	10-256MS	E098-10M	MS	GEN PREP	RSK-175	3
06-May-2010	10-256	E098-10R	N	GEN PREP	9060	3
06-May-2010	10-256MSD	E098-10S	MSD	3010A	6010B	3
06-May-2010	10-256MSD	E098-10S	MSD	5030B	8260B	3
06-May-2010	10-256MSD	E098-10S	MSD	GEN PREP	300.0	3
06-May-2010	10-256MSD	E098-10S	MSD	GEN PREP	300.0 N	3
06-May-2010	10-256MSD	E098-10S	MSD	GEN PREP	RSK-175	3
06-May-2010	10-256	E098-10T	N	GEN PREP	RSK-175	3
06-May-2010	10-256DUP	E098-10Z	DUP	GEN PREP	9060	3
06-May-2010	10-258	E098-11	N	5030B	8260B	3
06-May-2010	10-258	E098-11	N	GEN PREP	410.4	3
06-May-2010	10-259	E098-12	N	5030B	8260B	4
06-May-2010	10-259	E098-12	N	GEN PREP	410.4	3
06-May-2010	10-259	E098-12	N	GEN PREP	RSK-175	4
06-May-2010	10-259	E098-12T	N	GEN PREP	RSK-175	4
06-May-2010	10-255	E098-13	N	5030B	8260B	3
06-May-2010	10-255	E098-13	N	GEN PREP	160.1	3
06-May-2010	10-255	E098-13	N	GEN PREP	410.4	3
06-May-2010	10-262	E098-14	N	5030B	8260B	3
06-May-2010	10-262	E098-14	N	GEN PREP	410.4	3
06-May-2010	10-263	E098-15	N	5030B	8260B	3
06-May-2010	10-263	E098-15	N	GEN PREP	160.1	3
06-May-2010	10-263	E098-15	N	GEN PREP	410.4	3

III = EPA Level 3 Data Review *N = Normal Sample* *TB = Trip Blank* *MS = Matrix Spike*
IV = EPA Level 4 Data Validation *FD = Field Duplicate* *FB = Field Blank* *MSD = Matrix Spike Duplicate*

Sample Cross Reference

Date Collected	Field Sample ID	Lab Sample ID	Sample Type	Prep Method	Analytical Method	Review Level
06-May-2010	10-264	E098-16	FD	5030B	8260B	3
06-May-2010	10-264	E098-16	FD	GEN PREP	160.1	3
06-May-2010	10-264	E098-16	FD	GEN PREP	410.4	3
06-May-2010	10-265	E098-17	N	5030B	8260B	3
06-May-2010	10-265	E098-17	N	GEN PREP	160.1	3
06-May-2010	10-265	E098-17	N	GEN PREP	410.4	3
06-May-2010	10-265	E098-17	N	GEN PREP	RSK-175	3
06-May-2010	10-265DUP	E098-17D	DUP	GEN PREP	160.1	3
06-May-2010	10-265	E098-17T	N	GEN PREP	RSK-175	3
06-May-2010	10-268	E098-18	N	3010A	6010B	3
06-May-2010	10-268	E098-18	N	5030B	8260B	3
06-May-2010	10-268	E098-18	N	GEN PREP	300.0	3
06-May-2010	10-268	E098-18	N	GEN PREP	300.0 N	3
06-May-2010	10-268	E098-18	N	GEN PREP	310.1	3
06-May-2010	10-268	E098-18	N	GEN PREP	410.4	3
06-May-2010	10-268	E098-18	N	GEN PREP	RSK-175	3
06-May-2010	10-268	E098-18T	N	GEN PREP	RSK-175	3

III = EPA Level 3 Data Review *N = Normal Sample* *TB = Trip Blank* *MS = Matrix Spike*
IV = EPA Level 4 Data Validation *FD = Field Duplicate* *FB = Field Blank* *MSD = Matrix Spike Duplicate*

Attachment II

Overall Data Qualification Summary

Overall Qualified Results

Analytical Method	Field Sample ID	Matrix	Sample Type	Analyte	RL	Lab Result	Unc / Error	Overall Qualifier	Units	Reason Code
SDG: 10E098										
300.0	10-277	AQ	FB							
				CHLORIDE	0.200	0.164J		J	MG/L	
300.0	10-279	AQ	EB							
				CHLORIDE	0.200	0.189J		J	MG/L	
300.0 N	10-256	AQ	N							
				NITRATE	0.100	0.0878J		J	MG/L	
300.0 N	10-257	AQ	N							
				NITRATE	0.100	0.0592J		J	MG/L	
300.0 N	10-260	AQ	N							
				NITRATE	0.100	0.0555J		J	MG/L	
300.0 N	10-261	AQ	N							
				NITRATE	0.100	0.0745J		J	MG/L	
300.0 N	10-266	AQ	N							
				NITRATE	0.100	0.0712J		J	MG/L	
300.0 N	10-272	AQ	N							
				NITRATE	0.200	0.119J		J	MG/L	
300.0 N	10-277	AQ	FB							
				NITRITE	0.100	0.0677J		J	MG/L	
300.0 N	10-279	AQ	EB							
				NITRITE	0.100	0.0697J		J	MG/L	
8260B	10-256	AQ	N							
				ACETONE	50	8.1J		J	UG/L	
				TRANS-1,2-DICHLOROETHENE	1.0	0.44J		J	UG/L	
				TRICHLOROETHENE	1.0	0.92J		J	UG/L	
8260B	10-257	AQ	N							
				2-BUTANONE	50	5.1J		J	UG/L	
				ACETONE	50	11J		J	UG/L	
				VINYL CHLORIDE	0.50	0.33J		J	UG/L	

N = Normal Sample *TB = Trip Blank*
FD = Field Duplicate *FB = Field Blank*

Overall Qualified Results

Analytical Method	Field Sample ID	Matrix	Sample Type	Analyte	RL	Lab Result	Unc / Error	Overall Qualifier	Units	Reason Code
SDG: 10E098										
8260B	10-258	AQ	N							
				2-BUTANONE	50	35J		J	UG/L	
				ACETONE	50	20J		J	UG/L	
				TOLUENE	0.50	0.37J		J	UG/L	
				TRICHLOROETHENE	1.0	0.26J		J	UG/L	
8260B	10-259	AQ	N							
				TRANS-1,2-DICHLOROETHENE	1.0	0.38J		J	UG/L	
				TRICHLOROETHENE	1.0	0.56J		J	UG/L	
8260B	10-260	AQ	N							
				ACETONE	50	5.1J		J	UG/L	
				CHLOROETHANE	1.0	0.58J		J	UG/L	
8260B	10-261	AQ	N							
				ACETONE	50	6.6J		J	UG/L	
				CIS-1,2-DICHLOROETHENE	1.0	0.67J		J	UG/L	
				TRICHLOROETHENE	1.0	0.28J		J	UG/L	
8260B	10-263	AQ	N							
				TETRACHLOROETHENE	1.0	0.49J		J	UG/L	
8260B	10-264	AQ	FD							
				TETRACHLOROETHENE	1.0	0.41J		J	UG/L	
8260B	10-265	AQ	N							
				TRICHLOROETHENE	1.0	0.46J		J	UG/L	
8260B	10-266	AQ	N							
				2-BUTANONE	50	11J		J	UG/L	
				ACETONE	50	14J		J	UG/L	
				TOLUENE	0.50	0.36J		J	UG/L	
				TRICHLOROETHENE	1.0	0.79J		J	UG/L	
8260B	10-267	AQ	N							
				2-BUTANONE	50	5.9J		J	UG/L	
				ACETONE	50	8.6J		J	UG/L	
				CIS-1,2-DICHLOROETHENE	1.0	0.83J		J	UG/L	
				TOLUENE	0.50	0.30J		J	UG/L	

N = Normal Sample *TB = Trip Blank*
FD = Field Duplicate *FB = Field Blank*

Overall Qualified Results

Analytical Method	Field Sample ID	Matrix	Sample Type	Analyte	RL	Lab Result	Unc / Error	Overall Qualifier	Units	Reason Code
SDG: 10E098										
8260B	10-268	AQ	N							
				ACETONE	50	7.3J		J	UG/L	
8260B	10-272	AQ	N							
				2-BUTANONE	50	18J		J	UG/L	
				ETHYLBENZENE	0.50	0.32J		J	UG/L	
				TRICHLOROETHENE	1.0	0.71J		J	UG/L	
8260B	10-277	AQ	FB							
				ACETONE	50	6.4J		J	UG/L	
8260B	10-279	AQ	EB							
				ACETONE	50	7.8J		J	UG/L	
RSK-175	10-260	AQ	N							
				ETHANE	1.3	0.61J		J	UG/L	

N = Normal Sample *TB = Trip Blank*
FD = Field Duplicate *FB = Field Blank*

Attachment III

Tetra Tech EC Database Qualification Summary

Tetra Tech
Reason for Qualified Results
SDG Nos. : 10E098

Sample Del Group (SDG)	Sample ID	Test Method	CAS No.	Detected Qualifier	Non Detected Qualifier	Analyte Name	Reason

No Qualified Results

Attachment IV

Field Blank Summary

Field QC Detect Summary

SDG	Method	QC Type	Client Sample ID	Matrix	Sample Date	Analyte	Client Analyte ID	Lab Result	Units	Lab Qualifier	Reporting Limit
10E098	8260B	EB	10-279	AQ	05/06/2010 9:00	ACETONE	67-64-1	7.8	UG/L	J	50
10E098	300.0 N	EB	10-279	AQ	05/06/2010 9:00	NITRITE	14797-65-0	0.0697	MG/L	J	0.100
10E098	300.0 N	EB	10-279	AQ	05/06/2010 9:00	NITRATE	14797-55-8	0.162	MG/L		0.100
10E098	9060	EB	10-279	AQ	05/06/2010 9:00	TOTAL ORGANIC CARBON (TOC)	-28	1.26	MG/L		1.00
10E098	300.0	EB	10-279	AQ	05/06/2010 9:00	CHLORIDE	16887-00-6	0.189	MG/L	J	0.200
10E098	8260B	SB	10-277	AQ	05/06/2010 8:40	ACETONE	67-64-1	6.4	UG/L	J	50
10E098	300.0	SB	10-277	AQ	05/06/2010 8:40	CHLORIDE	16887-00-6	0.164	MG/L	J	0.200
10E098	300.0 N	SB	10-277	AQ	05/06/2010 8:40	NITRITE	14797-65-0	0.0677	MG/L	J	0.100
10E098	300.0 N	SB	10-277	AQ	05/06/2010 8:40	NITRATE	14797-55-8	0.161	MG/L		0.100
10E098	9060	SB	10-277	AQ	05/06/2010 8:40	TOTAL ORGANIC CARBON (TOC)	-28	1.44	MG/L		1.00

Enclosure I

EPA Level III ADR Outliers
(including Manual Review Outliers)

Quality Control Outlier Reports

10E098

Reporting Limits Outlier Report (detected results reported below the reporting limit)

Lab Report Batch: 10E098 **Lab ID:** EMXT

Client Sample ID	Lab Sample ID	Analysis Method	Matrix	Analyte Name	Lab Qualifier	Result	EDD Reporting Limit	Units
10-256	E098-10	300.0 N	AQ	NITRATE	J	0.0878	0.100	MG/L
		8260B		ACETONE	J	8.1	50	UG/L
				TRANS-1,2-DICHLOROETHENE	J	0.44	1.0	UG/L
				TRICHLOROETHENE	J	0.92	1.0	UG/L
10-257	E098-04	300.0 N		NITRATE	J	0.0592	0.100	MG/L
		8260B		2-BUTANONE	J	5.1	50	UG/L
				ACETONE	J	11	50	UG/L
				VINYL CHLORIDE	J	0.33	0.50	UG/L
10-258	E098-11			2-BUTANONE	J	35	50	UG/L
				ACETONE	J	20	50	UG/L
				TOLUENE	J	0.37	0.50	UG/L
				TRICHLOROETHENE	J	0.26	1.0	UG/L
10-259	E098-12			TRANS-1,2-DICHLOROETHENE	J	0.38	1.0	UG/L
				TRICHLOROETHENE	J	0.56	1.0	UG/L
10-260	E098-05	300.0 N		NITRATE	J	0.0555	0.100	MG/L
		8260B		ACETONE	J	5.1	50	UG/L
				CHLOROETHANE	J	0.58	1.0	UG/L
	E098-05T			TRANS-1,2-DICHLOROETHENE	J	2.4	10	UG/L
				TRICHLOROETHENE	J	4.1	10	UG/L
	E098-05	RSK-175		ETHANE	J	0.61	1.3	UG/L
10-261	E098-06	300.0 N		NITRATE	J	0.0745	0.100	MG/L
	E098-06R	8260B		ACETONE	J	6.6	50	UG/L
				CIS-1,2-DICHLOROETHENE	J	0.67	1.0	UG/L
				TRICHLOROETHENE	J	0.28	1.0	UG/L
10-263	E098-15			TETRACHLOROETHENE	J	0.49	1.0	UG/L
10-264	E098-16			TETRACHLOROETHENE	J	0.41	1.0	UG/L
10-265	E098-17			TRICHLOROETHENE	J	0.46	1.0	UG/L
10-266	E098-07	300.0 N		NITRATE	J	0.0712	0.100	MG/L
		8260B		2-BUTANONE	J	11	50	UG/L
				ACETONE	J	14	50	UG/L
				TOLUENE	J	0.36	0.50	UG/L
				TRICHLOROETHENE	J	0.79	1.0	UG/L
10-267	E098-09			2-BUTANONE	J	5.9	50	UG/L
				ACETONE	J	8.6	50	UG/L
				CIS-1,2-DICHLOROETHENE	J	0.83	1.0	UG/L
				TOLUENE	J	0.30	0.50	UG/L

Project Number and Name: **3210.010E - NWS SEAL BEACH, CTO 010**

Reporting Limits Outlier Report (detected results reported below the reporting limit)

Lab Report Batch: 10E098 **Lab ID:** EMXT

Client Sample ID	Lab Sample ID	Analysis Method	Matrix	Analyte Name	Lab Qualifier	Result	EDD Reporting Limit	Units
10-268	E098-18	8260B	AQ	ACETONE	J	7.3	50	UG/L
10-272	E098-08	300.0 N		NITRATE	J	0.119	0.200	MG/L
		8260B		2-BUTANONE	J	18	50	UG/L
				ETHYLBENZENE	J	0.32	0.50	UG/L
				TRICHLOROETHENE	J	0.71	1.0	UG/L
10-277	E098-01	300.0		CHLORIDE	J	0.164	0.200	MG/L
		300.0 N		NITRITE	J	0.0677	0.100	MG/L
		8260B		ACETONE	J	6.4	50	UG/L
10-279	E098-03	300.0		CHLORIDE	J	0.189	0.200	MG/L
		300.0 N		NITRITE	J	0.0697	0.100	MG/L
		8260B		ACETONE	J	7.8	50	UG/L

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/08/10 02:28
Sample ID:	10-277	Date Analyzed:	05/08/10 02:28
Lab Samp ID:	E098-01	Dilution Factor:	1
Lab File ID:	REC165	Matrix :	WATER
Ext Btch ID:	V067E07	% Moisture :	NA
Calib. Ref.:	RDC376	Instrument ID :	T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	6.4J J	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	ND	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	ND	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	ND	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	ND	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	ND	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	117	65-135
4-BROMOFLUOROBENZENE	97	75-125
TOLUENE-D8	101	75-125

6/8/10

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/08/10 01:58
Sample ID:	10-278	Date Analyzed:	05/08/10 01:58
Lab Samp ID:	E098-02	Dilution Factor:	1
Lab File ID:	REC164	Matrix	: WATER
Ext Btch ID:	V067E07	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	ND	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	ND	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	ND	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	ND	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	ND	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	ND	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	119	65-135
4-BROMOFLUOROBENZENE	97	75-125
TOLUENE-D8	99	75-125

6/8/10

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/08/10 02:58
Sample ID:	10-279	Date Analyzed:	05/08/10 02:58
Lab Samp ID:	E098-03	Dilution Factor:	1
Lab File ID:	REC166	Matrix	: WATER
Ext Btch ID:	V067E07	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	7.8J J	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	ND	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	ND	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	ND	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	ND	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	ND	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	119	65-135
4-BROMOFLUOROBENZENE	96	75-125
TOLUENE-D8	99	75-125

6/8/10

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/08/10 03:27
Sample ID:	10-257	Date Analyzed:	05/08/10 03:27
Lab Samp ID:	E098-04	Dilution Factor:	1
Lab File ID:	REC167	Matrix	: WATER
Ext Btch ID:	V067E07	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)		RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND		1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND		1.0	0.20
1,1,2-TRICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHENE	ND		1.0	0.20
1,2-DICHLOROETHANE	ND		1.0	0.20
1,2-DICHLOROPROPANE	ND		1.0	0.20
2-BUTANONE	5.1J	J	50	5.0
2-HEXANONE	ND		50	5.0
4-METHYL-2-PENTANONE	ND		50	5.0
ACETONE	11J	J	50	5.0
BENZENE	ND		0.50	0.20
BROMODICHLOROMETHANE	ND		1.0	0.20
BROMOFORM	ND		1.0	0.30
BROMOMETHANE	ND		1.0	0.20
CARBON TETRACHLORIDE	ND		1.0	0.20
CHLOROBENZENE	ND		1.0	0.20
CHLOROETHANE	ND		1.0	0.20
CHLOROFORM	ND		1.0	0.20
CHLOROMETHANE	ND		1.0	0.20
CIS-1,2-DICHLOROETHENE	ND		1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND		1.0	0.20
DIBROMOCHLOROMETHANE	ND		1.0	0.20
ETHYLBENZENE	ND		0.50	0.20
XYLENES	ND		1.0	0.20
MTBE	ND		1.0	0.20
METHYLENE CHLORIDE	ND		1.0	0.50
STYRENE	ND		1.0	0.20
TETRACHLOROETHENE	ND		1.0	0.20
TOLUENE	ND		0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND		1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND		1.0	0.20
TRICHLOROETHENE	ND		1.0	0.20
VINYL ACETATE	ND		50	0.20
VINYL CHLORIDE	0.33J	J	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	120	65-135
4-BROMOFLUOROBENZENE	98	75-125
TOLUENE-D8	100	75-125

6/8/10

2007

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/08/10 03:57
Sample ID:	10-260	Date Analyzed:	05/08/10 03:57
Lab Samp ID:	E098-05	Dilution Factor:	1
Lab File ID:	REC168	Matrix	: WATER
Ext Btch ID:	V067E07	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	5.1J J	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	0.58J J	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	87E R	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	ND	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLOROETHENE	2.4	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	4.0	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	37	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	123	65-135
4-BROMOFLUOROBENZENE	97	75-125
TOLUENE-D8	100	75-125

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2088

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/10/10 17:59
Sample ID:	10-260DL	Date Analyzed:	05/10/10 17:59
Lab Samp ID:	E098-05T	Dilution Factor:	10
Lab File ID:	REC196	Matrix	: WATER
Ext Btch ID:	V067E08	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND R	10	2.0
1,1,2,2-TETRACHLOROETHANE	ND	10	2.0
1,1,2-TRICHLOROETHANE	ND	10	2.0
1,1-DICHLOROETHANE	ND	10	2.0
1,1-DICHLOROETHENE	ND	10	2.0
1,2-DICHLOROETHANE	ND	10	2.0
1,2-DICHLOROPROPANE	ND	10	2.0
2-BUTANONE	ND	500	50
2-HEXANONE	ND	500	50
4-METHYL-2-PENTANONE	ND	500	50
ACETONE	ND	500	50
BENZENE	ND	5.0	2.0
BROMODICHLOROMETHANE	ND	10	2.0
BROMOFORM	ND	10	3.0
BROMOMETHANE	ND	10	2.0
CARBON TETRACHLORIDE	ND	10	2.0
CHLOROBENZENE	ND	10	2.0
CHLOROETHANE	ND	10	2.0
CHLOROFORM	ND	10	2.0
CHLOROMETHANE	ND	10	2.0
CIS-1,2-DICHLOROETHENE	90	10	2.0
CIS-1,3-DICHLOROPROPENE	ND R	10	2.0
DIBROMOCHLOROMETHANE	ND	10	2.0
ETHYLBENZENE	ND	5.0	2.0
XYLENES	ND	10	2.0
MTBE	ND	10	2.0
METHYLENE CHLORIDE	ND	10	5.0
STYRENE	ND	10	2.0
TETRACHLOROETHENE	ND	10	2.0
TOLUENE	ND	5.0	2.0
TRANS-1,2-DICHLOROETHENE	2.4J	10	2.0
TRANS-1,3-DICHLOROPROPENE	ND	10	2.0
TRICHLOROETHENE	4.1J	10	2.0
VINYL ACETATE	ND	500	2.0
VINYL CHLORIDE	42	5.0	2.0

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	122	65-135
4-BROMOFLUOROBENZENE	99	75-125
TOLUENE-D8	100	75-125

a 6/8/10

2009

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/10/10 19:28
Sample ID:	10-261	Date Analyzed:	05/10/10 19:28
Lab Samp ID:	E098-06R	Dilution Factor:	1
Lab File ID:	REC199	Matrix	: WATER
Ext Btch ID:	V067E08	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	6.6J J	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	ND	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	0.67J J	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	ND	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	0.28J J	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	0.78	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	124	65-135
4-BROMOFLUOROBENZENE	94	75-125
TOLUENE-D8	99	75-125

6/8/10

2010

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/08/10 04:57
Sample ID:	10-266	Date Analyzed:	05/08/10 04:57
Lab Samp ID:	E098-07	Dilution Factor:	1
Lab File ID:	REC170	Matrix	: WATER
Ext Btch ID:	V067E07	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)		RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND		1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND		1.0	0.20
1,1,2-TRICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHENE	ND		1.0	0.20
1,2-DICHLOROETHANE	ND		1.0	0.20
1,2-DICHLOROPROPANE	ND		1.0	0.20
2-BUTANONE	11J	J	50	5.0
2-HEXANONE	ND		50	5.0
4-METHYL-2-PENTANONE	ND		50	5.0
ACETONE	14J	J	50	5.0
BENZENE	ND		0.50	0.20
BROMODICHLOROMETHANE	ND		1.0	0.20
BROMOFORM	ND		1.0	0.30
BROMOMETHANE	ND		1.0	0.20
CARBON TETRACHLORIDE	ND		1.0	0.20
CHLOROBENZENE	ND		1.0	0.20
CHLOROETHANE	ND		1.0	0.20
CHLOROFORM	ND		1.0	0.20
CHLOROMETHANE	ND		1.0	0.20
CIS-1,2-DICHLOROETHENE	3.7		1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND		1.0	0.20
DIBROMOCHLOROMETHANE	ND		1.0	0.20
ETHYLBENZENE	ND		0.50	0.20
XYLENES	ND		1.0	0.20
MTBE	ND		1.0	0.20
METHYLENE CHLORIDE	ND		1.0	0.50
STYRENE	ND		1.0	0.20
TETRACHLOROETHENE	ND		1.0	0.20
TOLUENE	0.36J	J	0.50	0.20
TRANS-1,2-DICHLOROETHENE	1.1		1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND		1.0	0.20
TRICHLOROETHENE	0.79J	J	1.0	0.20
VINYL ACETATE	ND		50	0.20
VINYL CHLORIDE	4.0		0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	120	65-135
4-BROMOFLUOROBENZENE	98	75-125
TOLUENE-D8	99	75-125

a 6/8/10

2011

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/08/10 05:27
Sample ID:	10-272	Date Analyzed:	05/08/10 05:27
Lab Samp ID:	E098-08	Dilution Factor:	1
Lab File ID:	REC171	Matrix	: WATER
Ext Btch ID:	V067E07	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)		RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND		1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND		1.0	0.20
1,1,2-TRICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHENE	ND		1.0	0.20
1,2-DICHLOROETHANE	ND		1.0	0.20
1,2-DICHLOROPROPANE	ND		1.0	0.20
2-BUTANONE	18J	J	50	5.0
2-HEXANONE	ND		50	5.0
4-METHYL-2-PENTANONE	ND		50	5.0
ACETONE	230		50	5.0
BENZENE	ND		0.50	0.20
BROMODICHLOROMETHANE	ND		1.0	0.20
BROMOFORM	ND		1.0	0.30
BROMOMETHANE	ND		1.0	0.20
CARBON TETRACHLORIDE	ND		1.0	0.20
CHLOROBENZENE	ND		1.0	0.20
CHLOROETHANE	ND		1.0	0.20
CHLOROFORM	ND		1.0	0.20
CHLOROMETHANE	ND		1.0	0.20
CIS-1,2-DICHLOROETHENE	1.5		1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND		1.0	0.20
DIBROMOCHLOROMETHANE	ND		1.0	0.20
ETHYLBENZENE	0.32J	J	0.50	0.20
XYLENES	ND		1.0	0.20
MTBE	ND		1.0	0.20
METHYLENE CHLORIDE	ND		1.0	0.50
STYRENE	ND		1.0	0.20
TETRACHLOROETHENE	ND		1.0	0.20
TOLUENE	ND		0.50	0.20
TRANS-1,2-DICHLOROETHENE	2.5		1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND		1.0	0.20
TRICHLOROETHENE	0.71J	J	1.0	0.20
VINYL ACETATE	ND		50	0.20
VINYL CHLORIDE	2.3		0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	128	65-135
4-BROMOFLUOROBENZENE	94	75-125
TOLUENE-D8	98	75-125

CL 6/8/10

2018

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client : TETRA TECH EC, INC.	Date Collected: 05/06/10
Project : NWS SEAL BEACH, CTO 010	Date Received: 05/07/10
Batch No. : 10E098	Date Extracted: 05/08/10 05:57
Sample ID: 10-267	Date Analyzed: 05/08/10 05:57
Lab Samp ID: E098-09	Dilution Factor: 1
Lab File ID: REC172	Matrix : WATER
Ext Btch ID: V067E07	% Moisture : NA
Calib. Ref.: RDC376	Instrument ID : T-067

PARAMETERS	RESULTS (ug/L)		RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND		1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND		1.0	0.20
1,1,2-TRICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHENE	ND		1.0	0.20
1,2-DICHLOROETHANE	ND		1.0	0.20
1,2-DICHLOROPROPANE	ND		1.0	0.20
2-BUTANONE	5.9J	J	50	5.0
2-HEXANONE	ND		50	5.0
4-METHYL-2-PENTANONE	ND		50	5.0
ACETONE	8.6J	J	50	5.0
BENZENE	ND		0.50	0.20
BROMODICHLOROMETHANE	ND		1.0	0.20
BROMOFORM	ND		1.0	0.30
BROMOMETHANE	ND		1.0	0.20
CARBON TETRACHLORIDE	ND		1.0	0.20
CHLOROBENZENE	ND		1.0	0.20
CHLOROETHANE	ND		1.0	0.20
CHLOROFORM	ND		1.0	0.20
CHLOROMETHANE	ND		1.0	0.20
CIS-1,2-DICHLOROETHENE	0.83J	J	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND		1.0	0.20
DIBROMOCHLOROMETHANE	ND		1.0	0.20
ETHYLBENZENE	ND		0.50	0.20
XYLENES	ND		1.0	0.20
MTBE	ND		1.0	0.20
METHYLENE CHLORIDE	ND		1.0	0.50
STYRENE	ND		1.0	0.20
TETRACHLOROETHENE	ND		1.0	0.20
TOLUENE	0.30J	J	0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND		1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND		1.0	0.20
TRICHLOROETHENE	ND		1.0	0.20
VINYL ACETATE	ND		50	0.20
VINYL CHLORIDE	0.60		0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	123	65-135
4-BROMOFLUOROBENZENE	96	75-125
TOLUENE-D8	98	75-125

6/8/10

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/08/10 08:55
Sample ID:	10-256	Date Analyzed:	05/08/10 08:55
Lab Samp ID:	E098-10	Dilution Factor:	1
Lab File ID:	REC178	Matrix	: WATER
Ext Btch ID:	V067E07	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	8.1J J	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	ND	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	1.3	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	ND	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLOROETHENE	0.44J J	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	0.92J J	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	3.1	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	123	65-135
4-BROMOFLUOROBENZENE	98	75-125
TOLUENE-D8	99	75-125

6/8/10

2020

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/08/10 06:26
Sample ID:	10-258	Date Analyzed:	05/08/10 06:26
Lab Samp ID:	E098-11	Dilution Factor:	1
Lab File ID:	REC173	Matrix	: WATER
Ext Btch ID:	V067E07	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)		RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND		1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND		1.0	0.20
1,1,2-TRICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHENE	ND		1.0	0.20
1,2-DICHLOROETHANE	ND		1.0	0.20
1,2-DICHLOROPROPANE	ND		1.0	0.20
2-BUTANONE	35J	J	50	5.0
2-HEXANONE	ND		50	5.0
4-METHYL-2-PENTANONE	ND		50	5.0
ACETONE	20J	J	50	5.0
BENZENE	ND		0.50	0.20
BROMODICHLOROMETHANE	ND		1.0	0.20
BROMOFORM	ND		1.0	0.30
BROMOMETHANE	ND		1.0	0.20
CARBON TETRACHLORIDE	ND		1.0	0.20
CHLOROBENZENE	ND		1.0	0.20
CHLOROETHANE	ND		1.0	0.20
CHLOROFORM	ND		1.0	0.20
CHLOROMETHANE	ND		1.0	0.20
CIS-1,2-DICHLOROETHENE	2.5		1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND		1.0	0.20
DIBROMOCHLOROMETHANE	ND		1.0	0.20
ETHYLBENZENE	ND		0.50	0.20
XYLENES	ND		1.0	0.20
MTBE	ND		1.0	0.20
METHYLENE CHLORIDE	ND		1.0	0.50
STYRENE	ND		1.0	0.20
TETRACHLOROETHENE	ND		1.0	0.20
TOLUENE	0.37J	J	0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND		1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND		1.0	0.20
TRICHLOROETHENE	0.26J	J	1.0	0.20
VINYL ACETATE	ND		50	0.20
VINYL CHLORIDE	ND		0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	126	65-135
4-BROMOFLUOROBENZENE	92	75-125
TOLUENE-D8	97	75-125

CL 6/8/10

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/08/10 06:56
Sample ID:	10-259	Date Analyzed:	05/08/10 06:56
Lab Samp ID:	E098-12	Dilution Factor:	1
Lab File ID:	REC174	Matrix	: WATER
Ext Btch ID:	V067E07	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)		RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND		1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND		1.0	0.20
1,1,2-TRICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHENE	ND		1.0	0.20
1,2-DICHLOROETHANE	ND		1.0	0.20
1,2-DICHLOROPROPANE	ND		1.0	0.20
2-BUTANONE	ND		50	5.0
2-HEXANONE	ND		50	5.0
4-METHYL-2-PENTANONE	ND		50	5.0
ACETONE	ND		50	5.0
BENZENE	ND		0.50	0.20
BROMODICHLOROMETHANE	ND		1.0	0.20
BROMOFORM	ND		1.0	0.30
BROMOMETHANE	ND		1.0	0.20
CARBON TETRACHLORIDE	ND		1.0	0.20
CHLOROBENZENE	ND		1.0	0.20
CHLOROETHANE	ND		1.0	0.20
CHLOROFORM	ND		1.0	0.20
CHLOROMETHANE	ND		1.0	0.20
CIS-1,2-DICHLOROETHENE	1.5		1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND		1.0	0.20
DIBROMOCHLOROMETHANE	ND		1.0	0.20
ETHYLBENZENE	ND		0.50	0.20
XYLENES	ND		1.0	0.20
MTBE	ND		1.0	0.20
METHYLENE CHLORIDE	ND		1.0	0.50
STYRENE	ND		1.0	0.20
TETRACHLOROETHENE	ND		1.0	0.20
TOLUENE	ND		0.50	0.20
TRANS-1,2-DICHLOROETHENE	0.38J	J	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND		1.0	0.20
TRICHLOROETHENE	0.56J	J	1.0	0.20
VINYL ACETATE	ND		50	0.20
VINYL CHLORIDE	2.2		0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	121	65-135
4-BROMOFLUOROBENZENE	97	75-125
TOLUENE-D8	100	75-125

CL 6/8/10

2022

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/08/10 07:26
Sample ID:	10-255	Date Analyzed:	05/08/10 07:26
Lab Samp ID:	E098-13	Dilution Factor:	1
Lab File ID:	REC175	Matrix :	WATER
Ext Btch ID:	V067E07	% Moisture :	NA
Calib. Ref.:	RDC376	Instrument ID :	T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	ND	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	ND	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	2.5	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	ND	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLOROETHENE	6.3	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	1.9	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	4.6	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	124	65-135
4-BROMOFLUOROBENZENE	95	75-125
TOLUENE-D8	99	75-125

CA 6/8/10

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client : TETRA TECH EC, INC.	Date Collected: 05/06/10
Project : NWS SEAL BEACH, CTO 010	Date Received: 05/07/10
Batch No. : 10E098	Date Extracted: 05/08/10 07:55
Sample ID: 10-262	Date Analyzed: 05/08/10 07:55
Lab Samp ID: E098-14	Dilution Factor: 1
Lab File ID: REC176	Matrix : WATER
Ext Btch ID: V067E07	% Moisture : NA
Calib. Ref.: RDC376	Instrument ID : T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	ND	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	ND	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	ND	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	ND	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	ND	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	ND	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	126	65-135
4-BROMOFLUOROBENZENE	96	75-125
TOLUENE-D8	97	75-125

cl 6/8/10

2028

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/08/10 08:25
Sample ID:	10-263	Date Analyzed:	05/08/10 08:25
Lab Samp ID:	E098-15	Dilution Factor:	1
Lab File ID:	REC177	Matrix	: WATER
Ext Btch ID:	V067E07	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	ND	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	ND	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	ND	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	0.49J J	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	ND	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	ND	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	123	65-135
4-BROMOFLUOROBENZENE	95	75-125
TOLUENE-D8	99	75-125

A 6/8/10

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/07/10 20:31
Sample ID:	10-264	Date Analyzed:	05/07/10 20:31
Lab Samp ID:	E098-16	Dilution Factor:	1
Lab File ID:	REC153	Matrix	: WATER
Ext Btch ID:	V067E06	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	ND	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	ND	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	ND	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	0.41J J	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	ND	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	ND	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	120	65-135
4-BROMOFLUOROBENZENE	99	75-125
TOLUENE-D8	100	75-125

CA 6/8/10

2030

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/07/10 20:02
Sample ID:	10-265	Date Analyzed:	05/07/10 20:02
Lab Samp ID:	E098-17	Dilution Factor:	1
Lab File ID:	REC152	Matrix	: WATER
Ext Btch ID:	V067E06	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	ND	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	ND	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	27	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	ND	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	0.46J J	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	ND	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	119	65-135
4-BROMOFLUOROBENZENE	96	75-125
TOLUENE-D8	100	75-125

CL 6/8/10

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/07/10 19:32
Sample ID:	10-268	Date Analyzed:	05/07/10 19:32
Lab Samp ID:	E098-18	Dilution Factor:	1
Lab File ID:	REC151	Matrix	: WATER
Ext Btch ID:	V067E06	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	7.3J J	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	ND	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	1.2	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	ND	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLORDETHENE	ND	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	ND	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	2.1	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	123	65-135
4-BROMOFLUOROBENZENE	97	75-125
TOLUENE-D8	98	75-125

A 6/8/10

METHOD 3010A/6010B
METALS BY ICP

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10 08:40
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
SDG NO.	: 10E098	Date Extracted:	05/11/10 09:30
Sample ID:	10-277	Date Analyzed:	05/11/10 18:58
Lab Samp ID:	E098-01	Dilution Factor:	1
Lab File ID:	ID8E012042	Matrix :	WATER
Ext Btch ID:	IPE030W	% Moisture :	NA
Calib. Ref.:	ID8E012032	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/L)	RL (mg/L)	MDL (mg/L)
Calcium	ND	5.00	2.00
Iron	ND	0.100	0.0400
Magnesium	ND	5.00	2.00
Potassium	ND	5.00	2.00
Sodium	ND	5.00	2.00

6/8/10

7003

METHOD 3010A/6010B
METALS BY ICP

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10 09:00
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
SDG NO.	: 10E098	Date Extracted:	05/11/10 09:30
Sample ID:	10-279	Date Analyzed:	05/11/10 19:03
Lab Samp ID:	E098-03	Dilution Factor:	1
Lab File ID:	ID8E012043	Matrix :	WATER
Ext Btch ID:	IPE030W	% Moisture :	NA
Calib. Ref.:	ID8E012032	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/L)	RL (mg/L)	MDL (mg/L)
Calcium	ND	5.00	2.00
Iron	ND	0.100	0.0400
Magnesium	ND	5.00	2.00
Potassium	ND	5.00	2.00
Sodium	ND	5.00	2.00

AI 6/8/10

7884

METHOD 3010A/6010B
METALS BY ICP

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10 09:20
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
SDG NO.	: 10E098	Date Extracted:	05/11/10 09:30
Sample ID:	10-257	Date Analyzed:	05/11/10 19:22
Lab Samp ID:	E098-04	Dilution Factor:	1
Lab File ID:	ID8E012046	Matrix :	WATER
Ext Btch ID:	IPE030W	% Moisture :	NA
Calib. Ref.:	ID8E012D44	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/L)	RL (mg/L)	MDL (mg/L)
Calcium	83.9	5.00	2.00
Iron	17.1	0.100	0.0400
Magnesium	19.1	5.00	2.00
Potassium	5.43	5.00	2.00
Sodium	153	5.00	2.00

Cl 6/8/10

METHOD 3010A/6010B
METALS BY ICP

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10 10:08
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
SDG NO.	: 10E098	Date Extracted:	05/11/10 09:30
Sample ID:	10-260	Date Analyzed:	05/11/10 19:27
Lab Samp ID:	E098-05	Dilution Factor:	1
Lab File ID:	ID8E012047	Matrix :	WATER
Ext Btch ID:	IPE030W	% Moisture :	NA
Calib. Ref.:	ID8E012044	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/L)	RL (mg/L)	MDL (mg/L)
Calcium	236	5.00	2.00
Iron	15.2	0.100	0.0400
Magnesium	77.3	5.00	2.00
Potassium	5.40	5.00	2.00
Sodium	270	5.00	2.00

Cl 6/8/10

7006

METHOD 3010A/6010B
METALS BY ICP

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10 12:43
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
SDG NO.	: 10E098	Date Extracted:	05/11/10 09:30
Sample ID:	10-261	Date Analyzed:	05/11/10 19:32
Lab Samp ID:	E098-06	Dilution Factor:	1
Lab File ID:	ID8E012048	Matrix :	WATER
Ext Btch ID:	IPE030W	% Moisture :	NA
Calib. Ref.:	ID8E012044	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/L)	RL (mg/L)	MDL (mg/L)
Calcium	271	5.00	2.00
Iron	7.23	0.100	0.0400
Magnesium	78.5	5.00	2.00
Potassium	6.06	5.00	2.00
Sodium	282	5.00	2.00

CL 6/8/10

METHOD 3010A/6010B
METALS BY ICP

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10 11:40
Project	: NWS SEAL BEACH, CTO 010	Date Received.	05/07/10
SDG NO.	: 10E098	Date Extracted:	05/11/10 09:30
Sample ID:	10-266	Date Analyzed:	05/11/10 19:38
Lab Samp ID:	E098-07	Dilution Factor:	1
Lab File ID:	ID8E012049	Matrix :	WATER
Ext Btch ID:	IPE030W	% Moisture :	NA
Calib. Ref.:	ID8E012044	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/L)	RL (mg/L)	MDL (mg/L)
Calcium	182	5.00	2.00
Iron	40.1	0.100	0.0400
Magnesium	49.5	5.00	2.00
Potassium	8.33	5.00	2.00
Sodium	300	5.00	2.00

A 6/8/10

7008

METHOD 3010A/6010B
METALS BY ICP

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10 13:46
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
SDG NO.	: 10E098	Date Extracted:	05/11/10 09:30
Sample ID:	10-272	Date Analyzed:	05/11/10 19:43
Lab Samp ID:	E098-08	Dilution Factor:	1
Lab File ID:	ID8E012050	Matrix :	WATER
Ext Btch ID:	IPE030W	% Moisture :	NA
Calib. Ref.:	ID8E012044	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/L)	RL (mg/L)	MDL (mg/L)
Calcium	155	5.00	2.00
Iron	33.3	0.100	0.0400
Magnesium	52.8	5.00	2.00
Potassium	20.6	5.00	2.00
Sodium	537	5.00	2.00

Cl 6/8/10

7009

METHOD 3010A/6010B
METALS BY ICP

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10 14:25
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
SDG NO.	: 10E098	Date Extracted:	05/11/10 09:30
Sample ID:	10-256	Date Analyzed:	05/11/10 18:37
Lab Samp ID:	E098-10	Dilution Factor:	1
Lab File ID:	ID8E012038	Matrix :	WATER
Ext Btch ID:	IPE030W	% Moisture :	NA
Calib. Ref.:	ID8E012032	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/L)	RL (mg/L)	MDL (mg/L)
Calcium	329	5.00	2.00
Iron	29.2	0.100	0.0400
Magnesium	87.5	5.00	2.00
Potassium	6.27	5.00	2.00
Sodium	360	5.00	2.00

6/8/10

7010

METHOD 3010A/6010B
METALS BY ICP

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10 18:54
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
SDG NO.	: 10E098	Date Extracted:	05/11/10 09:30
Sample ID:	10-268	Date Analyzed:	05/11/10 19:48
Lab Samp ID:	E098-18	Dilution Factor:	1
Lab File ID:	ID8E012051	Matrix :	WATER
Ext Btch ID:	IPE030W	% Moisture :	NA
Calib. Ref.:	ID8E012044	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/L)	RL (mg/L)	MDL (mg/L)
Calcium	241	5.00	2.00
Iron	48.7	0.100	0.0400
Magnesium	74.3	5.00	2.00
Potassium	7.19	5.00	2.00
Sodium	229	5.00	2.00

cl 6/8/10

7011

METHOD 160.1
TOTAL DISSOLVED SOLIDS

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO 010
Batch No. : 10E098

Matrix : WATER
Instrument ID : 40706360

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	TDE003WB	ND	1	NA	10.0	5.00	05/07/1015:49	NA	TDE00301	NA	TDE003W	NA	NA
LCS1W	TDE003WL	895	1	NA	10.0	5.00	05/07/1015:49	NA	TDE00302	NA	TDE003W	NA	NA
LCD1W	TDE003WC	930	1	NA	10.0	5.00	05/07/1015:49	NA	TDE00303	NA	TDE003W	NA	NA
10-277	E098-01	ND	1	NA	10.0	5.00	05/07/1015:49	NA	TDE00312	NA	TDE003W	05/06/1008:40	05/07/10
10-261	E098-06	1900	1	NA	10.0	5.00	05/07/1015:49	NA	TDE00313	NA	TDE003W	05/06/1012:43	05/07/10
10-255	E098-13	2060	1	NA	10.0	5.00	05/07/1015:49	NA	TDE00314	NA	TDE003W	05/06/1016:39	05/07/10
10-263	E098-15	2080	1	NA	10.0	5.00	05/07/1015:49	NA	TDE00315	NA	TDE003W	05/06/1017:42	05/07/10
10-264	E098-16	2080	1	NA	10.0	5.00	05/07/1015:49	NA	TDE00316	NA	TDE003W	05/06/1017:47	05/07/10
10-265	E098-17	1110	1	NA	10.0	5.00	05/07/1015:49	NA	TDE00317	NA	TDE003W	05/06/1018:15	05/07/10
10-265DUP	E098-17D	1130	1	NA	10.0	5.00	05/07/1015:49	NA	TDE00318	NA	TDE003W	05/06/1018:15	05/07/10

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0092

METHOD 300.0
CHLORIDE

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO 010
Batch No. : 10E098

Matrix : WATER
Instrument ID : I100

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	ICE005WB	ND	1	NA	0.200	0.100	05/07/1010:23	NA	AE07-03	AE07-01	ICE005W	NA	NA
LCS1W	ICE005WL	4.94	1	NA	0.200	0.100	05/07/1010:39	NA	AE07-04	AE07-01	ICE005W	NA	NA
LCD1W	ICE005WC	4.75	1	NA	0.200	0.100	05/07/1010:55	NA	AE07-05	AE07-01	ICE005W	NA	NA
10-277	E098-01	0.164J	1	NA	0.200	0.100	05/07/1011:11	NA	AE07-06	AE07-01	ICE005W	05/06/1008:40	05/07/10
10-279	E098-03	0.189J	1	NA	0.200	0.100	05/07/1011:27	NA	AE07-07	AE07-01	ICE005W	05/06/1009:00	05/07/10
MBLK2W	ICE007WB	ND	1	NA	0.200	0.100	05/07/1019:49	NA	AE07-38	AE07-36	ICE007W	NA	NA
LCS2W	ICE007WL	4.81	1	NA	0.200	0.100	05/07/1020:05	NA	AE07-39	AE07-36	ICE007W	NA	NA
LCD2W	ICE007WC	4.88	1	NA	0.200	0.100	05/07/1020:21	NA	AE07-40	AE07-36	ICE007W	NA	NA
10-257	E098-04	71.6	5	NA	1.00	0.500	05/07/1021:42	NA	AE07-45	AE07-36	ICE007W	05/06/1009:20	05/07/10
10-260	E098-05	461	40	NA	8.00	4.00	05/07/1021:58	NA	AE07-46	AE07-36	ICE007W	05/06/1010:08	05/07/10
10-261	E098-06	305	20	NA	4.00	2.00	05/07/1023:02	NA	AE07-50	AE07-48	ICE007W	05/06/1012:43	05/07/10
10-266	E098-07	121	10	NA	2.00	1.00	05/07/1023:19	NA	AE07-51	AE07-48	ICE007W	05/06/1011:40	05/07/10
10-272	E098-08	143	10	NA	2.00	1.00	05/07/1023:35	NA	AE07-52	AE07-48	ICE007W	05/06/1013:46	05/07/10
10-256	E098-10	374	40	NA	8.00	4.00	05/07/1023:51	NA	AE07-53	AE07-48	ICE007W	05/06/1014:25	05/07/10
10-256DUP	E098-10D	356	40	NA	8.00	4.00	05/08/1000:07	NA	AE07-54	AE07-48	ICE007W	05/06/1014:25	05/07/10
10-256MS	E098-10M	554	40	NA	8.00	4.00	05/08/1000:23	NA	AE07-55	AE07-48	ICE007W	05/06/1014:25	05/07/10
10-256MSD	E098-10S	541	40	NA	8.00	4.00	05/08/1000:39	NA	AE07-56	AE07-48	ICE007W	05/06/1014:25	05/07/10
10-268	E098-18	126	10	NA	2.00	1.00	05/08/1000:56	NA	AE07-57	AE07-48	ICE007W	05/06/1018:54	05/07/10

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METHOD 300.0
NITRATE-N

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO 010
Batch No. : 10E098

Matrix : WATER
Instrument ID : I100

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	ICE005WB	ND	1	NA	0.100	0.0500	05/07/1010:23	NA	AE07-03	AE07-01	ICE005W	NA	NA
LCS1W	ICE005WL	1.88	1	NA	0.100	0.0500	05/07/1010:39	NA	AE07-04	AE07-01	ICE005W	NA	NA
LCD1W	ICE005WC	1.90	1	NA	0.100	0.0500	05/07/1010:55	NA	AE07-05	AE07-01	ICE005W	NA	NA
10-277	E098-01	0.161	1	NA	0.100	0.0500	05/07/1011:11	NA	AE07-06	AE07-01	ICE005W	05/06/1008:40	05/07/10
10-279	E098-03	0.162	1	NA	0.100	0.0500	05/07/1011:27	NA	AE07-07	AE07-01	ICE005W	05/06/1009:00	05/07/10
10-257	E098-04	0.0592J	1	NA	0.100	0.0500	05/07/1011:44	NA	AE07-08	AE07-01	ICE005W	05/06/1009:20	05/07/10
10-260	E098-05	0.0555J	1	NA	0.100	0.0500	05/07/1012:00	NA	AE07-09	AE07-01	ICE005W	05/06/1010:08	05/07/10
10-261	E098-06	0.0745J	1	NA	0.100	0.0500	05/07/1012:16	NA	AE07-10	AE07-01	ICE005W	05/06/1012:43	05/07/10
10-266	E098-07	0.0712J	1	NA	0.100	0.0500	05/07/1012:32	NA	AE07-11	AE07-01	ICE005W	05/06/1011:40	05/07/10
10-272	E098-08	0.119J	2	NA	0.200	0.100	05/07/1013:37	NA	AE07-15	AE07-13	ICE005W	05/06/1013:46	05/07/10
10-256	E098-10	0.0878J	1	NA	0.100	0.0500	05/07/1013:53	NA	AE07-16	AE07-13	ICE005W	05/06/1014:25	05/07/10
10-256DUP	E098-10D	0.0934J	1	NA	0.100	0.0500	05/07/1014:09	NA	AE07-17	AE07-13	ICE005W	05/06/1014:25	05/07/10
10-256MS	E098-10M	2.16	1	NA	0.100	0.0500	05/07/1014:25	NA	AE07-18	AE07-13	ICE005W	05/06/1014:25	05/07/10
10-256MSD	E098-10S	2.03	1	NA	0.100	0.0500	05/07/1014:41	NA	AE07-19	AE07-13	ICE005W	05/06/1014:25	05/07/10
10-268	E098-18	0.148	1	NA	0.100	0.0500	05/07/1014:58	NA	AE07-20	AE07-13	ICE005W	05/06/1018:54	05/07/10

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METHOD 300.0
NITRITE-N

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO 010
Batch No. : 10E098

Matrix : WATER
Instrument ID : I100

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	ICE005WB	ND	1	NA	0.100	0.0500	05/07/1010:23	NA	AE07-03	AE07-01	ICE005W	NA	NA
LCS1W	ICE005WL	2.03	1	NA	0.100	0.0500	05/07/1010:39	NA	AE07-04	AE07-01	ICE005W	NA	NA
LCD1W	ICE005WC	1.96	1	NA	0.100	0.0500	05/07/1010:55	NA	AE07-05	AE07-01	ICE005W	NA	NA
10-277	E098-01	0.0677J	1	NA	0.100	0.0500	05/07/1011:11	NA	AE07-06	AE07-01	ICE005W	05/06/1008:40	05/07/10
10-279	E098-03	0.0697J	1	NA	0.100	0.0500	05/07/1011:27	NA	AE07-07	AE07-01	ICE005W	05/06/1009:00	05/07/10
10-257	E098-04	ND	1	NA	0.100	0.0500	05/07/1011:44	NA	AE07-08	AE07-01	ICE005W	05/06/1009:20	05/07/10
10-260	E098-05	ND	1	NA	0.100	0.0500	05/07/1012:00	NA	AE07-09	AE07-01	ICE005W	05/06/1010:08	05/07/10
10-272	E098-08	ND	2	NA	0.200	0.100	05/07/1013:37	NA	AE07-15	AE07-13	ICE005W	05/06/1013:46	05/07/10
10-261	E098-06	ND	2	NA	0.200	0.100	05/07/1017:07	NA	AE07-28	AE07-25	ICE005W	05/06/1012:43	05/07/10
10-266	E098-07	ND	2	NA	0.200	0.100	05/07/1017:23	NA	AE07-29	AE07-25	ICE005W	05/06/1011:40	05/07/10
10-268	E098-18	ND	2	NA	0.200	0.100	05/07/1017:39	NA	AE07-30	AE07-25	ICE005W	05/06/1018:54	05/07/10
MBLK2W	ICE007WB	ND	1	NA	0.100	0.0500	05/07/1019:49	NA	AE07-38	AE07-36	ICE007W	NA	NA
LCS2W	ICE007WL	1.98	1	NA	0.100	0.0500	05/07/1020:05	NA	AE07-39	AE07-36	ICE007W	NA	NA
LCD2W	ICE007WC	2.01	1	NA	0.100	0.0500	05/07/1020:21	NA	AE07-40	AE07-36	ICE007W	NA	NA
10-256	E098-10	ND	2	NA	0.200	0.100	05/07/1020:37	NA	AE07-41	AE07-36	ICE007W	05/06/1014:25	05/07/10
10-256DUP	E098-10D	ND	2	NA	0.200	0.100	05/07/1020:53	NA	AE07-42	AE07-36	ICE007W	05/06/1014:25	05/07/10
10-256MS	E098-10M	4.05	2	NA	0.200	0.100	05/07/1021:09	NA	AE07-43	AE07-36	ICE007W	05/06/1014:25	05/07/10
10-256MSD	E098-10S	3.94	2	NA	0.200	0.100	05/07/1021:25	NA	AE07-44	AE07-36	ICE007W	05/06/1014:25	05/07/10

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METHOD 300.0
SULFATE

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO 010
Batch No. : 10E098

Matrix : WATER
Instrument ID : I100

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	ICE005WB	ND	1	NA	0.500	0.250	05/07/1010:23	NA	AE07-03	AE07-01	ICE005W	NA	NA
LCS1W	ICE005WL	4.94	1	NA	0.500	0.250	05/07/1010:39	NA	AE07-04	AE07-01	ICE005W	NA	NA
LCD1W	ICE005WC	4.78	1	NA	0.500	0.250	05/07/1010:55	NA	AE07-05	AE07-01	ICE005W	NA	NA
10-277	E098-01	ND	1	NA	0.500	0.250	05/07/1011:11	NA	AE07-06	AE07-01	ICE005W	05/06/1008:40	05/07/10
10-279	E098-03	ND	1	NA	0.500	0.250	05/07/1011:27	NA	AE07-07	AE07-01	ICE005W	05/06/1009:00	05/07/10
10-266	E098-07	1.75	1	NA	0.500	0.250	05/07/1012:32	NA	AE07-11	AE07-01	ICE005W	05/06/1011:40	05/07/10
10-272	E098-08	4.34	2	NA	1.00	0.500	05/07/1013:37	NA	AE07-15	AE07-13	ICE005W	05/06/1013:46	05/07/10
10-268	E098-18	0.880	1	NA	0.500	0.250	05/07/1014:58	NA	AE07-20	AE07-13	ICE005W	05/06/1018:54	05/07/10
10-261	E098-06	36.0	2	NA	1.00	0.500	05/07/1017:07	NA	AE07-28	AE07-25	ICE005W	05/06/1012:43	05/07/10
MBLK2W	ICE007WB	ND	1	NA	0.500	0.250	05/07/1019:49	NA	AE07-38	AE07-36	ICE007W	NA	NA
LCS2W	ICE007WL	4.99	1	NA	0.500	0.250	05/07/1020:05	NA	AE07-39	AE07-36	ICE007W	NA	NA
LCD2W	ICE007WC	4.90	1	NA	0.500	0.250	05/07/1020:21	NA	AE07-40	AE07-36	ICE007W	NA	NA
10-257	E098-04	41.4	5	NA	2.50	1.25	05/07/1021:42	NA	AE07-45	AE07-36	ICE007W	05/06/1009:20	05/07/10
10-260	E098-05	246	40	NA	20.0	10.0	05/07/1021:58	NA	AE07-46	AE07-36	ICE007W	05/06/1010:08	05/07/10
10-256	E098-10	121	40	NA	20.0	10.0	05/07/1023:51	NA	AE07-53	AE07-48	ICE007W	05/06/1014:25	05/07/10
10-256DUP	E098-10D	116	40	NA	20.0	10.0	05/08/1000:07	NA	AE07-54	AE07-48	ICE007W	05/06/1014:25	05/07/10
10-256MS	E098-10M	318	40	NA	20.0	10.0	05/08/1000:23	NA	AE07-55	AE07-48	ICE007W	05/06/1014:25	05/07/10
10-256MSD	E098-10S	310	40	NA	20.0	10.0	05/08/1000:39	NA	AE07-56	AE07-48	ICE007W	05/06/1014:25	05/07/10

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METHOD 310.1
TOTAL ALKALINITY

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO 010
Batch No. : 10E098

Matrix : WATER
Instrument ID : E5

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	ALE004WB	ND	1	NA	5.00	1.00	05/12/1010:16	NA	10E5E02003	NA	ALE004W	NA	NA
LCS1W	ALE004WL	579	1	NA	5.00	1.00	05/12/1010:27	NA	10E5E02004	NA	ALE004W	NA	NA
LCD1W	ALE004WC	579	1	NA	5.00	1.00	05/12/1010:38	NA	10E5E02005	NA	ALE004W	NA	NA
10-256	E098-10	1330	1	NA	5.00	1.00	05/12/1010:54	NA	10E5E02006	NA	ALE004W	05/06/1014:25	05/07/10
10-256DUP	E098-10D	1340	1	NA	5.00	1.00	05/12/1011:09	NA	10E5E02007	NA	ALE004W	05/06/1014:25	05/07/10
10-277	E098-01	ND	1	NA	5.00	1.00	05/12/1011:16	NA	10E5E02008	NA	ALE004W	05/06/1008:40	05/07/10
10-279	E098-03	ND	1	NA	5.00	1.00	05/12/1011:22	NA	10E5E02009	NA	ALE004W	05/06/1009:00	05/07/10
10-257	E098-04	501	1	NA	5.00	1.00	05/12/1011:32	NA	10E5E02010	NA	ALE004W	05/06/1009:20	05/07/10
10-260	E098-05	719	1	NA	5.00	1.00	05/12/1011:43	NA	10E5E02011	NA	ALE004W	05/06/1010:08	05/07/10
10-261	E098-06	1320	1	NA	5.00	1.00	05/12/1011:59	NA	10E5E02012	NA	ALE004W	05/06/1012:43	05/07/10
10-266	E098-07	1220	1	NA	5.00	1.00	05/12/1012:14	NA	10E5E02013	NA	ALE004W	05/06/1011:40	05/07/10
10-272	E098-08	1380	1	NA	5.00	1.00	05/12/1012:34	NA	10E5E02014	NA	ALE004W	05/06/1013:46	05/07/10
10-268	E098-18	1200	1	NA	5.00	1.00	05/12/1012:48	NA	10E5E02015	NA	ALE004W	05/06/1018:54	05/07/10

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METHOD 410.4
COD

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO 010
Batch No. : 10E098

Matrix : WATER
Instrument ID : I70

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	CDE002WB	ND	1	NA	10.0	5.00	05/11/1016:12	05/11/1009:30	CDE00210	CDE00208	CDE002W	NA	05/11/10
LCS1W	CDE002WL	394	1	NA	10.0	5.00	05/11/1016:13	05/11/1009:30	CDE00211	CDE00208	CDE002W	NA	05/11/10
LCD1W	CDE002WC	392	1	NA	10.0	5.00	05/11/1016:13	05/11/1009:30	CDE00212	CDE00208	CDE002W	NA	05/11/10
10-277	E098-01	ND	1	NA	10.0	5.00	05/11/1016:13	05/11/1009:30	CDE00213	CDE00208	CDE002W	05/06/1008:40	05/07/10
10-279	E098-03	ND	1	NA	10.0	5.00	05/11/1016:14	05/11/1009:30	CDE00214	CDE00208	CDE002W	05/06/1009:00	05/07/10
10-257	E098-04	29.5	1	NA	10.0	5.00	05/11/1016:15	05/11/1009:30	CDE00215	CDE00208	CDE002W	05/06/1009:20	05/07/10
10-260	E098-05	29.5	1	NA	10.0	5.00	05/11/1016:15	05/11/1009:30	CDE00216	CDE00208	CDE002W	05/06/1010:08	05/07/10
10-261	E098-06	51.6	1	NA	10.0	5.00	05/11/1016:16	05/11/1009:30	CDE00217	CDE00208	CDE002W	05/06/1012:43	05/07/10
10-266	E098-07	79.6	1	NA	10.0	5.00	05/11/1016:16	05/11/1009:30	CDE00218	CDE00208	CDE002W	05/06/1011:40	05/07/10
10-272	E098-08	2070	5	NA	50.0	25.0	05/11/1016:17	05/11/1009:30	CDE00219	CDE00208	CDE002W	05/06/1013:46	05/07/10
10-267	E098-09	61.6	1	NA	10.0	5.00	05/11/1016:18	05/11/1009:30	CDE00222	CDE00220	CDE002W	05/06/1011:12	05/07/10
10-256	E098-10	43.6	1	NA	10.0	5.00	05/11/1016:19	05/11/1009:30	CDE00223	CDE00220	CDE002W	05/06/1014:25	05/07/10
10-256DUP	E098-10D	43.6	1	NA	10.0	5.00	05/11/1016:19	05/11/1009:30	CDE00224	CDE00220	CDE002W	05/06/1014:25	05/07/10
10-256MS	E098-10M	436	1	NA	10.0	5.00	05/11/1016:19	05/11/1009:30	CDE00225	CDE00220	CDE002W	05/06/1014:25	05/07/10
10-258	E098-11	502	1	NA	10.0	5.00	05/11/1016:20	05/11/1009:30	CDE00226	CDE00220	CDE002W	05/06/1015:22	05/07/10
10-259	E098-12	43.6	1	NA	10.0	5.00	05/11/1016:20	05/11/1009:30	CDE00227	CDE00220	CDE002W	05/06/1015:56	05/07/10
10-255	E098-13	23.5	1	NA	10.0	5.00	05/11/1016:21	05/11/1009:30	CDE00228	CDE00220	CDE002W	05/06/1016:39	05/07/10
10-262	E098-14	39.6	1	NA	10.0	5.00	05/11/1016:22	05/11/1009:30	CDE00229	CDE00220	CDE002W	05/06/1017:15	05/07/10
10-263	E098-15	21.5	1	NA	10.0	5.00	05/11/1016:22	05/11/1009:30	CDE00230	CDE00220	CDE002W	05/06/1017:42	05/07/10
10-264	E098-16	19.5	1	NA	10.0	5.00	05/11/1016:22	05/11/1009:30	CDE00231	CDE00220	CDE002W	05/06/1017:47	05/07/10
10-265	E098-17	21.5	1	NA	10.0	5.00	05/11/1016:23	05/11/1009:30	CDE00234	CDE00232	CDE002W	05/06/1018:15	05/07/10
10-268	E098-18	61.6	1	NA	10.0	5.00	05/11/1016:23	05/11/1009:30	CDE00235	CDE00232	CDE002W	05/06/1018:54	05/07/10

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METHOD 9060
TOC

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO 010
Batch No. : 10E098

Matrix : WATER
Instrument ID : I62

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	TCE005WB	ND	1	NA	1.00	0.500	05/10/1019:33	NA	TCE003-27	TCE003-25	TCE005W	NA	NA
LCS1W	TCE005WL	24.5	1	NA	1.00	0.500	05/10/1019:46	NA	TCE003-28	TCE003-25	TCE005W	NA	NA
LCD1W	TCE005WC	24.7	1	NA	1.00	0.500	05/10/1019:59	NA	TCE003-29	TCE003-25	TCE005W	NA	NA
10-277	E098-01	1.44	1	NA	1.00	0.500	05/10/1020:09	NA	TCE003-30	TCE003-25	TCE005W	05/06/1008:40	05/07/10
10-279	E098-03	1.26	1	NA	1.00	0.500	05/10/1020:20	NA	TCE003-31	TCE003-25	TCE005W	05/06/1009:00	05/07/10
10-257	E098-04	3.41	1	NA	1.00	0.500	05/10/1020:31	NA	TCE003-32	TCE003-25	TCE005W	05/06/1009:20	05/07/10
10-260	E098-05	3.58	1	NA	1.00	0.500	05/10/1020:42	NA	TCE003-33	TCE003-25	TCE005W	05/06/1010:08	05/07/10
10-261	E098-06	5.19	1	NA	1.00	0.500	05/10/1020:54	NA	TCE003-34	TCE003-25	TCE005W	05/06/1012:43	05/07/10
10-266	E098-07	14.6	1	NA	1.00	0.500	05/10/1021:06	NA	TCE003-35	TCE003-25	TCE005W	05/06/1011:40	05/07/10
10-267	E098-09	11.0	1	NA	1.00	0.500	05/10/1022:36	NA	TCE003-42	TCE003-37	TCE005W	05/06/1011:12	05/07/10
MBLK2W	TCE006WB	ND	1	NA	1.00	0.500	05/11/1015:55	NA	TCE004-05	TCE004-02	TCE006W	NA	NA
LCS2W	TCE006WL	25.0	1	NA	1.00	0.500	05/11/1016:08	NA	TCE004-06	TCE004-02	TCE006W	NA	NA
LCD2W	TCE006WC	24.9	1	NA	1.00	0.500	05/11/1016:20	NA	TCE004-07	TCE004-02	TCE006W	NA	NA
10-272	E098-08R	705	40	NA	40.0	20.0	05/11/1019:53	NA	TCE004-24	TCE004-14	TCE006W	05/06/1013:46	05/07/10
MBLK3W	TCE007WB	ND	1	NA	1.00	0.500	05/12/1013:51	NA	TCE005-05	TCE005-02	TCE007W	NA	NA
LCS3W	TCE007WL	24.7	1	NA	1.00	0.500	05/12/1014:04	NA	TCE005-06	TCE005-02	TCE007W	NA	NA
LCD3W	TCE007WC	24.7	1	NA	1.00	0.500	05/12/1014:16	NA	TCE005-07	TCE005-02	TCE007W	NA	NA
10-256	E098-10R	3.65	1	NA	1.00	0.500	05/12/1014:25	NA	TCE005-08	TCE005-02	TCE007W	05/06/1014:25	05/07/10
10-256DUP	E098-10Z	3.64	1	NA	1.00	0.500	05/12/1014:34	NA	TCE005-09	TCE005-02	TCE007W	05/06/1014:25	05/07/10
10-256MS	E098-10G	28.8	1	NA	1.00	0.500	05/12/1015:41	NA	TCE005-10	TCE005-02	TCE007W	05/06/1014:25	05/07/10

6/8/10

0111

METHOD RSK-175
DISSOLVED GASES

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 01D	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/10/10 10:20
Sample ID:	10-257	Date Analyzed:	05/10/10 12:24
Lab Samp ID:	E098-04	Dilution Factor:	1
Lab File ID:	FE10006A	Matrix :	WATER
Ext Btch ID:	DGE006W	% Moisture :	NA
Calib. Ref.:	FE10002A	Instrument ID :	GCT010

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
ETHANE	ND	1.3	0.60
ETHENE	ND	1.2	0.60
METHANE	51DE R	1.0	0.60

E:Exceeded Calibration Range

6/8/10

METHOD RSK-175
DISSOLVED GASES

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/10/10 10:20
Sample ID:	10-257DL	Date Analyzed:	05/10/10 13:32
Lab Samp ID:	E098-04T	Dilution Factor:	1000
Lab File ID:	FE10010A	Matrix	: WATER
Ext Btch ID:	DGE006W	% Moisture	: NA
Calib. Ref.:	FE10002A	Instrument ID	: GCT010

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
ETHANE	ND R	1300	600
ETHENE	ND	1200	600
METHANE	14000	1000	600

6/8/10

METHOD RSK-175
DISSOLVED GASES

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/10/10 10:20
Sample ID:	10-260	Date Analyzed:	05/10/10 12:39
Lab Samp ID:	E098-05	Dilution Factor:	1
Lab File ID:	FE10007A	Matrix :	WATER
Ext Btch ID:	DGE006W	% Moisture :	NA
Calib. Ref.:	FE10002A	Instrument ID :	GCTD10

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
ETHANE	0.61J J	1.3	0.60
ETHENE	6.5	1.2	0.60
METHANE	300E R	1.0	0.60

E:Exceeded Calibration Range

6/8/10

METHOD RSK-175
DISSOLVED GASES

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/10/10 10:20
Sample ID:	10-260DL	Date Analyzed:	05/10/10 13:44
Lab Samp ID:	E098-05T	Dilution Factor:	200
Lab File ID:	FE10011A	Matrix	: WATER
Ext Btch ID:	DGE006W	% Moisture	: NA
Calib. Ref.:	FE10002A	Instrument ID	: GCT010

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
ETHANE	ND R	260	120
ETHENE	ND ↓	240	120
METHANE	3900	200	120

Al 6/8/10

METHOD RSK-175
DISSOLVED GASES

Client : TETRA TECH EC, INC.	Date Collected: 05/06/10
Project : NWS SEAL BEACH, CTO 010	Date Received: 05/07/10
Batch No. : 10E098	Date Extracted: 05/10/10 10:20
Sample ID: 10-261	Date Analyzed: 05/10/10 12:53
Lab Samp ID: E098-06	Dilution Factor: 1
Lab File ID: FE10008A	Matrix : WATER
Ext Btch ID: DGE006W	% Moisture : NA
Calib. Ref.: FE10002A	Instrument ID : GCT010

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
ETHANE	ND	1.3	0.60
ETHENE	2.3	1.2	0.60
METHANE	490E R	1.0	0.60

E:Exceeded Calibration Range

AL 6/8/10

4008

METHOD RSK-175
DISSOLVED GASES

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/10/10 10:20
Sample ID:	10-261DL	Date Analyzed:	05/10/10 13:56
Lab Samp ID:	E098-06T	Dilution Factor:	1000
Lab File ID:	FE10012A	Matrix :	WATER
Ext Btch ID:	DGE006W	% Moisture :	NA
Calib. Ref.:	FE10002A	Instrument ID :	GCT010

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
ETHANE	ND R	1300	600
ETHENE	ND ↓	1200	600
METHANE	15000	1000	600

A 6/8/10

METHOD RSK-175
DISSOLVED GASES

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/10/10 10:20
Sample ID:	10-266	Date Analyzed:	05/10/10 13:12
Lab Samp ID:	E098-07	Dilution Factor:	1
Lab File ID:	FE10009A	Matrix	: WATER
Ext Btch ID:	DGE006W	% Moisture	: NA
Calib. Ref.:	FE10002A	Instrument ID	: GCT010

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
ETHANE	ND	1.3	0.60
ETHENE	2.1	1.2	0.60
METHANE	490E R	1.0	0.60

E:Exceeded Calibration Range

6/8/10

4010

METHOD RSK-175
DISSOLVED GASES

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/10/10 10:20
Sample ID:	10-266DL	Date Analyzed:	05/10/10 15:11
Lab Samp ID:	E098-07T	Dilution Factor:	1000
Lab File ID:	FE10017A	Matrix :	WATER
Ext Btch ID:	DGE006W	% Moisture :	NA
Calib. Ref.:	FE10013A	Instrument ID :	GCT010

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
ETHANE	ND R	1300	600
ETHENE	ND ↓	1200	600
METHANE	13000	1000	600

6/8/10

4012

METHOD RSK-175
DISSOLVED GASES

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/10/10 10:20
Sample ID:	10-256	Date Analyzed:	05/10/10 14:26
Lab Samp ID:	E098-10	Dilution Factor:	1
Lab File ID:	FE10014A	Matrix :	WATER ✓
Ext Btch ID:	DGE006W	% Moisture :	NA
Calib. Ref.:	FE10013A	Instrument ID :	GCT010

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
ETHANE	ND	1.3	0.60
ETHENE	ND	1.2	0.60
METHANE	440E R	1.0	0.60

E:Exceeded Calibration Range

AC 6/8/10

401H

METHOD RSK-175
DISSOLVED GASES

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/10/10 10:20
Sample ID:	10-256DL	Date Analyzed:	05/10/10 15:46
Lab Samp ID:	E098-10T	Dilution Factor:	1000
Lab File ID:	FE10019A	Matrix :	WATER
Ext Btch ID:	DGE006W	% Moisture :	NA
Calib. Ref.:	FE10013A	Instrument ID :	GCT010

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
ETHANE	ND R	1300	600
ETHENE	ND ↓	1200	600
METHANE	16000	1000	600

6/8/10

4015

METHOD RSK-175
DISSOLVED GASES

Client : TETRA TECH EC, INC.	Date Collected: 05/06/10
Project : NWS SEAL BEACH, CTO 010	Date Received: 05/07/10
Batch No. : 10E098	Date Extracted: 05/10/10 10:20
Sample ID: 10-259	Date Analyzed: 05/10/10 15:24
Lab Samp ID: E098-12	Dilution Factor: 1
Lab File ID: FE10018A	Matrix : WATER
Ext Btch ID: DGE006W	% Moisture : NA
Calib. Ref.: FE10013A	Instrument ID : GCT010

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
ETHANE	2.0	1.3	0.60
ETHENE	3.2	1.2	0.60
METHANE	440E	1.0	0.60

E:Exceeded Calibration Range

AL 6/8/10

METHOD RSK-175
DISSOLVED GASES

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/10/10 10:20
Sample ID:	10-259DL	Date Analyzed:	05/10/10 16:13
Lab Samp ID:	E098-12T	Dilution Factor:	1000
Lab File ID:	FE10021A	Matrix :	WATER
Ext Btch ID:	DGE006W	% Moisture :	NA
Calib. Ref.:	FE10013A	Instrument ID :	GCT010

PARAMETERS	RESULTS (ug/L)		RL (ug/L)	MDL (ug/L)
ETHANE	ND	R	1300	600
ETHENE	ND	↓	1200	600
METHANE	10000		1000	600

A 6/8/10

METHOD RSK-175
DISSOLVED GASES

Client : TETRA TECH EC, INC.	Date Collected: 05/06/10
Project : NWS SEAL BEACH, CTO 010	Date Received: 05/07/10
Batch No. : 10E098	Date Extracted: 05/10/10 10:20
Sample ID: 10-265	Date Analyzed: 05/10/10 15:59
Lab Samp ID: E098-17	Dilution Factor: 1
Lab File ID: FE10020A	Matrix : WATER
Ext Btch ID: DGE006W	% Moisture : NA
Calib. Ref.: FE10013A	Instrument ID : GCT010

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
ETHANE	ND	1.3	0.60
ETHENE	ND	1.2	0.60
METHANE	440E R	1.0	0.60

E:Exceeded Calibration Range

dl 6/8/10

4020

METHOD RSK-175
DISSOLVED GASES

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/10/10 10:20
Sample ID:	10-265DL	Date Analyzed:	05/10/10 16:41
Lab Samp ID:	E098-17T	Dilution Factor:	1000
Lab File ID:	FE10023A	Matrix :	WATER
Ext Btch ID:	DGE006W	% Moisture :	NA
Calib. Ref.:	FE10013A	Instrument ID :	GCT010

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
ETHANE	ND	1300	600
ETHENE	ND	1200	600
METHANE	11000	1000	600

6/8/10

4021

METHOD RSK-175
DISSOLVED GASES

Client : TETRA TECH EC, INC.	Date Collected: 05/06/10
Project : NWS SEAL BEACH, CTO 010	Date Received: 05/07/10
Batch No. : 10E098	Date Extracted: 05/10/10 10:20
Sample ID: 10-268	Date Analyzed: 05/10/10 16:27
Lab Samp ID: E098-18	Dilution Factor: 1
Lab File ID: FE10022A	Matrix : WATER
Ext Btch ID: DGE006W	% Moisture : NA
Calib. Ref.: FE10013A	Instrument ID : GCT010

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
ETHANE	ND	1.3	0.60
ETHENE	ND	1.2	0.60
METHANE	460E R	1.0	0.60

E:Exceeded Calibration Range

CL 6/8/10

METHOD RSK-175
DISSOLVED GASES

Client	: TETRA TECH EC, INC.	Date Collected:	05/06/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E098	Date Extracted:	05/10/10 10:20
Sample ID:	10-268DL	Date Analyzed:	05/10/10 16:57
Lab Samp ID:	E098-18T	Dilution Factor:	1000
Lab File ID:	FE10024A	Matrix :	WATER
Ext Btch ID:	DGE006W	% Moisture :	NA ✓
Calib. Ref.:	FE10013A	Instrument ID :	GCT010

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
ETHANE	ND R	1300	600
ETHENE	ND ↓	1200	600
METHANE	14000	1000	600

6/8/10

LDC #: 23272A1
SDG #: 10E098
Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET
ADR/IV

Date: 6/4/10
Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 5/6/10
II.	GC/MS Instrument performance check	A	
III.	Initial calibration	A	%RSD ≤ 30, r²
IV.	Continuing calibration/ICV	A	ICV/CCV ≤ 25
V.	Blanks	A	Not reviewed for ADR validation.
VI.	Surrogate spikes	A	Not reviewed for ADR validation.
VII.	Matrix spike/Matrix spike duplicates	A	Not reviewed for ADR validation.
VIII.	Laboratory control samples	A	Not reviewed for ADR validation. LCS/D
IX.	Regional Quality Assurance and Quality Control	N	
X.	Internal standards	A	Not reviewed for ADR validation.
XI.	Target compound identification	A	Not reviewed for ADR validation.
XII.	Compound quantitation/CRQLs	SW	Not reviewed for ADR validation.
XIII.	Tentitatively identified compounds (TICs)	N	Not reviewed for ADR validation.
XIV.	System performance	A	Not reviewed for ADR validation.
XV.	Overall assessment of data	SW	Not reviewed for ADR validation.
XVI.	Field duplicates	N	
XVII.	Field blanks	SW	SB = 1 TB* = 2 EB = 3

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank

Validated Samples: ** Indicates sample underwent Level IV validation

water

1	2	10-277 SB	11	2	10-256	21	2	10-256MSD	31 1 MBLK1W
2	2	10-278 TB	12	2	10-258	22			32 MBLK2W
3	2	10-279 EB	13	2	10-259**	23			33 3 MBLK3W
4	2	10-257	14	2	10-255	24			34
5	2	10-260	15	2	10-262	25			35
6	3	10-260DL	16	2	10-263 D	26			36
7	3	10-261	17	1	10-264 D	27			37
8	2	10-266**	18	1	10-265	28			38
9	2	10-272	19	1	10-268	29			39
10	2	10-267	20	2	10-256MS	30			40

LDC #: 23272A4

SDG #: 10E098

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

ADR/IV

Date: 6-3-10

Page: 1 of 1

Reviewer: CR

2nd Reviewer: [illegible]

METHOD: Metals (EPA SW 846 Method 6010B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 5/6/10
II.	ICP/MS Tune	N	Not utilized
III.	Calibration	A	
IV.	Blanks	A	
V.	ICP Interference Check Sample (ICS) Analysis	A	Not reviewed for ADR validation.
VI.	Matrix Spike Analysis	A	Not reviewed for ADR validation. MS/D (Ca, Fe, Na > 4x)
VII.	Duplicate Sample Analysis	N	Not reviewed for ADR validation.
VIII.	Laboratory Control Samples (LCS)	A	Not reviewed for ADR validation. LCS/D
IX.	Internal Standard (ICP-MS)	N	Not reviewed for ADR validation. Not utilized
X.	Furnace Atomic Absorption QC	N	Not reviewed for ADR validation.
XI.	ICP Serial Dilution	A	
XII.	Sample Result Verification	A	Not reviewed for ADR validation.
XIII.	Overall Assessment of Data	A	Not reviewed for ADR validation.
XIV.	Field Duplicates	N	
XV	Field Blanks	ND	SB=1, EB=2

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank

Validated Samples: ** Indicates sample underwent Level IV validation

Water

1	10-277	11	10-256MSD	21	PBW	31	
2	10-279	12		22		32	
3	10-257	13		23		33	
4	10-260	14		24		34	
5	10-261	15		25		35	
6	10-266**	16		26		36	
7	10-272	17		27		37	
8	10-256	18		28		38	
9	10-268	19		29		39	
10	10-256MS	20		30		40	

Notes:

LDC #: 23272A6

SDG #: 10E098

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

~~ADR~~ ~~III~~ ADR

Date: 6-3-10

Page: 1 of 1

Reviewer:

2nd Reviewer:

METHOD: (Analyte) Alkalinity (EPA Method 310.1), Chloride, Nitrate-N, Nitrite-N, Sulfate (EPA Method 300.0), COD (EPA Method 410.4), TDS (EPA Method 160.1), TOC (EPA SW846 Method 9060)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 5/6/10
IIa.	Initial calibration	A	
IIb.	Calibration verification	A	
III.	Blanks	A	
IV	Matrix Spike/Matrix Spike Duplicates	A	MS/D
V	Duplicates	A	Dup
VI.	Laboratory control samples	A	LCS/D
VII.	Sample result verification	N	
VIII.	Overall assessment of data	A	
IX.	Field duplicates	~~SW~~	(14, 15)
X	Field blanks	~~SW~~	SB=1, EB=2

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source BLK

Validated Samples: water

1	10-277	11	10-259	21	10-265DUP	31	PBW
2	10-279	12	10-255	22		32	
3	10-257	13	10-262	23		33	
4	10-260	14	10-263	24		34	
5	10-261	15	10-264	25		35	
6	10-266	16	10-265	26		36	
7	10-272	17	10-268	27		37	
8	10-267	18	10-256MS	28		38	
9	10-256	19	10-256MSD	29		39	
10	10-258	20	10-256DUP	30		40	

Notes:

LDC #: 23272A6
SDG #: See cover

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Page: 1 of 1
Reviewer: CR
2nd reviewer: W

All circled methods are applicable to each sample.

Sample ID	Parameter
1,5,12,14-16	pH (TDS) Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
1-7,9,~~8~~,17	pH TDS (Cl) F (NO_3) (NO_2) (SO_4) PO_4 (ALK) CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
~~10,11,18~~	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
1-17	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} (COD) ____ ____
1-9	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN (TOC) CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
QC: 18	pH TDS (Cl) F (NO_3) (NO_2) (SO_4) PO_4 ALK CN^- NH_3 TKN (TOC) CR^{6+} (COD) ____ ____ ____
19	pH TDS (Cl) F (NO_3) (NO_2) (SO_4) PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
20	pH TDS (Cl) F (NO_3) (NO_2) (SO_4) PO_4 (ALK) CN^- NH_3 TKN (TOC) CR^{6+} (COD) ____ ____ ____
21	pH (TDS) Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ____ ____ ____ ____

Comments:

LDC #: 23272A51

SDG #: 10E098

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

ADR/IV

Date: 6-4-10

Page: 1 of 1

Reviewer: RT

2nd Reviewer: AT

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	N	Sampling dates: 5/6/10
IIa.	Initial calibration	A	%RSD
IIb.	Calibration verification/ICV	A	ICV/CCV ≤ 20%
III.	Blanks	N	Not reviewed for ADR validation.
IVa.	Surrogate recovery		Not reviewed for ADR validation.
IVb.	Matrix spike/Matrix spike duplicates		Not reviewed for ADR validation.
IVc.	Laboratory control samples		Not reviewed for ADR validation.
V.	Target compound identification		Not reviewed for ADR validation.
VI.	Compound Quantitation and CRQLs		Not reviewed for ADR validation.
VII.	System Performance		Not reviewed for ADR validation.
VIII.	Overall assessment of data SW		Not reviewed for ADR validation.
IX.	Field duplicates		
X.	Field blanks		

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank

Validated Samples: ** Indicates sample underwent Level IV validation

ALL H2O

1	10-257	11	10-259**	21		31	
2	10-257DL	12	10-259DL**	22		32	
3	10-260	13	10-265	23		33	
4	10-260DL	14	10-265DL	24		34	
5	10-261	15	10-268	25		35	
6	10-261DL	16	10-268DL	26		36	
7	10-266**	17	10-256MS	27		37	
8	10-266DL**	18	10-256MSD	28		38	
9	10-256	19		29		39	
10	10-256DL	20		30		40	

Notes:

LDC #: 23272A51
SDG #: See Cover

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: X GC ___ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

Y N N/A Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated Samples	Qualifications
	Methane	Exceeded calib. Range	1, 3, 5, 7, 9, 11, 13, 15	~~R/A~~ Do not use
	All except Methane	Dilution	2, 4, 6, 8, 10, 12, 14, 16	~~R/A~~ Do not use

Comments: _____

OVRNew.wpd

Enclosure II

EPA Level IV Validation Reports

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: NWS Seal Beach, CTO 010

Collection Date: May 6, 2009

LDC Report Date: June 7, 2010

Matrix: Water

Parameters: Volatiles

Validation Level: EPA Level IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 10E098

Sample Identification

10-266
10-259

Introduction

This data review covers 2 water samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA SW 846 Method 8260B for Volatiles.

This review follows a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008).

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section V.

Field duplicates are summarized in Section XVI.

The following are definitions of the data qualifiers:

U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.

J Indicates an estimated value.

R Quality control indicates the data is not usable.

N Presumptive evidence of presence of the constituent.

UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.

A Indicates the finding is based upon technical validation criteria.

P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. GC/MS Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration

Initial calibration was performed using required standard concentrations.

Percent relative standard deviations (%RSD) were less than or equal to 30.0% for all compounds.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990 .

Average relative response factors (RRF) for all compounds were within method and validation criteria.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

Percent differences (%D) between the initial calibration RRF and the continuing calibration RRF were within the method criteria of less than or equal to 20.0% for calibration check compounds (CCCs) and 25.0% for all other compounds.

The percent differences (%D) of the second source calibration standard were less than or equal to 25.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within method and validation criteria.

V. Blanks

Method blanks were reviewed for each matrix as applicable. No volatile contaminants were found in the method blanks.

VI. Surrogate Spikes

Surrogates were added to all samples and blanks as required by the method. All surrogate recoveries (%R) were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples (LCS)

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

IX. Regional Quality Assurance and Quality Control

Not applicable.

X. Internal Standards

All internal standard areas and retention times were within QC limits.

XI. Target Compound Identifications

All target compound identifications were within validation criteria.

XII. Compound Quantitation and CRQLs

All compound quantitation and CRQLs were within validation criteria.

All compounds reported below the RL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 10E098	All compounds reported below the RL.	J (all detects)	A

XIII. Tentatively Identified Compounds (TICs)

All tentatively identified compounds were within validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

XVI. Field Duplicates

No field duplicates were identified in this SDG.

XVII. Field Blanks

Sample 10-278 was identified as a trip blank. No volatile contaminants were found in this blank.

Sample 10-279 was identified as an equipment blank. No volatile contaminants were found in this blank with the following exceptions:

Equipment Blank ID	Compound	Concentration (ug/L)
10-279	Acetone	7.8

Sample 10-277 was identified as a source blank. No volatile contaminants were found in this blank with the following exceptions:

Source Blank ID	Compound	Concentration (ug/L)
10-277	Acetone	6.4

NWS Seal Beach, CTO 010
Volatiles - Data Qualification Summary - SDG 10E098

SDG	Sample	Compound	Flag	A or P	Reason
10E098	10-266 10-259	All compounds reported below the RL.	J (all detects)	A	Compound quantitation and CRQLs

NWS Seal Beach, CTO 010
Volatiles - Laboratory Blank Data Qualification Summary - SDG 10E098

No Sample Data Qualified in this SDG

LDC #: 23272A1

SDG #: 10E098

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

ADR/IV

Date: 6/4/10

Page: 1 of 1

Reviewer:

2nd Reviewer:

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 5/6/10
II.	GC/MS Instrument performance check	A	
III.	Initial calibration	A	% RSD ≤ 30, r²
IV.	Continuing calibration/ICV	A	ICV/CCV ≤ 25
V.	Blanks	A	~~Not reviewed for ADR validation~~.
VI.	Surrogate spikes	A	Not reviewed for ADR validation.
VII.	Matrix spike/Matrix spike duplicates	A	Not reviewed for ADR validation.
VIII.	Laboratory control samples	A	~~Not reviewed for ADR validation~~. LCS/D
IX.	Regional Quality Assurance and Quality Control	N	
X.	Internal standards	A	Not reviewed for ADR validation.
XI.	Target compound identification	A	Not reviewed for ADR validation.
XII.	Compound quantitation/CRQLs A	~~SW~~	Not reviewed for ADR validation.
XIII.	Tentitatively identified compounds (TICs)	N	Not reviewed for ADR validation.
XIV.	System performance	A	Not reviewed for ADR validation.
XV.	Overall assessment of data A	~~SW~~	~~Not reviewed for ADR validation~~.
XVI.	Field duplicates	N	
XVII.	Field blanks	SW	SB = 1 TB* = 2 EB = 3

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank

Validated Samples: ** Indicates sample underwent Level IV validation

water

1 ~~2~~	~~10-277~~ SB	11 ~~2~~	~~10-258~~	21 ~~2~~	~~10-256~~MSD	31 1	MBLK1W
2 2	10-278 TB	12 ~~2~~	10-258	22		32	MBLK2W
3 2	10-279 EB	13 2	10-259**	23		33 3	MBLK3W
4 2	10-257	14 ~~2~~	~~10-255~~	24		34	
5 2	10-260	15 2	10-262	25		35	
6 3	10-260DL	16 2	10-263 D	26		36	
7 3	~~10-261~~	17 1	10-264 D	27		37	
8 2	10-266**	18 1	10-265	28		38	
9 ~~2~~	~~10-272~~	19 1	10-268	29		39	
10 ~~2~~	~~10-267~~	20 ~~2~~	~~10-256MS~~	30		40	

LDC #: 23272A
SDG #: per cover

VALIDATION FINDINGS CHECKLIST

Reviewer: FZ
2nd Reviewer: A

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
III. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Was a curve fit used for evaluation?	✓			
Did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
Were all percent relative standard deviations (%RSD) ≤ 30% and relative response factors (RRF) ≥ 0.05?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Were all percent differences (%D) ≤ 25% and relative response factors (RRF) ≥ 0.05?	✓			
V. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Surrogate spikes				
Were all surrogate %R within QC limits?	✓			
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	✓			
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			

LDC #: 23272A1
SDG #: per cover

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
Reviewer: KT
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?			✓	
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
X. Internal standards				
Were internal standard area counts within -50% or +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XI. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XII. Compound quantitation/CRQLs				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Tentatively identified compounds (TICs)				
Were the major ions (> 10 percent relative intensity) in the reference spectrum evaluated in sample spectrum?			✓	
Were relative intensities of the major ions within ± 20% between the sample and the reference spectra?			✓	
Did the raw data indicate that the laboratory performed a library search for all required peaks in the chromatograms (samples and blanks)?			✓	
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XVI. Field duplicates				
Field duplicate pairs were identified in this SDG.		✓		
Target compounds were detected in the field duplicates.			✓	
XVII. Field blanks				
Field blanks were identified in this SDG.	✓			
Target compounds were detected in the field blanks.	✓			

TARGET COMPOUND WORKSHEET

METHOD: VOA (EPA SW 846 Method 8260B)

A. Chloromethane*	U. 1,1,2-Trichloroethane	OO. 2,2-Dichloropropane	III. n-Butylbenzene	CCCC.1-Chlorohexane
B. Bromomethane	V. Benzene	PP. Bromochloromethane	JJJ. 1,2-Dichlorobenzene	DDDD. Isopropyl alcohol
C. Vinyl choride**	W. trans-1,3-Dichloropropene	QQ. 1,1-Dichloropropene	KKK. 1,2,4-Trichlorobenzene	EEEE. Acetonitrile
D. Chloroethane	X. Bromoform*	RR. Dibromomethane	LLL. Hexachlorobutadiene	FFFF. Acrolein
E. Methylene chloride	Y. 4-Methyl-2-pentanone	SS. 1,3-Dichloropropane	MMM. Naphthalene	GGGG. Acrylonitrile
F. Acetone	Z. 2-Hexanone	TT. 1,2-Dibromoethane	NNN. 1,2,3-Trichlorobenzene	HHHH. 1,4-Dioxane
G. Carbon disulfide	AA. Tetrachloroethene	UU. 1,1,1,2-Tetrachloroethane	OOO. 1,3,5-Trichlorobenzene	IIII. Isobutyl alcohol
H. 1,1-Dichloroethene**	BB. 1,1,2,2-Tetrachloroethane*	VV. Isopropylbenzene	PPP. trans-1,2-Dichloroethene	JJJJ. Methacrylonitrile
I. 1,1-Dichloroethane*	CC. Toluene**	WW. Bromobenzene	QQQ. cis-1,2-Dichloroethene	KKKK. Propionitrile
J. 1,2-Dichloroethene, total	DD. Chlorobenzene*	XX. 1,2,3-Trichloropropane	RRR. m,p-Xylenes	LLLL. Ethyl ether
K. Chloroform**	EE. Ethylbenzene**	YY. n-Propylbenzene	SSS. o-Xylene	MMMM. Benzyl chloride
L. 1,2-Dichloroethane	FF. Styrene	ZZ. 2-Chlorotoluene	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	NNNN.
M. 2-Butanone	GG. Xylenes, total	AAA. 1,3,5-Trimethylbenzene	UUU. 1,2-Dichlorotetrafluoroethane	OOOO.
N. 1,1,1-Trichloroethane	HH. Vinyl acetate	BBB. 4-Chlorotoluene	VVV. 4-Ethyltoluene	PPPP.
O. Carbon tetrachloride	II. 2-Chloroethylvinyl ether	CCC. tert-Butylbenzene	WWW. Ethanol	QQQQ.
P. Bromodichloromethane	JJ. Dichlorodifluoromethane	DDD. 1,2,4-Trimethylbenzene	XXX. Di-isopropyl ether	RRRR.
Q. 1,2-Dichloropropane**	KK. Trichlorofluoromethane	EEE. sec-Butylbenzene	YYY. tert-Butanol	SSSS.
R. cis-1,3-Dichloropropene	LL. Methyl-tert-butyl ether	FFF. 1,3-Dichlorobenzene	ZZZ. tert-Butyl alcohol	TTTT.
S. Trichloroethene	MM. 1,2-Dibromo-3-chloropropane	GGG. p-Isopropyltoluene	AAAA. Ethyl tert-butyl ether	UUUU.
T. Dibromochloromethane	NN. Methyl ethyl ketone	HHH. 1,4-Dichlorobenzene	BBBB. tert-Amyl methyl ether	VVVV.

* = System performance check compounds (SPCC) for RRF ; ** = Calibration check compounds (CCC) for %RSD.

LDC #: 23272A1
SDG #: per cover

VALIDATION FINDINGS WORKSHEET
Field Blanks

Page: 1 of 1
Reviewer:
2nd reviewer:

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Y N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?

Sample: SB #1 Field Blank / Trip Blank / Rinsate / Other _____ (circle one)

Compound	Concentration Units (ug/L)
F	6.4

Sample: EB #3 Field Blank / Trip Blank / Rinsate / Other _____ (circle one)

Compound	Concentration Units (ug/L)
F	7.8

Sample: _____ Field Blank / Trip Blank / Rinsate / Other _____ (circle one)

Compound	Concentration Units ( )

LDC #: 23272A1
SDG #: µu conu

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer: F7
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs
X = Mean of the RRFs

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported RRF (10 std)	Recalculated RRF (10 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	4/26/10	C (1st internal standard)	0.228	0.228	0.201	0.201	11.82	11.82
			V (2nd internal standard)	1.589	1.589	1.542	1.542	3.06	3.06
			BB (3rd internal standard)	0.433	0.433	0.432	0.432	4.41	4.41
2			(1st internal standard)						
			(2nd internal standard)						
			(3rd internal standard)						
3			(1st internal standard)						
			(2nd internal standard)						
			(3rd internal standard)						
4			(1st internal standard)						
			(2nd internal standard)						
			(3rd internal standard)						

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 23272A1
SDG #: all cones

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Page: 1 of 1
Reviewer: F7
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (Initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported %D	Recalculated %D
1	RE 2158	5/7/10	C (1st internal standard)	0.201	0.210	0.210	4.5	4.5
			V (2nd internal standard)	1.542	1.569	1.569	1.8	1.8
			BB (3rd internal standard)	0.432	0.411	0.411	4.9	4.9
2			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
3			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
4			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					

Comments: Refer to Continuing Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

CONCLC.1S

LDC #: 23272A1
SDG #: per cover

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: FT
2nd reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: #8

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Toluene-d8	10	9.94	99	99	0
Bromofluorobenzene	↓	9.75	98	98	↓
1,2-Dichloroethane-d4		12.0	120	120	
Dibromofluoromethane					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Toluene-d8					
Bromofluorobenzene					
1,2-Dichloroethane-d4					
Dibromofluoromethane					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Toluene-d8					
Bromofluorobenzene					
1,2-Dichloroethane-d4					
Dibromofluoromethane					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Toluene-d8					
Bromofluorobenzene					
1,2-Dichloroethane-d4					
Dibromofluoromethane					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Toluene-d8					
Bromofluorobenzene					
1,2-Dichloroethane-d4					
Dibromofluoromethane					

LDC #: 23272A1
SDG #: per cover

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: F2
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA

Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentration

RPD = I MSC - MSC I * 2/(MSC + MSDC)

MSC = Matrix spike concentration; MSDC = Matrix spike duplicate concentration

MS/MSD sample: 20 + 21

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
1,1-Dichloroethene	10.0	10.0	ND	9.92	9.85	99	99	99	99	1	1
Trichloroethene	↓	↓	0.915	10.4	10.5	95	95	96	96	0	0
Benzene	↓	↓	ND	9.82	9.76	98	98	98	98	1	1
Toluene	↓	↓	↓	9.55	9.52	95	95	95	95	0	0
Chlorobenzene	↓	↓	↓	10.0	9.94	100	100	99	99	1	1

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 23272A1
SDG #: per cover

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Page: 1 of 1
Reviewer: EZ
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboraotry control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS ID: LCS/D (MBLK2W)

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
1,1-Dichloroethene	10.0	10.0	9.74	10.2	97	97	102	102	5	5
Trichloroethene			9.73	10.3	97	97	103	103	6	6
Benzene			9.57	10.1	96	96	101	101	6	6
Toluene			9.39	9.87	94	94	99	99	5	5
Chlorobenzene			9.79	10.3	98	98	103	100	5	5

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LCSCLC.1SB

LDC #: 23272 A1
SDG #: see cover

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: F7
2nd reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?

Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
RRF	=	Relative response factor of the calibration standard.
V_o	=	Volume or weight of sample pruged in milliliters (ml) or grams (g).
Df	=	Dilution factor.
%S	=	Percent solids, applicable to soils and solid matrices only.

Example:

Sample I.D. #1 . QQQ

Conc. = $\frac{(276459)(1)(\quad)(\quad)}{(232886)(0.312)(\quad)(\quad)}$

= 3.7 ug/L

#	Sample ID	Compound	Reported Concentration ( )	Calculated Concentration ( )	Qualification

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: NWS Seal Beach, CTO 010

Collection Date: May 6, 2010

LDC Report Date: June 4, 2010

Matrix: Water

Parameters: Metals

Validation Level: EPA Level IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 10E098

Sample Identification

10-266

Introduction

This data review covers one water sample listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA SW 846 Method 6010B for Metals. The metals analyzed were Calcium, Iron, Magnesium, Potassium, and Sodium.

This review follows a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (October 2004).

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blanks are summarized in Section IV.

Field duplicates are summarized in Section XIV.

The following are definitions of the data qualifiers:

U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.

J Indicates an estimated value.

R Quality control indicates the data is not usable.

N Presumptive evidence of presence of the constituent.

UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.

A Indicates the finding is based upon technical validation criteria.

P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. ICPMS Tune

ICP-MS was not utilized in this SDG.

III. Calibration

An initial calibration was performed.

The frequency and analysis criteria of the initial calibration verification (ICV) and continuing calibration verification (CCV) were met.

IV. Blanks

Method blanks were reviewed for each matrix as applicable. No contaminant concentrations were found in the initial, continuing and preparation blanks.

V. ICP Interference Check Sample (ICS) Analysis

The frequency of analysis was met.

The criteria for analysis were met.

VI. Matrix Spike Analysis

Matrix spike (MS) and matrix spike duplicate (MSD) samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate sample analyses were reviewed for each matrix as applicable.

VIII. Laboratory Control Samples (LCS)

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

IX. Internal Standards

ICP-MS was not utilized in this SDG.

X. Furnace Atomic Absorption QC

Graphite furnace atomic absorption was not utilized in this SDG.

XI. ICP Serial Dilution

ICP serial dilution analysis was performed by the laboratory. The analysis criteria were met.

XII. Sample Result Verification

All sample result verification met validation criteria with the following exceptions:

Sample	Analyte	Flag	A or P
All samples in SDG 10E098	All results reported below the reporting limit.	J (all detects)	A

XIII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

XIV. Field Duplicates

No field duplicates were identified in this SDG.

XV. Field Blanks

Sample 10-279 was identified as an equipment blank. No metal contaminants were found in this blank.

Sample 10-277 was identified as a source blank. No metal contaminants were found in this blank.

NWS Seal Beach, CTO 010
Metals - Data Qualification Summary - SDG 10E098

SDG	Sample	Analyte	Flag	A or P	Reason
10E098	10-266	All results reported below the reporting limit.	J (all detects)	A	Sample result verification

NWS Seal Beach, CTO 010
Metals - Laboratory Blank Data Qualification Summary - SDG 10E098

No Sample Data Qualified in this SDG

LDC #: 23272A4

SDG #: 10E098

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

~~ADR~~/IV

Date: 6-3-10

Page: 1 of 1

Reviewer: CR

2nd Reviewer: W

METHOD: Metals (EPA SW 846 Method 6010B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 5/6/10
II.	ICP/MS Tune	N	Not utilized
III.	Calibration	A	
IV.	Blanks	A	
V.	ICP Interference Check Sample (ICS) Analysis	A	Not reviewed for ADR validation.
VI.	Matrix Spike Analysis	A	Not reviewed for ADR validation. MS/D
VII.	Duplicate Sample Analysis	N	Not reviewed for ADR validation.
VIII.	Laboratory Control Samples (LCS)	A	Not reviewed for ADR validation. LCS/D
IX.	Internal Standard (ICP-MS)	N	Not reviewed for ADR validation. Not utilized
X.	Furnace Atomic Absorption QC	N	Not reviewed for ADR validation.
XI.	ICP Serial Dilution	A	
XII.	Sample Result Verification	A	Not reviewed for ADR validation.
XIII.	Overall Assessment of Data	A	Not reviewed for ADR validation.
XIV.	Field Duplicates	N	
XV	Field Blanks	ND	~~SB=1~~; EB=2 TB=1

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank

Validated Samples: ** Indicates sample underwent Level IV validation

Water

1	~~10-277~~	11	~~10-256MSD~~	21	PBW	31	
2	10-279	12		22		32	
3	10-257	13		23		33	
4	10-260	14		24		34	
5	~~10-261~~	15		25		35	
6	10-266**	16		26		36	
7	~~10-272~~	17		27		37	
8	10-256	18		28		38	
9	10-268	19		29		39	
10	~~10-256MS~~	20		30		40	

Notes:

LDC #: 23272A4
SDG #: See cover

VALIDATION FINDINGS CHECKLIST

Reviewer: CR
2nd Reviewer: ✓

Method: Metals (EPA SW 846 Method 6010/7000/6020)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. Calibration				
Were all isotopes in the tuning solution mass resolution within 0.1 amu?			✓	
Were %RSD of isotopes in the tuning solution < 5%?			✓	
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% (80-120% for mercury and 85-115% for cyanide) QC limits?	✓			
Were all initial calibration correlation coefficients ≥ 0.995?	✓			
III. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
IV. ICP Interference Check Sample				
Were ICP interference check samples performed daily?	✓			
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	✓			
IV. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of +/- RL(+/-2X RL for soil) was used for samples that were ≤ 5X the RL, including when only one of the duplicate sample values were < 5X the RL.	✓			
V. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% QC limits for water samples and laboratory established QC limits for soils?	✓			

LDC #: 23272A4
SDG #: see cover

VALIDATION FINDINGS CHECKLIST

Reviewer: CR
2nd Reviewer: W

Validation Area	Yes	No	NA	Findings/Comments
VI. Furnace Atomic Absorption QC				
If MSA was performed, was the correlation coefficients > 0.995?			✓	
Do all applicable analysis have duplicate injections? (Level IV only)			✓	
For sample concentrations > RL, are applicable duplicate injection RSD values < 20%? (Level IV only)			✓	
Were analytical spike recoveries within the 85-115% QC limits?			✓	
VII. ICP Serial Dilution				
Was an ICP serial dilution analyzed if analyte concentrations were > 50X the IDL?	✓			
Were all percent differences (%Ds) < 10%?	✓			
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.		✓		
VIII. Internal Standards (EPA SW-846 Method 6020)				
Were all the percent recoveries (%R) within the 30-120% of the intensity of the internal standard in the associated initial calibration?			✓	
If the %Rs were outside the criteria, was a reanalysis performed?			✓	
X. Federal Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
X. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XII. Field Duplicates				
Field duplicate pairs were identified in this SDG.		✓		
Target analytes were detected in the field duplicates.			✓	
XIII. Field Blanks				
Field blanks were identified in this SDG.	✓			
Target analytes were detected in the field blanks.		✓		

LDC #: 23272A4
SDG #: S0C0002

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Page: 1 of 1
Reviewer: CR
2nd reviewer: W

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1-9		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
QC-10,11		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
Analysis Method		
ICP		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
ICP Trace		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
ICP-MS		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
GFAA		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___

Comments: Mercury by CVAA if performed

LDC #: 232724
SDG #: seecover

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Page: 1 of 1
Reviewer: GR
2nd Reviewer: h

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

An initial and continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = Found / True x 100 Where, Found = concentration (in ug/L) of each analyte measured in the analysis of the ICV or CCV solution
True = concentration (in ug/L) of each analyte in the ICV or CCV source

Standard ID	Type of Analysis	Element	Found (~~ug~~ mg/L)	True (~~ug~~ mg/L)	Recalculated %R	Reported %R	Acceptable (Y/N)
ICV	ICP (Initial calibration)	Fe	4.9943	5	100	100	Y
	GFAA (Initial calibration)						
	CVAA (Initial calibration)						
CCV5	ICP (Continuing calibration)	K	47.632	50	95	95	Y
	GFAA (Continuing calibration)						
	CVAA (Continuing calibration)						
	ICP/MS (Initial calibration)						
	ICP/MS (Continuing calibation)						

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

CALCLC.4SW

LDC #: 23274S
SDG #: See cover

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Page: 1 of 1
Reviewer: GR
2nd Reviewer: [illegible]

METHOD: Trace Metals (EPA SW 846 Method 6010/7000)

Percent recoveries (%R) for an ICP interference check sample, a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$\%R = \frac{Found}{True} \times 100$ Where, Found = Concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = Concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$RPD = \frac{|S-D|}{(S+D)/2} \times 100$ Where, S = Original sample concentration
D = Duplicate sample concentration

An ICP serial dilution percent difference (%D) was recalculated using the following formula:

$\%D = \frac{|I-SDR|}{I} \times 100$ Where, I = Initial Sample Result (mg/L)
SDR = Serial Dilution Result (mg/L) (Instrument Reading x 5)

Sample ID	Type of Analysis	Element	Found / S / I ~~(units)~~ mg/L	True / D / SDR ~~(units)~~ mg/L	Recalculated %R / RPD / %D	Reported %R / RPD / %D	Acceptable (Y/N)
ICSAB	ICP interference check	Mg	499.87	500	100	100	Y
LCS	Laboratory control sample	Mg	49.9	50	100	100	
10	Matrix spike	K	(SSR-SR) 50.53	50	101	101	
10/11	Duplicate	Na	388	383	1	1	
8	ICP serial dilution	Ca	329	341	4	4	

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

TOTCLC.4SW

LDC #: 23272A1
SDG #: see cover

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: CR
2nd reviewer: [illegible]

METHOD: Trace Metals (EPA SW 846 Method 6010/7000)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments and within the linear range of the ICP?
Y N N/A Are all detection limits below the CRDL?

Detected analyte results for Fe were recalculated and verified using the following equation:

Concentration = (RD)(FV)(Dil) / (In. Vol.)(%S)

RD = Raw data concentration
FV = Final volume (ml)
In. Vol. = Initial volume (ml) or weight (G)
Dil = Dilution factor
%S = Decimal percent solids

Recalculation:

Raw Data: 40.112 mg/L

Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
6	Ca	182	182	Y
	Fe	40.1	40.1	
	Mg	49.5	49.5	
	K	8.33	8.33	
	Na	300	300	

RECALC.4S2

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: NWS Seal Beach, CTO 010

Collection Date: May 6, 2010

LDC Report Date: June 4, 2010

Matrix: Water

Parameters: Methane, Ethane, & Ethene

Validation Level: EPA Level IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 10E098

Sample Identification

10-266
10-266DL
10-259
10-259DL

Introduction

This data review covers 4 water samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per Method RSK-175 for Methane, Ethane, and Ethene.

This review follows a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008).

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section IX.

The following are definitions of the data qualifiers:

U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.

J Indicates an estimated value.

R Quality control indicates the data is not usable.

N Presumptive evidence of presence of the constituent.

UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.

A Indicates the finding is based upon technical validation criteria.

P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

Initial calibration of compounds was performed as required by the method.

The percent relative standard deviations (%RSD) of calibration factors for compounds were less than or equal to 20.0% .

b. Calibration Verification

Calibration verification was performed at required frequencies. The percent differences (%D) of amounts in continuing standard mixtures were within the 20.0% QC limits.

The percent difference (%D) of the second source calibration standard were less than or equal to 20.0% for all compounds.

III. Blanks

Method blanks were reviewed for each matrix as applicable. No methane, ethane, or ethene contaminants were found in the method blanks.

IV. Accuracy and Precision Data

a. Surrogate Recovery

Surrogates were not required by the method.

b. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were not within QC limits. Since the sample concentration was greater than the spiked concentration, no data were qualified.

c. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

V. Target Compound Identification

All target compound identifications were within validation criteria.

VI. Compound Quantitation and CRQLs

All compound quantitation and CRQLs were within validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
10-266 10-259	Methane	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A

All compounds reported below the RL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 10E098	All compounds reported below the RL.	J (all detects)	A

VII. System Performance

The system performance was acceptable.

VIII. Overall Assessment of Data

The overall assessment of data was acceptable. In the case where more than one result was reported for an individual sample, the least technically acceptable results were rejected as follows:

Sample	Compound	Flag	A or P
10-266 10-259	Methane	R	A
10-266DL 10-259DL	Ethane Ethene	R R	A

Data flags are summarized at the end of this report if data has been qualified.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Field Blanks

No field blanks were identified in this SDG.

NWS Seal Beach, CTO 010
Methane, Ethane, & Ethene - Data Qualification Summary - SDG 10E098

SDG	Sample	Compound	Flag	A or P	Reason
10E098	10-266 10-259	Methane	J (all detects)	A	Compound quantitation and CRQLs
10E098	10-266 10-266DL 10-259 10-259DL	All compounds reported below the RL.	J (all detects)	A	Compound quantitation and CRQLs
10E098	10-266 10-259	Methane	R	A	Overall assessment of data
10E098	10-266DL 10-259DL	Ethane Ethene	R R	A	Overall assessment of data

NWS Seal Beach, CTO 010
Methane, Ethane, & Ethene - Laboratory Blank Data Qualification Summary - SDG 10E098

No Sample Data Qualified in this SDG

LDC #: 23272A51
SDG #: 10E098
Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET
ADR/IV

Date: 6-4-10
Page: 1 of 1
Reviewer: AT
2nd Reviewer: [illegible]

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 5/6/10
IIa.	Initial calibration	A	%RSD
IIb.	Calibration verification/ICV	A	ICV/CCV ≤ 20%
III.	Blanks	A	Not reviewed for ADR validation.
IVa.	Surrogate recovery	N	Not reviewed for ADR validation.
IVb.	Matrix spike/Matrix spike duplicates	SW	Not reviewed for ADR validation.
IVc.	Laboratory control samples	A	Not reviewed for ADR validation. LCS/D
V.	Target compound identification	A	Not reviewed for ADR validation.
VI.	Compound Quantitation and CRQLs	SW	Not reviewed for ADR validation.
VII.	System Performance	SW	Not reviewed for ADR validation.
VIII.	Overall assessment of data	A	Not reviewed for ADR validation.
IX.	Field duplicates	N	
X.	Field blanks	N	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet

ND = No compounds detected
R = Rinsate
FB = Field blank

D = Duplicate
TB = Trip blank
EB = Equipment blank

Validated Samples: ** Indicates sample underwent Level IV validation

ALL H2O

1	10-257	11	10-259**	21		31	
2	10-257DL	12	10-259DL**	22		32	
3	10-260	13	10-265	23		33	
4	10-260DL	14	10-265DL	24		34	
5	10-261	15	10-268	25		35	
6	10-261DL	16	10-268DL	26		36	
7	10-266**	17	10-256MS	27		37	
8	10-266DL**	18	10-256MSD	28		38	
9	10-256	19		29		39	
10	10-256DL	20		30		40	

Notes:

LDC #: 23272A51
SDG #: See cover

VALIDATION FINDINGS CHECKLIST

Reviewer: NA
2nd Reviewer: [illegible]

Method: ✓ GC ____ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation?		✓		
Did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?			✓	
Were the RT windows properly established?	✓			
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20%.0 or percent recoveries 80-120%?	✓			
Were all the retention times within the acceptance windows?	✓			
V. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank analyzed for each matrix and concentration?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Surrogate spikes				
Were all surrogate %R within the QC limits?			✓	
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?				✓

LDC #: 23272A51
SDG #: See Cover

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
Reviewer: NH
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
X. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XI. Compound quantitation/CRQLs				
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. System performance				
System performance was found to be acceptable.	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XIV. Field duplicates				
Field duplicate pairs were identified in this SDG.		✓		
Target compounds were detected in the field duplicates.			✓	
XV. Field blanks				
Field blanks were identified in this SDG.		✓		
Target compounds were detected in the field blanks.			✓	

LDC #: 23272A5
SDG #: See cover

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: AT
2nd Reviewer: [illegible]

METHOD: X GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?
(Y) N N/A Was an MS/MSD analyzed every 20 samples for each matrix or whenever a sample extraction was performed?
Y (N) N/A Were the MS/MSD percent recoveries (%R) and relative percent differences (RPD) within QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	17/18	Methane	201 (50-150)	( )	( )	9	no qual
			( )	( )	( )		Sample 74x spike
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC #23072A51
SDG #See Cover

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: NA
2nd Reviewer: [illegible]

METHOD: X **GC** __ **HPLC**

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Level IV/D Only

N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

#	Compound Name	Finding	Associated Samples	Qualifications
	~~All~~ Methane	Exceeded calib. Range	7, 11	J dLAS / A

Comments: See sample calculation verification worksheet for recalculations

LDC #: 23272A51
SDG #: See Cover

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: X GC ___ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

(Y) N N/A Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated Samples	Qualifications
	Methane	Exceeded calib Range	7, 11	R/A
	All except Methane	Dilution	8, 12	R/A

Comments: _____

OVRNew.wpd

LDC #: 23272A51
SDG #: See Cover

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: GC X HPLC

The calibration Factor (CF), average CF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

CF = A/C
average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

A = Area of compound,
C = Concentration of compound,
S = Standard deviation of the CF
X = Mean of the CFs

#	Standard ID	Calibration Date	Compound	Reported CF (8.5 std)	Recalculated CF (8.5 std)	Reported Average CF (initial)	Recalculated Average CF (initial)	Reported %RSD	Recalculated %RSD
1	ICAL	1/5/10	Methane	29126	29037	29725.6	29635.9	4.4	4.4
2									
3									
4									

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

INICLC.1SB

LDC #: 23272A51
SDG #: See Cover

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC ✓ HPLC ____

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration CF were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. CF - CF)/ave. CF
CF = A/C

Where: ave. CF = initial calibration average CF
CF = continuing calibration CF
A = Area of compound
C = Concentration of compound

#	Standard ID	Calibration Date	Compound	Average CF(Ical)/ CCV Conc.	Reported CF/Conc. CCV	Recalculated CF/Conc. CCV	Reported %D	Recalculated %D
1	FE10002A	5/10/10	Methane	13.6	13.58	13.62	0	0
	FE10013A		Methane	13.6	13.39	13.42	1	1
2								
3								
4								

Comments: Refer to Continuing Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

CONCLC.1S

LDC #: 23272451
SDG #: See Cover

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: X GC __HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC - SC)/SA

Where

SSC = Spiked sample concentration
SA = Spike added
MS = Matrix spike
SC = Sample concentration
MSD = Matrix spike duplicate

RPD =(((SSCMS - SSCMSD) * 2) / (SSCMS + SSCMSD))*100

MS/MSD samples: 17/18

Compound	Spike Added (ug/L)		Sample Conc. (ug/L)	Spike Sample Concentration (ug/L)		Matrix spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	--	MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)											
Diesel (8015)											
Benzene (8021B)											
Methane (RSK-175)	13.6	13.6	445	472	461	201	198	122	118	2	2
2,4-D (8151)											
Dinoseb (8151)											
Naphthalene (8310)											
Anthracene (8310)											
HMX (8330)											
2,4,6-Trinitrotoluene (8330)											

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 23272A51
SDG #: See cover

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample/Laboratory Control Sample Duplicate Results Verification

Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: X GC __HPLC

The percent recoveries (%R) and Relative Percent difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100* (SSC-SC)/SA
RPD = I LCS - LCSD I * 2/(LCS + LCSD)

Where: SSC = Spiked sample concentration
SA = Spike added
LCS = Laboratory control sample percent recovery
SC = Concentration
LCSD = Laboratory control sample duplicate percent recovery

LCS/LCSD samples: DGE006W-LCS/D

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)										
Diesel (8015)										
Benzene (8021B)										
Methane (RSK-175)	13.6	13.6	13.2	13.2	97	97	97	97	0	0
2,4-D (8151)										
Dinoseb (8151)										
Naphthalene (8310)										
Anthracene (8310)										
HMX (8330)										
2,4,6-Trinitrotoluene (8330)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 23272A51
SDG #: See Cover

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: ☑ GC ___ HPLC

(Y) N N/A Were all reported results recalculated and verified for all level IV samples?
(Y) N N/A Were all recalculated results for detected target compounds within 10% of the reported results?

Concentration= (A)(Fv)(Df) / (RF)(Vs or Ws)(%S/100)

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound in the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID. 8 Compound Name Methane

Concentration = (389727) / (29725.6) (1000X)

= 13,110 ug/L

#	Sample ID	Compound	Reported Concentrations ( )	Recalculated Results Concentrations ( )	Qualifications
			13,000 ug/L		

Comments:

SAMPCALew.wpd

CHAIN OF CUSTODY

EMAX LABORATORIES, INC.
1835 W. 205th Street, Torrance, CA 90501
Tel #: 310-618-8889 Fax #: 310-618-0818
Email: info@emaxlabs.com

PO NUMBER: 61630
SAMPLE STORAGE: Coolers
EMAX CONTROL NO. * 10E119
PROJECT CODE: 3210.010

CLIENT: Tetra Tech EC
PROJECT: Seal Beach NWS IRP Site 40
COORDINATOR: Wendy Bryant
TEL: 949-989-5022 FAX: EMAIL:
SEND REPORT TO: S. Sodoku
COMPANY: Tetra Tech EC
ADDRESS:
EMAX PM:

MATRIX CODE	PRESERVATIVE CODE
DW=Drinking Water	IC = Ice
GW=Ground Water	HC = HCl
WW=Waste Water	HN=HNO3
SD=Solid Waste SL=Sludge	SH=NaOH
SS=Soil/ Sediment	ST=Na2S2O3
WP=Wipes PP=Pure Products	ZA=Zinc Acetate
AR=Air	HS=H_2SO_4
O=	

TAT: ☐ Rush ____hrs. ☐ Rush ____days ☐ 7 days ☐ 14 days ☐ 21 days ☐ 30 days ☒ 5 days ☐

LAB	SAMPLE ID CLIENT	SAMPLING LOCATION	DATE	TIME	CONTAINER NO.	SIZE	TYPE	MATRIX CODE	QC	VOCs 8260B	TDC 9060	BSL-175	TDS 160.1	Cations 6010B	COD 410.4	Anions 300.0	Alkalinity 310.1	COMMENTS
										PRESERVATIVE CODE								
										HC	HC	IC	IC	HN	HS	IC	IC	
1	10-280		5/7/10	0815	3			GW	TB	X								Trip Blank
2	10-269		5/7/10	0832	8			GW	N	X	X		X	X	X	X	X	IW-1 ✓
3	10-~~274~~ 271 WB		5/7/10	0923	4			GW	N	X					X			IW-4 ✓
4	10-274		5/7/10	1000	4			GW	N	X					X			IW-14 ✓
5	10-275		5/7/10	1044	4			GW	N	X					X			IW-16 ✓
6	10-276		5/7/10	1045	4			GW	FD	X					X			IW-16 Dup ✓
7	10-273		5/7/10	1126	4			GW	N	X					X			IW-12
8	10-281		5/7/10	1150	7			GW	EB	X	X		X		X	X	X	Equip Blank
9																		
10																		

Instructions

Cooler #	Temp. (°C)	Sample #s

SAMPLER

COURIER/AIRBILL

RELINQUISHED BY	Date	Time	RECEIVED BY
[illegible]	5/7/10	1415	[illegible]

0036770

NOTICE: Turn-around-time (TAT) for samples shall not begin until all discrepancies have been resolved. For samples received and discrepacies resolved after 1500 hrs, TAT shall start at 0800 hrs the next business day. The client is responsible for all cost associted with sample disposal. Samples shall be disposed of as soon as practical (but not prior to fifteen (15) calendar days) after issuance of analytical report unless a different sample disposal schedule is pre-arranged with EMAX. Disposal fee for samples defined by CA Title 22 as non-hazardous shall be $5.00 per sample. EMAX will return hazardous samples to the client at the client's expense unless directed in writing otherwise.

LABORATORY DATA CONSULTANTS, INC.
7750 El Camino Real, Suite 2L Carlsbad, CA 92009 Phone: 760/634-0437 Fax: 760/634-0439

Tetra Tech EC, Inc.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
ATTN: Ms. Sabina Sudoko

June 8, 2010

SUBJECT: NWS Seal Beach CTO 010, Data Validation

Dear Ms. Sudoko,

Enclosed is the final validation report and Excel qualification sheet for the fractions listed below. These SDGs were received on June 3rd, 2010.

LDC project# 23272:

SDG #	Fraction
10E098, 10E119	Volatiles (EPA SW 846 Method 8260B) Metals (EPA SW 846 Method 6010B) Dissolved Gases (Method RSK-175) Wet Chemistry (EPA Method 160.1, 310.1, 410.4, 300.0, and EPA SW 846 Method 9060)

The following deliverables are submitted under this report:

- Attachment I — Sample ID Cross Reference and Data Review Level
- Attachment II — Overall Data Qualification Summary
- Attachment III — Tetra Tech EC Database Qualification Summary
- Attachment IV — Field Blank Summary
- Enclosure I — EPA Level III ADR Outliers (including manual review outliers)
- Enclosure II — EPA Level IV Validation Reports

The data validation was performed in accordance to the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, June 2008 and for Inorganic Data Review, October 2004. Where specific guidance is not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience. The following items were evaluated during the review:

- Holding Times
- Sample Preservation
- Cooler Temperatures
- Initial Calibration (Manual Review)
- Continuing Calibration (Manual Review)
- Blanks
- Surrogates
- Internal Standards (Manual Review)

- Matrix Spike/Matrix Spike Duplicates
- Laboratory Control Samples
- Detection and Quantitation Limits
- Field QC Samples

Please feel free to contact us if you have any questions.

Sincerely,

Andrew Kong
Project Manager/Chemist

Attachment I

Sample ID Cross Reference and Data Review Level

Sample Cross Reference

Date Collected	Field Sample ID	Lab Sample ID	Sample Type	Prep Method	Analytical Method	Review Level
07-May-2010	10-280	E119-01	TB	5030B	8260B	3
07-May-2010	10-269	E119-02	N	3010A	6010B	3
07-May-2010	10-269	E119-02	N	GEN PREP	160.1	3
07-May-2010	10-269	E119-02	N	GEN PREP	300.0	3
07-May-2010	10-269	E119-02	N	GEN PREP	300.0 N	3
07-May-2010	10-269	E119-02	N	GEN PREP	310.1	3
07-May-2010	10-269	E119-02	N	GEN PREP	410.4	3
07-May-2010	10-269	E119-02	N	GEN PREP	9060	3
07-May-2010	10-269	E119-02R	N	5030B	8260B	3
07-May-2010	10-269	E119-02R	N	GEN PREP	300.0	3
07-May-2010	10-271	E119-03	N	GEN PREP	410.4	3
07-May-2010	10-271	E119-03R	N	5030B	8260B	3
07-May-2010	10-274	E119-04	N	GEN PREP	410.4	3
07-May-2010	10-274	E119-04R	N	5030B	8260B	3
07-May-2010	10-274	E119-04T	N	5030B	8260B	3
07-May-2010	10-275	E119-05	N	GEN PREP	410.4	3
07-May-2010	10-275	E119-05R	N	5030B	8260B	3
07-May-2010	10-276	E119-06	FD	GEN PREP	410.4	3
07-May-2010	10-276	E119-06R	FD	5030B	8260B	3
07-May-2010	10-273	E119-07	N	GEN PREP	410.4	3
07-May-2010	10-273	E119-07R	N	5030B	8260B	3
07-May-2010	10-281	E119-08	EB	5030B	8260B	3
07-May-2010	10-281	E119-08	EB	GEN PREP	160.1	3
07-May-2010	10-281	E119-08	EB	GEN PREP	300.0	3
07-May-2010	10-281	E119-08	EB	GEN PREP	300.0 N	3
07-May-2010	10-281	E119-08	EB	GEN PREP	310.1	3

III = EPA Level 3 Data Review *N = Normal Sample* *TB = Trip Blank* *MS = Matrix Spike*
IV = EPA Level 4 Data Validation *FD = Field Duplicate* *FB = Field Blank* *MSD = Matrix Spike Duplicate*

Sample Cross Reference

Date Collected	Field Sample ID	Lab Sample ID	Sample Type	Prep Method	Analytical Method	Review Level
07-May-2010	10-281	E119-08	EB	GEN PREP	410.4	3
07-May-2010	10-281	E119-08	EB	GEN PREP	9060	3

III = EPA Level 3 Data Review *N = Normal Sample* *TB = Trip Blank* *MS = Matrix Spike*
IV = EPA Level 4 Data Validation *FD = Field Duplicate* *FB = Field Blank* *MSD = Matrix Spike Duplicate*

Attachment II

Overall Data Qualification Summary

Overall Qualified Results

Analytical Method	Field Sample ID	Matrix	Sample Type	Analyte	RL	Lab Result	Unc / Error	Overall Qualifier	Units	Reason Code
SDG: 10E119										
6010B	10-269	AQ	N							
				POTASSIUM	5.00	2.91J		J	MG/L	
8260B	10-269	AQ	N							
				ACETONE	50	8.3J		J	UG/L	
				CIS-1,2-DICHLOROETHENE	1.0	0.40J		J	UG/L	
				TRANS-1,2-DICHLOROETHENE	1.0	0.47J		J	UG/L	
8260B	10-271	AQ	N							
				ACETONE	50	5.5J		J	UG/L	
				CIS-1,2-DICHLOROETHENE	1.0	0.40J		J	UG/L	
				TRICHLOROETHENE	1.0	0.33J		J	UG/L	
8260B	10-273	AQ	N							
				2-BUTANONE	50	9.7J		J	UG/L	
				ACETONE	50	28J		J	UG/L	
				CIS-1,2-DICHLOROETHENE	1.0	0.62J		J	UG/L	
				ETHYLBENZENE	0.50	0.28J		J	UG/L	
				TOLUENE	0.50	0.43J		J	UG/L	
				TRICHLOROETHENE	1.0	0.43J		J	UG/L	
				VINYL CHLORIDE	0.50	0.39J		J	UG/L	
8260B	10-274	AQ	N							
				2-BUTANONE	500	260J		J	UG/L	
				ACETONE	500	360J		J	UG/L	
				TOLUENE	0.50	0.26J		J	UG/L	
				TRANS-1,2-DICHLOROETHENE	1.0	0.22J		J	UG/L	
				TRICHLOROETHENE	1.0	0.64J		J	UG/L	
8260B	10-275	AQ	N							
				ACETONE	50	5.0J		J	UG/L	
				CIS-1,2-DICHLOROETHENE	1.0	0.84J		J	UG/L	
8260B	10-276	AQ	FD							
				CIS-1,2-DICHLOROETHENE	1.0	0.93J		J	UG/L	

N = Normal Sample *TB = Trip Blank*
FD = Field Duplicate *FB = Field Blank*

Attachment III

Tetra Tech EC Database Qualification Summary

Tetra Tech
Reason for Qualified Results
SDG Nos. : 10E119

Sample Del Group (SDG)	Sample ID	Test Method	CAS No.	Detected Qualifier	Non Detected Qualifier	Analyte Name	Reason

No Qualified Results

Attachment IV

Field Blank Summary

Field QC Detect Summary

SDG	Method	QC Type	Client Sample ID	Matrix	Sample Date	Analyte	Client Analyte ID	Lab Result	Units	Lab Qualifier	Reporting Limit
10E119	160.1	EB	10-281	AQ	05/07/2010 11:50	TOTAL DISSOLVED SOLIDS	-10	670	MG/L		10.0
10E119	300.0	EB	10-281	AQ	05/07/2010 11:50	CHLORIDE	16887-00-6	90.3	MG/L		4.00
10E119	300.0	EB	10-281	AQ	05/07/2010 11:50	SULFATE AS SO4	14808-79-8	233	MG/L		10.0
10E119	300.0 N	EB	10-281	AQ	05/07/2010 11:50	NITRATE	14797-55-8	0.744	MG/L		0.100
10E119	310.1	EB	10-281	AQ	05/07/2010 11:50	ALKALINITY, TOTAL	-17	114	MG/L		5.00
10E119	410.4	EB	10-281	AQ	05/07/2010 11:50	CHEMICAL OXYGEN DEMAND	-13	25.5	MG/L		10.0
10E119	9060	EB	10-281	AQ	05/07/2010 11:50	TOTAL ORGANIC CARBON (TOC)	-28	1.28	MG/L		1.00

Enclosure I

EPA Level III ADR Outliers
(including Manual Review Outliers)

Quality Control Outlier Reports

10E119

Reporting Limits Outlier Report (detected results reported below the reporting limit)

Lab Report Batch: 10E119 **Lab ID:** EMXT

Client Sample ID	Lab Sample ID	Analysis Method	Matrix	Analyte Name	Lab Qualifier	Result	EDD Reporting Limit	Units
10-269	E119-02	6010B	AQ	POTASSIUM	J	2.91	5.00	MG/L
	E119-02R	8260B		ACETONE	J	8.3	50	UG/L
				CIS-1,2-DICHLOROETHENE	J	0.40	1.0	UG/L
				TRANS-1,2-DICHLOROETHENE	J	0.47	1.0	UG/L
10-271	E119-03R			ACETONE	J	5.5	50	UG/L
				CIS-1,2-DICHLOROETHENE	J	0.40	1.0	UG/L
				TRICHLOROETHENE	J	0.33	1.0	UG/L
10-273	E119-07R			2-BUTANONE	J	9.7	50	UG/L
				ACETONE	J	28	50	UG/L
				CIS-1,2-DICHLOROETHENE	J	0.62	1.0	UG/L
				ETHYLBENZENE	J	0.28	0.50	UG/L
				TOLUENE	J	0.43	0.50	UG/L
				TRICHLOROETHENE	J	0.43	1.0	UG/L
				VINYL CHLORIDE	J	0.39	0.50	UG/L
10-274	E119-04T			2-BUTANONE	J	260	500	UG/L
				ACETONE	J	360	500	UG/L
	E119-04R			TOLUENE	J	0.26	0.50	UG/L
				TRANS-1,2-DICHLOROETHENE	J	0.22	1.0	UG/L
				TRICHLOROETHENE	J	0.64	1.0	UG/L
10-275	E119-05R			ACETONE	J	5.0	50	UG/L
				CIS-1,2-DICHLOROETHENE	J	0.84	1.0	UG/L
10-276	E119-06R			CIS-1,2-DICHLOROETHENE	J	0.93	1.0	UG/L

QC Outlier Report: Field Duplicates (Non-qualified Outliers)

Lab Report Batch: 10E119 **Lab ID:** EMXT

			Field Sample				Field Sample Duplicate						
Analysis Method	Matrix	Analyte Name	Client Sample ID	Ana Type	Result	Lab Qualifier	Client Sample Duplicate ID	Ana Type	Result	Lab Qualifiers	RPD Dup* (%)	RPD Criteria (%)	Result Units
8260B	AQ	ACETONE	10-275	RES	5.0	J	10-276	RES	50	U	200.0		UG/L

**Note: Outlier report also includes analytes detected in one sample but not in the related sample, i.e., analyte was detected in the field sample but not in the field duplicate sample, or vice versa. In this case, RPD value assigned to the field duplicate sample is 200.*

Project Number and Name: ***3210.010E - NWS SEAL BEACH, CTO 010***

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/07/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E119	Date Extracted:	05/11/10 16:13
Sample ID:	10-280	Date Analyzed:	05/11/10 16:13
Lab Samp ID:	E119-01	Dilution Factor:	1
Lab File ID:	REC218	Matrix :	WATER
Ext Btch ID:	V067E09	% Moisture :	NA
Calib. Ref.:	RDC376	Instrument ID :	T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	ND	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	ND	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	ND	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	ND	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	ND	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	ND	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	113	65-135
4-BROMOFLUOROBENZENE	98	75-125
TOLUENE-D8	99	75-125

6/8/10

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/07/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E119	Date Extracted:	05/11/10 19:10
Sample ID:	10-269	Date Analyzed:	05/11/10 19:10
Lab Samp ID:	E119-02R	Dilution Factor:	1
Lab File ID:	REC224	Matrix	: WATER
Ext Btch ID:	V067E09	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	8.3J J	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	ND	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	0.40J J	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	ND	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLOROETHENE	0.47J J	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	ND	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	1.4	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	119	65-135
4-BROMOFLUOROBENZENE	97	75-125
TOLUENE-D8	100	75-125

6/8/10

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/07/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E119	Date Extracted:	05/11/10 18:41
Sample ID:	10-271	Date Analyzed:	05/11/10 18:41
Lab Samp ID:	E119-03R	Dilution Factor:	1
Lab File ID:	REC223	Matrix	: WATER
Ext Btch ID:	V067E09	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)		RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND		1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND		1.0	0.20
1,1,2-TRICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHENE	ND		1.0	0.20
1,2-DICHLOROETHANE	ND		1.0	0.20
1,2-DICHLOROPROPANE	ND		1.0	0.20
2-BUTANONE	ND		50	5.0
2-HEXANONE	ND		50	5.0
4-METHYL-2-PENTANONE	ND		50	5.0
ACETONE	5.5J	J	50	5.0
BENZENE	ND		0.50	0.20
BROMODICHLOROMETHANE	ND		1.0	0.20
BROMOFORM	ND		1.0	0.30
BROMOMETHANE	ND		1.0	0.20
CARBON TETRACHLORIDE	ND		1.0	0.20
CHLOROBENZENE	ND		1.0	0.20
CHLOROETHANE	ND		1.0	0.20
CHLOROFORM	ND		1.0	0.20
CHLOROMETHANE	ND		1.0	0.20
CIS-1,2-DICHLOROETHENE	0.40J	J	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND		1.0	0.20
DIBROMOCHLOROMETHANE	ND		1.0	0.20
ETHYLBENZENE	ND		0.50	0.20
XYLENES	ND		1.0	0.20
MTBE	ND		1.0	0.20
METHYLENE CHLORIDE	ND		1.0	0.50
STYRENE	ND		1.0	0.20
TETRACHLOROETHENE	ND		1.0	0.20
TOLUENE	ND		0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND		1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND		1.0	0.20
TRICHLOROETHENE	0.33J	J	1.0	0.20
VINYL ACETATE	ND		50	0.20
VINYL CHLORIDE	1.0		0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	123	65-135
4-BROMOFLUOROBENZENE	98	75-125
TOLUENE-D8	99	75-125

6/8/10

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/07/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E119	Date Extracted:	05/11/10 21:09
Sample ID:	10-274	Date Analyzed:	05/11/10 21:09
Lab Samp ID:	E119-04R	Dilution Factor:	1
Lab File ID:	REC228	Matrix	: WATER
Ext Btch ID:	V067E09	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)		RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND		1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND		1.0	0.20
1,1,2-TRICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHENE	ND		1.0	0.20
1,2-DICHLOROETHANE	ND		1.0	0.20
1,2-DICHLOROPROPANE	ND		1.0	0.20
2-BUTANONE	260E	R	50	5.0
2-HEXANONE	ND		50	5.0
4-METHYL-2-PENTANONE	ND		50	5.0
ACETONE	340E	R	50	5.0
BENZENE	ND		0.50	0.20
BROMODICHLOROMETHANE	ND		1.0	0.20
BROMOFORM	ND		1.0	0.30
BROMOMETHANE	ND		1.0	0.20
CARBON TETRACHLORIDE	ND		1.0	0.20
CHLOROBENZENE	ND		1.0	0.20
CHLOROETHANE	ND		1.0	0.20
CHLOROFORM	ND		1.0	0.20
CHLOROMETHANE	ND		1.0	0.20
CIS-1,2-DICHLOROETHENE	1.4		1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND		1.0	0.20
DIBROMOCHLOROMETHANE	ND		1.0	0.20
ETHYLBENZENE	0.57		0.50	0.20
XYLENES	ND		1.0	0.20
MTBE	ND		1.0	0.20
METHYLENE CHLORIDE	ND		1.0	0.50
STYRENE	ND		1.0	0.20
TETRACHLOROETHENE	ND		1.0	0.20
TOLUENE	0.26J	J	0.50	0.20
TRANS-1,2-DICHLOROETHENE	0.22J	J	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND		1.0	0.20
TRICHLOROETHENE	0.64J	J	1.0	0.20
VINYL ACETATE	ND		50	0.20
VINYL CHLORIDE	1.1		0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	134	65-135
4-BROMOFLUOROBENZENE	94	75-125
TOLUENE-D8	96	75-125

CA 6/30/10

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/07/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E119	Date Extracted:	05/11/10 20:40
Sample ID:	10-274DL	Date Analyzed:	05/11/10 20:40
Lab Samp ID:	E119-04T	Dilution Factor:	10
Lab File ID:	REC227	Matrix	: WATER
Ext Btch ID:	V067E09	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)		RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	R	10	2.0
1,1,2,2-TETRACHLOROETHANE	ND		10	2.0
1,1,2-TRICHLOROETHANE	ND		10	2.0
1,1-DICHLOROETHANE	ND		10	2.0
1,1-DICHLOROETHENE	ND		10	2.0
1,2-DICHLOROETHANE	ND		10	2.0
1,2-DICHLOROPROPANE	ND		10	2.0
2-BUTANONE	260J	J	500	50
2-HEXANONE	ND	R	500	50
4-METHYL-2-PENTANONE	ND		500	50
ACETONE	360J	J	500	50
BENZENE	ND	R	5.0	2.0
BROMODICHLOROMETHANE	ND		10	2.0
BROMOFORM	ND		10	3.0
BROMOMETHANE	ND		10	2.0
CARBON TETRACHLORIDE	ND		10	2.0
CHLOROBENZENE	ND		10	2.0
CHLOROETHANE	ND		10	2.0
CHLOROFORM	ND		10	2.0
CHLOROMETHANE	ND		10	2.0
CIS-1,2-DICHLOROETHENE	ND		10	2.0
CIS-1,3-DICHLOROPROPENE	ND		10	2.0
DIBROMOCHLOROMETHANE	ND		10	2.0
ETHYLBENZENE	ND		5.0	2.0
XYLENES	ND		10	2.0
MTBE	ND		10	2.0
METHYLENE CHLORIDE	ND		10	5.0
STYRENE	ND		10	2.0
TETRACHLOROETHENE	ND		10	2.0
TOLUENE	ND		5.0	2.0
TRANS-1,2-DICHLOROETHENE	ND		10	2.0
TRANS-1,3-DICHLOROPROPENE	ND		10	2.0
TRICHLOROETHENE	ND		10	2.0
VINYL ACETATE	ND		500	2.0
VINYL CHLORIDE	ND		5.0	2.0

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	126	65-135
4-BROMOFLUOROBENZENE	98	75-125
TOLUENE-D8	99	75-125

al 6/8/10

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/07/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E119	Date Extracted:	05/11/10 18:12
Sample ID:	10-275	Date Analyzed:	05/11/10 18:12
Lab Samp ID:	E119-05R	Dilution Factor:	1
Lab File ID:	REC222	Matrix	: WATER
Ext Btch ID:	V067E09	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)		RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND		1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND		1.0	0.20
1,1,2-TRICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHENE	ND		1.0	0.20
1,2-DICHLOROETHANE	ND		1.0	0.20
1,2-DICHLOROPROPANE	ND		1.0	0.20
2-BUTANONE	ND		50	5.0
2-HEXANONE	ND		50	5.0
4-METHYL-2-PENTANONE	ND		50	5.0
ACETONE	5.0J	J	50	5.0
BENZENE	ND		0.50	0.20
BROMODICHLOROMETHANE	ND		1.0	0.20
BROMOFORM	ND		1.0	0.30
BROMOMETHANE	ND		1.0	0.20
CARBON TETRACHLORIDE	ND		1.0	0.20
CHLOROBENZENE	ND		1.0	0.20
CHLOROETHANE	ND		1.0	0.20
CHLOROFORM	ND		1.0	0.20
CHLOROMETHANE	ND		1.0	0.20
CIS-1,2-DICHLOROETHENE	0.84J	J	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND		1.0	0.20
DIBROMOCHLOROMETHANE	ND		1.0	0.20
ETHYLBENZENE	ND		0.50	0.20
XYLENES	ND		1.0	0.20
MTBE	ND		1.0	0.20
METHYLENE CHLORIDE	ND		1.0	0.50
STYRENE	ND		1.0	0.20
TETRACHLOROETHENE	ND		1.0	0.20
TOLUENE	ND		0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND		1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND		1.0	0.20
TRICHLOROETHENE	1.3		1.0	0.20
VINYL ACETATE	ND		50	0.20
VINYL CHLORIDE	ND		0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	120	65-135
4-BROMOFLUOROBENZENE	97	75-125
TOLUENE-D8	99	75-125

A 6/8/10

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/07/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E119	Date Extracted:	05/11/10 17:42
Sample ID:	10-276	Date Analyzed:	05/11/10 17:42
Lab Samp ID:	E119-06R	Dilution Factor:	1
Lab File ID:	REC221	Matrix	: WATER
Ext Btch ID:	V067E09	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	ND	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	ND	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	0.93J J	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	ND	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	1.4	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	ND	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	119	65-135
4-BROMOFLUOROBENZENE	100	75-125
TOLUENE-D8	100	75-125

6/8/10

2010

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client	: TETRA TECH EC, INC.	Date Collected:	05/07/10
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
Batch No.	: 10E119	Date Extracted:	05/11/10 17:12
Sample ID:	10-273	Date Analyzed:	05/11/10 17:12
Lab Samp ID:	E119-07R	Dilution Factor:	1
Lab File ID:	REC220	Matrix	: WATER
Ext Btch ID:	V067E09	% Moisture	: NA
Calib. Ref.:	RDC376	Instrument ID	: T-067

PARAMETERS	RESULTS (ug/L)		RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND		1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND		1.0	0.20
1,1,2-TRICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHANE	ND		1.0	0.20
1,1-DICHLOROETHENE	ND		1.0	0.20
1,2-DICHLOROETHANE	ND		1.0	0.20
1,2-DICHLOROPROPANE	ND		1.0	0.20
2-BUTANONE	9.7J	J	50	5.0
2-HEXANONE	ND		50	5.0
4-METHYL-2-PENTANONE	ND		50	5.0
ACETONE	28J	J	50	5.0
BENZENE	ND		0.50	0.20
BROMODICHLOROMETHANE	ND		1.0	0.20
BROMOFORM	ND		1.0	0.30
BROMOMETHANE	ND		1.0	0.20
CARBON TETRACHLORIDE	ND		1.0	0.20
CHLOROBENZENE	ND		1.0	0.20
CHLOROETHANE	ND		1.0	0.20
CHLOROFORM	ND		1.0	0.20
CHLOROMETHANE	ND		1.0	0.20
CIS-1,2-DICHLOROETHENE	0.62J	J	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND		1.0	0.20
DIBROMOCHLOROMETHANE	ND		1.0	0.20
ETHYLBENZENE	0.28J	J	0.50	0.20
XYLENES	ND		1.0	0.20
MTBE	ND		1.0	0.20
METHYLENE CHLORIDE	ND		1.0	0.50
STYRENE	ND		1.0	0.20
TETRACHLOROETHENE	ND		1.0	0.20
TOLUENE	0.43J	J	0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND		1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND		1.0	0.20
TRICHLOROETHENE	0.43J	J	1.0	0.20
VINYL ACETATE	ND		50	0.20
VINYL CHLORIDE	0.39J	J	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	121	65-135
4-BROMOFLUOROBENZENE	95	75-125
TOLUENE-D8	99	75-125

4/8/10

SW 5030B/8260B
VOLATILE ORGANICS BY GC/MS

Client : TETRA TECH EC, INC.	Date Collected: 05/07/10
Project : NWS SEAL BEACH, CTO 010	Date Received: 05/07/10
Batch No. : 10E119	Date Extracted: 05/11/10 16:43
Sample ID: 10-281	Date Analyzed: 05/11/10 16:43
Lab Samp ID: E119-08	Dilution Factor: 1
Lab File ID: REC219	Matrix : WATER
Ext Btch ID: V067E09	% Moisture : NA
Calib. Ref.: RDC376	Instrument ID : T-067

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
1,1,1-TRICHLOROETHANE	ND	1.0	0.20
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHANE	ND	1.0	0.20
1,1-DICHLOROETHENE	ND	1.0	0.20
1,2-DICHLOROETHANE	ND	1.0	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.20
2-BUTANONE	ND	50	5.0
2-HEXANONE	ND	50	5.0
4-METHYL-2-PENTANONE	ND	50	5.0
ACETONE	ND	50	5.0
BENZENE	ND	0.50	0.20
BROMODICHLOROMETHANE	ND	1.0	0.20
BROMOFORM	ND	1.0	0.30
BROMOMETHANE	ND	1.0	0.20
CARBON TETRACHLORIDE	ND	1.0	0.20
CHLOROBENZENE	ND	1.0	0.20
CHLOROETHANE	ND	1.0	0.20
CHLOROFORM	ND	1.0	0.20
CHLOROMETHANE	ND	1.0	0.20
CIS-1,2-DICHLOROETHENE	ND	1.0	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.20
DIBROMOCHLOROMETHANE	ND	1.0	0.20
ETHYLBENZENE	ND	0.50	0.20
XYLENES	ND	1.0	0.20
MTBE	ND	1.0	0.20
METHYLENE CHLORIDE	ND	1.0	0.50
STYRENE	ND	1.0	0.20
TETRACHLOROETHENE	ND	1.0	0.20
TOLUENE	ND	0.50	0.20
TRANS-1,2-DICHLOROETHENE	ND	1.0	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.20
TRICHLOROETHENE	ND	1.0	0.20
VINYL ACETATE	ND	50	0.20
VINYL CHLORIDE	ND	0.50	0.20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	113	65-135
4-BROMOFLUOROBENZENE	97	75-125
TOLUENE-D8	100	75-125

6/8/10

2012

METHOD 3010A/6010B
METALS BY ICP

Client	: TETRA TECH EC, INC.	Date Collected:	05/07/10 08:32
Project	: NWS SEAL BEACH, CTO 010	Date Received:	05/07/10
SDG NO.	: 10E119	Date Extracted:	05/11/10 09:30
Sample ID:	10-269	Date Analyzed:	05/11/10 19:53
Lab Samp ID:	E119-02	Dilution Factor:	1
Lab File ID:	ID8E012052	Matrix :	WATER
Ext Btch ID:	IPE030W	% Moisture :	NA
Calib. Ref.:	ID8E012044	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/L)	RL (mg/L)	MDL (mg/L)
Calcium	104	5.00	2.00
Iron	67.9	0.100	0.0400
Magnesium	39.0	5.00	2.00
Potassium	2.91J	5.00	2.00
Sodium	270	5.00	2.00

6/8/10

METHOD 160.1
TOTAL DISSOLVED SOLIDS

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO D1D
Batch No. : 10E119

Matrix : WATER
Instrument ID : 40706360

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	TDE004WB	ND	1	NA	10.0	5.00	05/11/1015:33	NA	TDE00401	NA	TDE004W	NA	NA
LCS1W	TDE004WL	1070	1	NA	10.0	5.00	05/11/1015:33	NA	TDE00402	NA	TDE004W	NA	NA
LCD1W	TDE004WC	1070	1	NA	10.0	5.00	05/11/1015:33	NA	TDE00403	NA	TDE004W	NA	NA
10-269	E119-02	1140	1	NA	10.0	5.00	05/11/1015:33	NA	TDE00411	NA	TDE004W	05/07/1008:32	05/07/10
10-281	E119-08	670	1	NA	10.0	5.00	05/11/1015:33	NA	TDE00412	NA	TDE004W	05/07/1011:50	05/07/10

6/8/10

METHOD 300.0
CHLORIDE

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO 010
Batch No. : 10E119

Matrix : WATER
Instrument ID : I100

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	ICE013WB	ND	1	NA	0.200	0.100	05/11/1010:21	NA	AE13-03	AE13-01	ICE013W	NA	NA
LCS1W	ICE013WL	4.87 ✓	1	NA	0.200	0.100	05/11/1010:37	NA	AE13-04	AE13-01	ICE013W	NA	NA
LCD1W	ICE013WC	4.84	1	NA	0.200	0.100	05/11/1010:53	NA	AE13-05	AE13-01	ICE013W	NA	NA
10-269	E119-02R	303	20	NA	4.00	2.00	05/11/1014:07	NA	AE13-17	AE13-13	ICE013W	05/07/1008:32	05/07/10
MBLK2W	ICE011WB	ND	1	NA	0.200	0.100	05/10/1011:58	NA	AE11-03	AE11-01	ICE011W	NA	NA
LCS2W	ICE011WL	4.83	1	NA	0.200	0.100	05/10/1012:14	NA	AE11-04	AE11-01	ICE011W	NA	NA
LCD2W	ICE011WC	4.94 ✓	1	NA	0.200	0.100	05/10/1012:30	NA	AE11-05	AE11-01	ICE011W	NA	NA
10-281	E119-08	90.3	20	NA	4.00	2.00	05/10/1014:47	NA	AE11-11	AE11-01	ICE011W	05/07/1011:50	05/07/10

6/8/10

METHOD 300.0
NITRATE-N

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO 010
Batch No. : 10E119

Matrix : WATER
Instrument ID : I100

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	ICE005WB	ND	1	NA	0.100	0.0500	05/07/1010:23	NA	AE07-03	AE07-01	ICE005W	NA	NA
LCS1W	ICE005WL	1.88	1	NA	0.100	0.0500	05/07/1010:39	NA	AE07-04	AE07-01	ICE005W	NA	NA
LCD1W	ICE005WC	1.90	1	NA	0.100	0.0500	05/07/1010:55	NA	AE07-05	AE07-01	ICE005W	NA	NA
10-281	E119-08	0.744	1	NA	0.100	0.0500	05/07/1018:12	NA	AE07-32	AE07-25	ICE005W	05/07/1011:50	05/07/10
10-269	E119-02	0.108	1	NA	0.100	0.0500	05/07/1018:28	NA	AE07-33	AE07-25	ICE005W	05/07/1008:32	05/07/10

6/8/10

0912

METHOD 300.0
NITRITE-N

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO 010
Batch No. : 10E119

Matrix : WATER
Instrument ID : I100

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	ICE005WB	ND	1	NA	0.100	0.0500	05/07/1010:23	NA	AE07-03	AE07-01	ICE005W	NA	NA
LCS1W	ICE005WL	2.03	1	NA	0.100	0.0500	05/07/1010:39	NA	AE07-04	AE07-01	ICE005W	NA	NA
LCD1W	ICE005WC	1.96	1	NA	0.100	0.0500	05/07/1010:55	NA	AE07-05	AE07-01	ICE005W	NA	NA
10-281	E119-08	ND	1	NA	0.100	0.0500	05/07/1018:12	NA	AE07-32	AE07-25	ICE005W	05/07/1011:50	05/07/10
10-269	E119-02	ND	2	NA	0.200	0.100	05/07/1018:44	NA	AE07-34	AE07-25	ICE005W	05/07/1008:32	05/07/10

c/8/10

0193

METHOD 300.0
SULFATE

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO 010
Batch No. : 10E119

Matrix : WATER
Instrument ID : I100

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	ICE005WB	ND	1	NA	0.500	0.250	05/07/1010:23	NA	AE07-03	AE07-01	ICE005W	NA	NA
LCS1W	ICE005WL	4.94	1	NA	0.500	0.250	05/07/1010:39	NA	AE07-04	AE07-01	ICE005W	NA	NA
LCD1W	ICE005WC	4.78	1	NA	0.500	0.250	05/07/1010:55	NA	AE07-05	AE07-01	ICE005W	NA	NA
10-269	E119-02	1.81	1	NA	0.500	0.250	05/07/1018:28	NA	AE07-33	AE07-25	ICE005W	05/07/1008:32	05/07/10
MBLK2W	ICE011WB	ND	1	NA	0.500	0.250	05/10/1011:58	NA	AE11-03	AE11-01	ICE011W	NA	NA
LCS2W	ICE011WL	5.22	1	NA	0.500	0.250	05/10/1012:14	NA	AE11-04	AE11-01	ICE011W	NA	NA
LCD2W	ICE011WC	5.08	1	NA	0.500	0.250	05/10/1012:30	NA	AE11-05	AE11-01	ICE011W	NA	NA
10-281	E119-08	233	20	NA	10.0	5.00	05/10/1014:47	NA	AE11-11	AE11-01	ICE011W	05/07/1011:50	05/07/10

6/8/00

METHOD 310.1
TOTAL ALKALINITY

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO 010
Batch No. : 10E119

Matrix : WATER
Instrument ID : E5

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	ALE004WB	ND	1	NA	5.00	1.00	05/12/1010:16	NA	10E5E02003	NA	ALE004W	NA	NA
LCS1W	ALE004WL	579	1	NA	5.00	1.00	05/12/1010:27	NA	10E5E02004	NA	ALE004W	NA	NA
LCD1W	ALE004WC	579	1	NA	5.00	1.00	05/12/1010:38	NA	10E5E02005	NA	ALE004W	NA	NA
10-269	E119-02	631	1	NA	5.00	1.00	05/12/1012:59	NA	10E5E02016	NA	ALE004W	05/07/1008:32	05/07/10
10-281	E119-08	114	1	NA	5.00	1.00	05/12/1013:06	NA	10E5E02017	NA	ALE004W	05/07/1011:50	05/07/10

6/8/10

METHOD 410.4
COD

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO 010
Batch No. : 10E119

Matrix : WATER
Instrument ID : I70

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	CDE003WB	ND	1	NA	10.0	5.00	05/11/1016:38	05/11/1011:30	CDE00310	CDE00308	CDE003W	NA	05/11/10
LCS1W	CDE003WL	394	1	NA	10.0	5.00	05/11/1016:38	05/11/1011:30	CDE00311	CDE00308	CDE003W	NA	05/11/10
LCD1W	CDE003WC	392	1	NA	10.0	5.00	05/11/1016:38	05/11/1011:30	CDE00312	CDE00308	CDE003W	NA	05/11/10
10-269	E119-02	53.6	1	NA	10.0	5.00	05/11/1016:39	05/11/1011:30	CDE00313	CDE00308	CDE003W	05/07/1008:32	05/07/10
10-271	E119-03	53.6	1	NA	10.0	5.00	05/11/1016:39	05/11/1011:30	CDE00314	CDE00308	CDE003W	05/07/1009:23	05/07/10
10-274	E119-04	2580	5	NA	50.0	25.0	05/11/1016:40	05/11/1011:30	CDE00315	CDE00308	CDE003W	05/07/1010:00	05/07/10
10-275	E119-05	47.6	1	NA	10.0	5.00	05/11/1016:40	05/11/1011:30	CDE00316	CDE00308	CDE003W	05/07/1010:44	05/07/10
10-276	E119-06	63.6	1	NA	10.0	5.00	05/11/1016:41	05/11/1011:30	CDE00317	CDE00308	CDE003W	05/07/1010:45	05/07/10
10-273	E119-07	406	1	NA	10.0	5.00	05/11/1016:41	05/11/1011:30	CDE00318	CDE00308	CDE003W	05/07/1011:26	05/07/10
10-281	E119-08	25.5	1	NA	10.0	5.00	05/11/1016:42	05/11/1011:30	CDE00319	CDE00308	CDE003W	05/07/1011:50	05/07/10

6/8/10

METHOD 9060
TOC

Client : TETRA TECH EC, INC.
Project : NWS SEAL BEACH, CTO 010
Batch No. : 10E119

Matrix : WATER
Instrument ID : I62

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	TCE006WB	ND	1	NA	1.00	0.500	05/11/1015:55	NA	TCE004-05	TCE004-02	TCE006W	NA	NA
LCS1W	TCE006WL	25.0	1	NA	1.00	0.500	05/11/1016:08	NA	TCE004-06	TCE004-02	TCE006W	NA	NA
LCD1W	TCE006WC	24.9	1	NA	1.00	0.500	05/11/1016:20	NA	TCE004-07	TCE004-02	TCE006W	NA	NA
10-269	E119-02	5.17	1	NA	1.00	0.500	05/11/1018:01	NA	TCE004-16	TCE004-14	TCE006W	05/07/1008:32	05/07/10
10-281	E119-08	1.28	1	NA	1.00	0.500	05/11/1018:11	NA	TCE004-17	TCE004-14	TCE006W	05/07/1011:50	05/07/10

6/8/10

1095

LDC #: 23272B1
SDG #: 10E119
Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET
ADR

Date: 6/4/10
Page: 1 of 1
Reviewer: PZ
2nd Reviewer: [illegible]

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	N	Sampling dates: 5/7/10
II.	GC/MS Instrument performance check	A	
III.	Initial calibration	A	% RSD ≤ 30, r^2
IV.	Continuing calibration/ICV	A	ICV/CCV ≤ 25
V.	Blanks	N	
VI.	Surrogate spikes	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	N	
IX.	Regional Quality Assurance and Quality Control	N	
X.	Internal standards	N	
XI.	Target compound identification	N	
XII.	Compound quantitation/CRQLs	SW	
XIII.	Tentitatively identified compounds (TICs)	N	
XIV.	System performance	N	
XV.	Overall assessment of data	SW	
XVI.	Field duplicates	N	
XVII.	Field blanks	N	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet

ND = No compounds detected
R = Rinsate
FB = Field blank

D = Duplicate
TB = Trip blank
EB = Equipment blank

Validated Samples: walley

1	10-280 TB	11	MBLKIW	21		31	
2	10-269	12		22		32	
3	10-271	13		23		33	
4	10-274	14		24		34	
5	10-274DL	15		25		35	
6	10-275 D	16		26		36	
7	10-276 D	17		27		37	
8	10-273	18		28		38	
9	10-281 EB	19		29		39	
10		20		30		40	

TARGET COMPOUND WORKSHEET

METHOD: VOA (EPA SW 846 Method 8260B)

A. Chloromethane*	U. 1,1,2-Trichloroethane	OO. 2,2-Dichloropropane	III. n-Butylbenzene	CCCC.1-Chlorohexane
B. Bromomethane	V. Benzene	PP. Bromochloromethane	JJJ. 1,2-Dichlorobenzene	DDDD. Isopropyl alcohol
C. Vinyl choride**	W. trans-1,3-Dichloropropene	QQ. 1,1-Dichloropropene	KKK. 1,2,4-Trichlorobenzene	EEEE. Acetonitrile
D. Chloroethane	X. Bromoform*	RR. Dibromomethane	LLL. Hexachlorobutadiene	FFFF. Acrolein
E. Methylene chloride	Y. 4-Methyl-2-pentanone	SS. 1,3-Dichloropropane	MMM. Naphthalene	GGGG. Acrylonitrile
F. Acetone	Z. 2-Hexanone	TT. 1,2-Dibromoethane	NNN. 1,2,3-Trichlorobenzene	HHHH. 1,4-Dioxane
G. Carbon disulfide	AA. Tetrachloroethene	UU. 1,1,1,2-Tetrachloroethane	OOO. 1,3,5-Trichlorobenzene	IIII. Isobutyl alcohol
H. 1,1-Dichloroethene**	BB. 1,1,2,2-Tetrachloroethane*	VV. Isopropylbenzene	PPP. trans-1,2-Dichloroethene	JJJJ. Methacrylonitrile
I. 1,1-Dichloroethane*	CC. Toluene**	WW. Bromobenzene	QQQ. cis-1,2-Dichloroethene	KKKK. Propionitrile
J. 1,2-Dichloroethene, total	DD. Chlorobenzene*	XX. 1,2,3-Trichloropropane	RRR. m,p-Xylenes	LLLL. Ethyl ether
K. Chloroform**	EE. Ethylbenzene**	YY. n-Propylbenzene	SSS. o-Xylene	MMMM. Benzyl chloride
L. 1,2-Dichloroethane	FF. Styrene	ZZ. 2-Chlorotoluene	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	NNNN.
M. 2-Butanone	GG. Xylenes, total	AAA. 1,3,5-Trimethylbenzene	UUU. 1,2-Dichlorotetrafluoroethane	OOOO.
N. 1,1,1-Trichloroethane	HH. Vinyl acetate	BBB. 4-Chlorotoluene	VVV. 4-Ethyltoluene	PPPP.
O. Carbon tetrachloride	II. 2-Chloroethylvinyl ether	CCC. tert-Butylbenzene	WWW. Ethanol	QQQQ.
P. Bromodichloromethane	JJ. Dichlorodifluoromethane	DDD. 1,2,4-Trimethylbenzene	XXX. Di-isopropyl ether	RRRR.
Q. 1,2-Dichloropropane**	KK. Trichlorofluoromethane	EEE. sec-Butylbenzene	YYY. tert-Butanol	SSSS.
R. cis-1,3-Dichloropropene	LL. Methyl-tert-butyl ether	FFF. 1,3-Dichlorobenzene	ZZZ. tert-Butyl alcohol	TTTT.
S. Trichloroethene	MM. 1,2-Dibromo-3-chloropropane	GGG. p-Isopropyltoluene	AAAA. Ethyl tert-butyl ether	UUUU.
T. Dibromochloromethane	NN. Methyl ethyl ketone	HHH. 1,4-Dichlorobenzene	BBBB. tert-Amyl methyl ether	VVVV.

* = System performance check compounds (SPCC) for RRF ; ** = Calibration check compounds (CCC) for %RSD.

LDC #: 23272B1
SDG #: see cover

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: FT
2nd Reviewer:

METHOD: GC/MS VOA (EPA SW 846 method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?
Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Date	compounds	Finding	Associated Samples	Qualifications
		M, F	x'd cal Range	4	J/A det

Comments: See sample calculation verification worksheet for recalculations

LDC #: 23272B1
SDG #: see cover

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: FT
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

Y N N/A Was the overall quality and usability of the data acceptable?

#	Date	~~Sample ID~~ compd	Finding	Associated Samples	Qualifications
		M, F	x'd cal Range	4	R/A
		All except M, F	diluted	5	R/A

Comments:

OVR.1S

LDC #: 23272B4
SDG #: 10E119
Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET
ADR

Date: 6-3-10
Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: Metals (EPA SW 846 Method 6010B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	N	Sampling dates: 5/7/10
II.	ICP/MS Tune	N	
III.	Calibration	A	
IV.	Blanks	A	
V.	ICP Interference Check Sample (ICS) Analysis	A	
VI.	Matrix Spike Analysis	A	MS/D (SDG# 10E098)
VII.	Duplicate Sample Analysis	N	
VIII.	Laboratory Control Samples (LCS)	N	LCS/D
IX.	Internal Standard (ICP-MS)	N	
X.	Furnace Atomic Absorption QC	N	
XI.	ICP Serial Dilution	A	(SDG# 10E098)
XII.	Sample Result Verification	N	
XIII.	Overall Assessment of Data	N	
XIV.	Field Duplicates	—	
XV	Field Blanks	—	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet
ND = No compounds detected
R = Rinsate
FB = Field blank
D = Duplicate
TB = Trip blank
EB = Equipment blank

Validated Samples: water

1	10-269	11	PBW	21		31	
2		12		22		32	
3		13		23		33	
4		14		24		34	
5		15		25		35	
6		16		26		36	
7		17		27		37	
8		18		28		38	
9		19		29		39	
10		20		30		40	

Notes:

LDC #: 23272B4
SDG #: S80CA02

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Page: 1 of 1
Reviewer: CR
2nd reviewer: W

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
Analysis Method		
ICP		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
ICP Trace		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
ICP-MS		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___ ___
GFAA		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN-, ___

Comments: Mercury by CVAA if performed

LDC #: 23272B6
SDG #: 10E119
Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

~~ADR~~ III

Date: 6-3-10
Page: 1 of 1
Reviewer: ar
2nd Reviewer: h

METHOD: (Analyte) Alkalinity (EPA Method 310.1), Chloride, Nitrate-N, Nitrite-N, Sulfate (EPA Method 300.0), COD (EPA Method 410.4), TDS (EPA Method 160.1), TOC (EPA SW846 Method 9060)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 5/7/10
IIa.	Initial calibration	A	
IIb.	Calibration verification	A	
III.	Blanks	A	
IV	Matrix Spike/Matrix Spike Duplicates	N	Client specified
V	Duplicates	N	↓
VI.	Laboratory control samples	A	LCS/D
VII.	Sample result verification	N	
VIII.	Overall assessment of data	A	
IX.	Field duplicates	SW	(4,5)
X	Field blanks	SW	EB=7

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet

ND = No compounds detected
R = Rinsate
FB = Field blank

D = Duplicate
TB = Trip blank
EB = Equipment blank

Validated Samples: water

1	10-269	11	PBW	21		31	
2	10-271	12		22		32	
3	10-274	13		23		33	
4	10-275	14		24		34	
5	10-276	15		25		35	
6	10-273	16		26		36	
7	10-281	17		27		37	
8		18		28		38	
9		19		29		39	
10		20		30		40	

Notes:

LDC #: 23272B6
SDG #: See cover

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Page: 1 of 1
Reviewer: CR
2nd reviewer: [illegible]

All circled methods are applicable to each sample.

Sample ID	Parameter				
1,7	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
1-7	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}	COD			
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				
	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+}				

Comments:

TETRATECH
1230 Columbia Street, Suite 750
San Diego, CA 92101 (619) 234-8696

CHAIN-OF-CUSTODY RECORD

NUMBER 40890

ENTERED

PROJECT NAME	IRP Site 40
PROJECT LOCATION	Seal Beach NWS
SAMPLER NAME	Wendy Bryant
PROJECT CONTACT	Sabina Sudoko
PURCHASE ORDER NO.	61565
PROJECT NO.	3210.010E
AIRBILL NUMBER	FedEx 872632714958
PROJECT CONTACT PHONE NUMBER	949-509-5022

LABORATORY NAME: EAS

LABORATORY ID (FOR LABORATORY): 210187

Project Information Section Do not submit to Laboratory

ANALYSES REQUIRED: TO-15 VOCs; ASTM D 1946-(Fixed Gases); LCR

SAMPLE ID	DATE COLLECTED	TIME COLLECTED	NO. OF CONTAINER	LEVEL 3	LEVEL 4	TYPE	TAT	TO-15 VOCs	ASTM D 1946-(Fixed Gases)	LCR	COMMENTS	LOCATION	DEPTH START	DEPTH END	QC
10-645	5/4/10	1425	1		X	V	10 Day	X	X			IW-1			N
10-646	5/4/10	1510	1	X		V	10 Day	X	X			IW-7			N
10-647	5/4/10	1550	1	X		V	10 Day	X	X			MW-40-37			N
10-648	5/4/10	1455	1	X		V	10 Day	X	X			MW-40-23			N
10-649	5/4/10	1535	1	X		V	10 Day	X	X			MW-40-26			N

RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)
[illegible]	5/4/10	FedEx
COMPANY: TTEC	TIME	COMPANY: FedEx
RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)
COMPANY	TIME	COMPANY
RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)
COMPANY	TIME	COMPANY

LABORATORY INSTRUCTIONS/COMMENTS: ADR EDD REQUIRED

COMPOSITE DESCRIPTION

SAMPLE CONDITION UPON RECEIPT (FOR LABORATORY)
TEMPERATURE: _____ SAMPLE CONDITION: ☐ INTACT ☐ BROKEN
COOLER SEAL: ☐ INTACT ☐ BROKEN

SAMPLING COMMENT: H

White - Laboratory; Pink - Laboratory; Canary - Project File; Manila - Data Management

ENVIRONMENTAL
Analytical Service Inc.

May 24, 2010
Sample Delivery Group (SDG): 210187

Sabina Sudoko
Tetra Tech
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614-6213

Dear Sabina:

Enclosed is the analytical report for the samples received and analyzed by Environmental Analytical Service, Inc. for the following project:

Project Name:	IRP Site 40 – Seal Beach
Project Number:	3210.010E
Sample Date:	5/4/10

The report consists of the following sections:

I. Sample Description
II. Laboratory Narrative and Chain of Custody Forms
III. Laboratory Certification
IV. Quality Control Reports
V. Analytical Results

If you have any questions on the report or the analytical data please contact me at (805) 781-3585.

Sincerely,

Steven D. Hoyt, Ph.D.
Laboratory Director

SDH/lims

173 Cross Street, San Luis Obispo, CA 93401-7597
805.781.3585 Fax: 805-541-4550

Analytical Report

SDG Number 210187

Client: Tetra Tech **Date Received:** 5/5/2010

I. SAMPLE DESCRIPTION AND ANALYSIS REQUESTED

Client Sample No.	EAS Lab No	Analysis Requested	Date Sample Rec	Pressure (torr) Final
10-645	210187 1	ASTM D1946 Fixed Gases, Level 4	5/4/2010	
10-645	210187 1	EPA TO-15 Volatile Organics, Level 4	5/4/2010	
10-646	210187 2	ASTM D1946 Fixed Gases, Level 3	5/4/2010	
10-646	210187 2	EPA TO-15 Volatile Organics, Level 3	5/4/2010	
10-647	210187 3	ASTM D1946 Fixed Gases, Level 3	5/4/2010	
10-647	210187 3	EPA TO-15 Volatile Organics, Level 3	5/4/2010	
10-648	210187 4	ASTM D1946 Fixed Gases, Level 3	5/4/2010	
10-648	210187 4	EPA TO-15 Volatile Organics, Level 3	5/4/2010	
10-649	210187 5	ASTM D1946 Fixed Gases, Level 3	5/4/2010	
10-649	210187 5	EPA TO-15 Volatile Organics, Level 3	5/4/2010	

II. LABORATORY CASE NARRATIVE and CHAIN OF CUSTODY FORMS

EAS SDG Number 210187

Client: Tetra Tech

Daily Analytical Batch #: 050510-GC5
All analysis met the QC requirements for the method.

Daily Analytical Batch #: 050510-MS1
All analysis met the QC requirements for the method except 1,2,4-trimethylbenzene marginally exceeds QC limits (39.5%) on the beginning continuing calibration analysis. As per the EAS quality manual, 10% of the total target list compounds may marginally exceed QC limits and still be acceptable.

Freon 114 (-51%), methyl isobutyl ketone (-53.6%), 1,2-dichlorobenzene (40.5%), 1,2,4-trimethylbenzene (65.4%), and hexachlorobutadiene exceed QC limits for %D on the ending continuing calibration analysis.

Carbon disulfide exceeds QC limits (>1/2RL) on the method blank analysis. The samples in this daily analytical batch were non-detected for this compound, and no data flags were applied.

Daily Analytical Batch #: 050610-MS1
All analysis met the QC requirements for the method except 1,2,4-trimethylbenzene marginally exceeds QC limits (44.3%) on the beginning continuing calibration analysis. As per the EAS quality manual, 10% of the total target list compounds may marginally exceed QC limits and still be acceptable.

The above does not affect data quality.

III. LABORATORY CERTIFICATION

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness other than the condition noted above.

Steven D. Hoyt, Ph.D.
Laboratory Director

TETRATECH
1230 Columbia Street, Suite 750
San Diego, CA 92101 (619) 234-8696

CHAIN-OF-CUSTODY RECORD

NUMBER 40890

PROJECT NAME: IRP Site 40	PURCHASE ORDER NO.: 61565
PROJECT LOCATION: Seal Beach NWS	PROJECT NO.: 3210.010E
SAMPLER NAME: Wendy Bergant	AIRBILL NUMBER: FedEx
PROJECT CONTACT: Sabina Sudoko	PROJECT CONTACT PHONE NUMBER: 949-809-5022

LABORATORY NAME: EAS

LABORATORY ID (FOR LABORATORY):

ANALYSES REQUIRED

SAMPLE ID	DATE COLLECTED	TIME COLLECTED	NO. OF CONTAINER	LEVEL 3	LEVEL 4	TYPE	TAT	TO-15 VOCs	ASTM D 1946-(Fixed Gases)			210 187					COMMENTS
10-645	5/4/10	1425	1		X	V	10 Day	X	X			-1					
10-646	5/4/10	1510	1	X		V	10 Day	X	X			-2					
10-647	5/4/10	1550	1	X		V	10 Day	X	X			-3					
10-648	5/4/10	1455	1	X		V	10 Day	X	X			-4					
10-649	5/4/10	1535	1	X		V	10 Day	X	X			-5					

RELINQUISHED BY (Signature): [signature]	DATE: 5/4/10	RECEIVED BY (Signature): FedEx	LABORATORY INSTRUCTIONS/COMMENTS: ADR EDD REQUIRED
COMPANY: TtEC	TIME:	COMPANY: FedEx	
RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)	COMPOSITE DESCRIPTION
COMPANY	TIME	COMPANY	
RELINQUISHED BY (Signature)	DATE: 5/5/10	RECEIVED BY (Signature): Kanna Campbell	SAMPLE CONDITION UPON RECEIPT (FOR LABORATORY)
COMPANY	TIME: 1143	COMPANY: EAS	TEMPERATURE: _____ SAMPLE CONDITION: ☐ INTACT ☐ BROKEN COOLER SEAL: ☐ INTACT ☐ BROKEN

White - Laboratory; Pink - Laboratory; Canary - Project File; Manila - Data Management

IV. QUALITY CONTROL REPORT

SDG Number: 210187
Client: Tetra Tech

LABORATORY QC REPORT

QC NARRATIVE

This report was run with the standard laboratory QC.

STANDARD LABORATORY QC REPORT

Unless project specific QC was requested, this Section contains the standard laboratory QC supplied with the analytical reports, which includes the daily method blank and the daily duplicate control samples as described below. Each day that samples are analyzed comprises a Daily Analytical Batch for a particular instrument. A Daily Analytical Batch QC report will be supplied for each method and each day samples from this SDG Group were analyzed.

METHOD BLANK

A method blank is a laboratory-generated sample which assesses the degree to which laboratory operations and procedures cause false-positive analytical results for your samples. A copy of the batch blank is included with the report.

DUPLICATE CONTROL SAMPLES

A duplicate or duplicate control sample (DCS) was analyzed as part of each daily analytical batch. A DCS is a well-characterized matrix (blank water, ambient air, or actual sample) which may or may not be spiked and run in duplicate with your sample batch. The results are on the attached Duplicate Sample/Spike results. Precision is measured in a duplicate test by Relative Percent Difference (RPD) as in:

$$RPD = \frac{[\% \text{ Recovery Test 1} - \% \text{ Recovery Test 2}] \times 100}{(\text{Recovery Test 1} + \text{Recovery Test 2}) / 2}$$

METHOD BLANK REPORT

ENVIRONMENTAL
Analytical Service, Inc.

ASTM D 1946 GC/TCD | **SDG:** **LABQC**
Analytical Method: **ASTM 1946** | **Laboratory Number:** **B05050**

File:	B05050MB.D	**Date Sampled:**		**Time:**	
Description:	METHOD BLANK	**Date Received:**			
Can/Tube#:		**Date Extracted:**			
Sam_Type:	MB	**Date Analyzed:**	05/05/10	**Time:**	16:19
QC_Batch:	050510-GC5	**Can Dilution Factor:**	1.00		0
Air Volume:	0.5 ml	**Not Detected Flag:**	U		3

CAS#	Compound	MDL ppmv	MDL %	RL ppmv	RL %	Sample Concentration ppmv	Sample Concentration %	Flag
74-82-8	Methane	10	0.001	30	0.003	10	0.001	U
124-38-9	Carbon Dioxide	10	0.001	30	0.003	10	0.001	U
74-85-1	Ethene	10	0.001	30	0.003	10	0.001	U
74-84-0	Ethane	10	0.001	30	0.003	10	0.001	U

Notes: 1) U and ND are Flags used for Not Detected
2) %* Indicates sample concentration is normalized to 100% (only available for complete analysis)
3) J is a flag for a result between the MDL and the RL (or lower quantitation limit, LQL)
4) Argon co-elutes with Oxygen; Atmospheric Argon is 0.946%

METHOD BLANK REPORT

ENVIRONMENTAL
Analytical Service, Inc.

EPA Method TO-15 Modified Full Scan GC/MS | **SDG:** LABQC
Analytical Method: TO-15 | **Laboratory Number:** B05050

File:	CC709B.D	**Date Sampled:**		**Time:**	
Description:	METHOD BLANK	**Date Received:**			
Can/Tube#:		**Date Extracted:**			
Sam_Type:	MB	**Date Analyzed:**	05/05/10	**Time:**	17:29
QC_Batch:	050510-MS1	**Can Dilution Factor:**	1.00		2
Air Volume:	5 ml	**Not Detected Flag:**	U		

CAS#	Compound	MDL ppbv	RL ppbv	Amount ppbv	MDL ug/m3	RL ug/m3	Amount ug/m3	Flag
75-71-8	Dichlorodifluoromethane	21	53	21	110	270	110	U
74-87-3	Chloromethane	20	51	20	44	110	44	U
76-14-2	Freon 114	21	52	21	150	380	150	U
75-01-4	Vinyl chloride	21	52	21	55	140	55	U
74-83-9	Bromomethane	21	52	21	83	210	83	U
75-00-3	Chloroethane	21	52	21	57	140	57	U
75-69-4	Trichlorofluoromethane	21	52	21	120	300	120	U
67-64-1	Acetone	23	57	23	56	140	56	U
75-35-4	1,1-Dichloroethene	20	51	20	83	210	83	U
76-13-1	Freon 113	20	51	20	160	400	160	U
75-09-2	Methylene chloride	21	52	21	75	190	75	U
75-15-0	Carbon disulfide	17	43	76	55	140	250	
156-60-5	trans-1,2-Dichloroethene	13	33	13	54	140	54	U
75-34-3	1,1-Dichloroethane	20	51	20	84	210	84	U
108-05-4	Vinyl acetate	16	160	16	59	590	59	U
78-93-3	2-Butanone	19	47	19	57	140	57	U
156-59-2	cis-1,2-Dichloroethene	21	52	21	84	210	84	U
67-66-3	Chloroform	20	51	20	100	260	100	U
71-55-6	1,1,1-Trichloroethane	20	51	20	110	290	110	U
107-06-2	1,2-Dichloroethane	21	52	21	86	220	86	U
71-43-2	Benzene	41	210	41	140	680	140	U
56-23-5	Carbon tetrachloride	20	51	20	130	330	130	U
78-87-5	1,2-Dichloropropane	21	52	21	98	250	98	U
79-01-6	Trichloroethene	21	52	21	110	290	110	U
75-27-4	Bromodichloromethane	7	19	7	51	130	51	U
108-10-1	4-Methyl-2-pentanone	14	35	14	59	150	59	U
10061-01-5	cis-1,3-Dichloropropene	21	53	21	99	250	99	U
108-88-3	Toluene	21	52	21	80	200	80	U
10061-02-6	trans-1,3-Dichloropropene	21	52	21	98	240	98	U
79-00-5	1,1,2-Trichloroethane	20	51	20	110	290	110	U
591-78-6	2-Hexanone	13	33	13	55	140	55	U
124-48-1	Dibromochloromethane	7	18	7	65	160	65	U
106-93-4	1,2-Dibromoethane	21	52	21	170	410	170	U
127-18-4	Tetrachloroethene	20	51	20	140	360	140	U
108-90-7	Chlorobenzene	20	51	20	97	240	97	U
100-41-4	Ethylbenzene	21	52	21	93	230	93	U
1330-20-7	m,p-Xylenes	41	100	41	180	460	180	U
100-42-5	Styrene	21	52	21	91	230	91	U
75-25-2	Bromoform	5	12	5	53	130	53	U
95-47-6	o-Xylene	20	51	20	91	230	91	U

CAS#	Compound	MDL ppbv	RL ppbv	Amount ppbv	MDL ug/m3	RL ug/m3	Amount ug/m3	Flag
79-34-5	1,1,2,2-Tetrachloroethane	20	51	20	140	360	140	U
622-96-8	4-Ethyltoluene	11	28	11	58	140	58	U
108-67-8	1,3,5-Trimethylbenzene	21	53	21	110	270	110	U
95-63-6	1,2,4-Trimethylbenzene	20	200	20	100	1,000	100	U
541-73-1	1,3-Dichlorobenzene	20	200	20	130	1,300	130	U
100-44-7	Benzyl chloride	12	29	12	63	160	63	U
106-46-7	1,4-Dichlorobenzene	20	200	20	130	1,300	130	U
95-50-1	1,2-Dichlorobenzene	20	200	20	120	1,200	120	U
120-82-1	1,2,4-Trichlorobenzene	21	52	21	160	400	160	U
87-68-3	Hexachlorobutadiene	21	210	21	230	2,300	230	U

	Surrogate Recovery	Spike Amt. ppbV	Amount ppbV	% Rec.	QC Limits	Flag * = Out
2037-26-5	Toluene-d8	10.00	9.49	95	70-130	

Notes: 1) Reported results are to be interpreted to two significant figures.
2) ug/m3 = ppbV*FW/23.68 calculated assuming conditions at 60 F and 1 atm.
3) MDL and RL are adjusted for sample volume and can dilution.
4) U and ND are Flags used for Not Detected
5) J is a flag for a result between the MDL and the RL (or lower quantitation limit, LQL)

METHOD BLANK REPORT

ENVIRONMENTAL
Analytical Service, Inc.

EPA Method TO-15 Modified Full Scan GC/MS | **SDG:** LABQC
Analytical Method: TO-15 | **Laboratory Number:** B05050

File:	B05060B.D	**Date Sampled:**		**Time:**	
Description:	METHOD BLANK	**Date Received:**			
Can/Tube#:		**Date Extracted:**			
Sam_Type:	MB	**Date Analyzed:**	05/06/10	**Time:**	14:51
QC_Batch:	050610-MS1	**Can Dilution Factor:**	1.00		2
Air Volume:	5 ml	**Not Detected Flag:**	U		

CAS#	Compound	MDL ppbv	RL ppbv	Amount ppbv	MDL ug/m3	RL ug/m3	Amount ug/m3	Flag
75-71-8	Dichlorodifluoromethane	21	53	21	110	270	110	U
74-87-3	Chloromethane	20	51	20	44	110	44	U
76-14-2	Freon 114	21	52	21	150	380	150	U
75-01-4	Vinyl chloride	21	52	21	55	140	55	U
74-83-9	Bromomethane	21	52	21	83	210	83	U
75-00-3	Chloroethane	21	52	21	57	140	57	U
75-69-4	Trichlorofluoromethane	21	52	21	120	300	120	U
67-64-1	Acetone	23	57	23	56	140	56	U
75-35-4	1,1-Dichloroethene	20	51	20	83	210	83	U
76-13-1	Freon 113	20	51	20	160	400	160	U
75-09-2	Methylene chloride	21	52	21	75	190	75	U
75-15-0	Carbon disulfide	17	43	17	55	140	55	U
156-60-5	trans-1,2-Dichloroethene	13	33	13	54	140	54	U
75-34-3	1,1-Dichloroethane	20	51	20	84	210	84	U
108-05-4	Vinyl acetate	16	160	16	59	590	59	U
78-93-3	2-Butanone	19	47	19	57	140	57	U
156-59-2	cis-1,2-Dichloroethene	21	52	21	84	210	84	U
67-66-3	Chloroform	20	51	20	100	260	100	U
71-55-6	1,1,1-Trichloroethane	20	51	20	110	290	110	U
107-06-2	1,2-Dichloroethane	21	52	21	86	220	86	U
71-43-2	Benzene	41	210	41	140	680	140	U
56-23-5	Carbon tetrachloride	20	51	20	130	330	130	U
78-87-5	1,2-Dichloropropane	21	52	21	98	250	98	U
79-01-6	Trichloroethene	21	52	21	110	290	110	U
75-27-4	Bromodichloromethane	7	19	7	51	130	51	U
108-10-1	4-Methyl-2-pentanone	14	35	14	59	150	59	U
10061-01-5	cis-1,3-Dichloropropene	21	53	21	99	250	99	U
108-88-3	Toluene	21	52	21	80	200	80	U
10061-02-6	trans-1,3-Dichloropropene	21	52	21	98	240	98	U
79-00-5	1,1,2-Trichloroethane	20	51	20	110	290	110	U
591-78-6	2-Hexanone	13	33	13	55	140	55	U
124-48-1	Dibromochloromethane	7	18	7	65	160	65	U
106-93-4	1,2-Dibromoethane	21	52	21	170	410	170	U
127-18-4	Tetrachloroethene	20	51	20	140	360	140	U
108-90-7	Chlorobenzene	20	51	20	97	240	97	U
100-41-4	Ethylbenzene	21	52	21	93	230	93	U
1330-20-7	m,p-Xylenes	41	100	41	180	460	180	U
100-42-5	Styrene	21	52	21	91	230	91	U
75-25-2	Bromoform	5	12	5	53	130	53	U
95-47-6	o-Xylene	20	51	20	91	230	91	U

CAS#	Compound	MDL ppbv	RL ppbv	Amount ppbv	MDL ug/m3	RL ug/m3	Amount ug/m3	Flag
79-34-5	1,1,2,2-Tetrachloroethane	20	51	20	140	360	140	U
622-96-8	4-Ethyltoluene	11	28	11	58	140	58	U
108-67-8	1,3,5-Trimethylbenzene	21	53	21	110	270	110	U
95-63-6	1,2,4-Trimethylbenzene	20	200	20	100	1,000	100	U
541-73-1	1,3-Dichlorobenzene	20	200	20	130	1,300	130	U
100-44-7	Benzyl chloride	12	29	12	63	160	63	U
106-46-7	1,4-Dichlorobenzene	20	200	20	130	1,300	130	U
95-50-1	1,2-Dichlorobenzene	20	200	20	120	1,200	120	U
120-82-1	1,2,4-Trichlorobenzene	21	52	21	160	400	160	U
87-68-3	Hexachlorobutadiene	21	210	21	230	2,300	230	U

	Surrogate Recovery	Spike Amt. ppbV	Amount ppbV	% Rec.	QC Limits	Flag * = Out
2037-26-5	Toluene-d8	10.00	9.40	94	70-130	

Notes: 1) Reported results are to be interpreted to two significant figures.
2) ug/m3 = ppbV*FW/23.68 calculated assuming conditions at 60 F and 1 atm.
3) MDL and RL are adjusted for sample volume and can dilution.
4) U and ND are Flags used for Not Detected
5) J is a flag for a result between the MDL and the RL (or lower quantitation limit, LQL)

QUALITY CONTROL DUPLICATE

ENVIRONMENTAL
Analytical Service, Inc.

Duplicate of QC Sample

ASTM D 1946 GC/TCD **SDG: LABQC**
Analytical Method: **ASTM 1946**

Dup File: QC5050PD.D
Description: ST60123
Can/Tube#:
QC_Batch: 050510-GC5

CAS#	Compound	LCD %	LCS %	RPD %D	Limit %	Flag * = Out
74-82-8	Methane	1.100	1.103	0	25	
124-38-9	Carbon Dioxide	0.980	0.986	1	25	
74-85-1	Ethene	0.997	1.000	0	25	
74-84-0	Ethane	0.999	1.003	0	25	

QUALITY CONTROL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

LABORATORY CONTROL SPIKE

ASTM D 1946 GC/TCD **SDG: LABQC**

Analytical Method: **ASTM 1946**

File: QC5050PC.D
Description: ST60123
Can/Tube#:
Sam_Type: LCS
QC_Batch: 050510-GC5
Air Volume: 0.5 ml

Date Sampled: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 05/05/10 **Time:** 15:46
Can Dilution Factor: 1.00 0
QC Duplicate: No 3

CAS#	Compound	MDL ppmv	Spike Conc %	Conc %	Matrix Amt %	Spk Amt %	Percent Recovery	LCL %	UCL %	Flag
74-82-8	Methane	10	1.000	1.103	0.000	1.103	110	70	130	
124-38-9	Carbon Dioxide	10	1.000	0.986	0.000	0.986	99	70	130	
74-85-1	Ethene	10	1.000	1.000	0.000	1.000	100	70	130	
74-84-0	Ethane	10	1.000	1.003	0.000	1.003	100	70	130	

QUALITY CONTROL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

LABORATORY CONTROL DUPLICATE

ASTM D 1946 GC/TCD **SDG: LABQC**

Analytical Method: **ASTM 1946**

File: QC5050PD.D
Description: ST60123
Can/Tube#:
Sam_Type: LCD
QC_Batch: 050510-GC5
Air Volume: 0.5 ml

Date Sampled: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 05/05/10 **Time:** 15:53
Can Dilution Factor: 1.00 0
QC Duplicate: Yes 3

CAS#	Compound	MDL ppmv	Spike Conc %	Conc %	Matrix Amt %	Spk Amt %	Percent Recovery	LCL %	UCL %	Flag
74-82-8	Methane	10	1.000	1.100	0.000	1.100	110	70	130	
124-38-9	Carbon Dioxide	10	1.000	0.980	0.000	0.980	98	70	130	
74-85-1	Ethene	10	1.000	0.997	0.000	0.997	100	70	130	
74-84-0	Ethane	10	1.000	0.999	0.000	0.999	100	70	130	

QUALITY CONTROL DUPLICATE

ENVIRONMENTAL
Analytical Service, Inc.

Duplicate of QC Sample

EPA Method TO-15 Modified Full Scan GC/MS **SDG: LABQC**
Analytical Method: TO-15

Dup File: QC05050C.D
Description: ST60421
Can/Tube#:
QC_Batch: 050510-MS1

CAS#	Compound	LCD ppbv	LCS ppbv	RPD %D	Limit %	Flag * = Out
75-35-4	1,1-Dichloroethene	0.89	0.92	3	25	
71-43-2	Benzene	1.19	1.23	4	25	
79-01-6	Trichloroethene	1.08	1.20	12	25	
108-88-3	Toluene	1.13	1.11	2	25	
108-90-7	Chlorobenzene	1.28	1.32	4	25	

QUALITY CONTROL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

LABORATORY CONTROL SPIKE

EPA Method TO-15 Modified Full Scan GC/MS **SDG: LABQC**
Analytical Method: **TO-15**

File: QC05050B.D
Description: ST60421
Can/Tube#:
Sam_Type: LCS
QC_Batch: 050510-MS1
Air Volume: 1000 ml

Date Sampled: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 05/05/10 **Time:** 13:57
Can Dilution Factor: 1.00 2
QC Duplicate: No

CAS#	Compound	MDL ppbv	Spike Conc ppbv	Amount ppbv	Matrix Amt ppbv	Spk Amt ppbv	Percent Recovery	LCL %	UCL %	Flag
75-35-4	1,1-Dichloroethene	0.10	1.04	0.92	0.000	0.92	88	70	130	
71-43-2	Benzene	0.10	1.03	1.23	0.000	1.23	119	70	130	
79-01-6	Trichloroethene	0.10	1.03	1.20	0.000	1.20	117	70	130	
108-88-3	Toluene	0.10	1.03	1.11	0.000	1.11	108	70	130	
108-90-7	Chlorobenzene	0.10	1.02	1.32	0.000	1.32	129	70	130	

Surrogate Recovery	Spike Amt. ppbV	Amount ppbV	% Rec.	QC Limits	Flag * = Out
Toluene-d8	10.000	9.555	96	70-130	

Notes: Reported results are to be interpreted to two significant figures.
*ug/m3 calculated assuming conditions at 60 F and 1 atm.

QUALITY CONTROL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

LABORATORY CONTROL DUPLICATE

EPA Method TO-15 Modified Full Scan GC/MS **SDG: LABQC**
Analytical Method: **TO-15**

File: QC05050C.D
Description: ST60421
Can/Tube#:
Sam_Type: LCD
QC_Batch: 050510-MS1
Air Volume: 1000 ml

Date Sampled: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 05/05/10 **Time:** 14:59
Can Dilution Factor: 1.00 2
QC Duplicate: Yes

CAS#	Compound	MDL ppbv	Spike Conc ppbv	Amount ppbv	Matrix Amt ppbv	Spk Amt ppbv	Percent Recovery	LCL %	UCL %	Flag
75-35-4	1,1-Dichloroethene	0.10	1.04	0.89	0.000	0.89	86	70	130	
71-43-2	Benzene	0.10	1.03	1.19	0.000	1.19	116	70	130	
79-01-6	Trichloroethene	0.10	1.03	1.08	0.000	1.08	105	70	130	
108-88-3	Toluene	0.10	1.03	1.13	0.000	1.13	110	70	130	
108-90-7	Chlorobenzene	0.10	1.02	1.28	0.000	1.28	125	70	130	

Surrogate Recovery	Spike Amt. ppbV	Amount ppbV	% Rec.	QC Limits	Flag * = Out
Toluene-d8	10.000	9.587	96	70-130	

Notes: Reported results are to be interpreted to two significant figures.
*ug/m3 calculated assuming conditions at 60 F and 1 atm.

QUALITY CONTROL DUPLICATE

ENVIRONMENTAL
Analytical Service, Inc.

Duplicate of QC Sample

EPA Method TO-15 Modified Full Scan GC/MS **SDG: LABQC**
Analytical Method: **TO-15**

Dup File: QC05060B.D
Description: ST60421
Can/Tube#:
QC_Batch: 050610-MS1

CAS#	Compound	LCD ppbv	LCS ppbv	RPD %D	Limit %	Flag * = Out
75-35-4	1,1-Dichloroethene	1.19	0.94	24	25	
71-43-2	Benzene	1.11	1.15	4	25	
79-01-6	Trichloroethene	1.12	1.15	3	25	
108-88-3	Toluene	1.09	1.10	1	25	
108-90-7	Chlorobenzene	1.21	1.31	10	25	

QUALITY CONTROL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

LABORATORY CONTROL SPIKE

EPA Method TO-15 Modified Full Scan GC/MS **SDG: LABQC**
Analytical Method: **TO-15**

File: QC05060A.D
Description: ST60421
Can/Tube#:
Sam_Type: LCS
QC_Batch: 050610-MS1
Air Volume: 1000 ml

Date Sampled: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 05/06/10 **Time:** 11:42
Can Dilution Factor: 1.00 2
QC Duplicate: No

CAS#	Compound	MDL ppbv	Spike Conc ppbv	Amount ppbv	Matrix Amt ppbv	Spk Amt ppbv	Percent Recovery	LCL %	UCL %	Flag
75-35-4	1,1-Dichloroethene	0.10	1.04	0.94	0.000	0.94	90	70	130	
71-43-2	Benzene	0.10	1.03	1.15	0.000	1.15	112	70	130	
79-01-6	Trichloroethene	0.10	1.03	1.15	0.000	1.15	112	70	130	
108-88-3	Toluene	0.10	1.03	1.10	0.000	1.10	107	70	130	
108-90-7	Chlorobenzene	0.10	1.02	1.31	0.000	1.31	128	70	130	

Surrogate Recovery	Spike Amt. ppbV	Amount ppbV	% Rec.	QC Limits	Flag * = Out
Toluene-d8	10.000	10.098	101	70-130	

Notes: Reported results are to be interpreted to two significant figures.
*ug/m3 calculated assuming conditions at 60 F and 1 atm.

QUALITY CONTROL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

LABORATORY CONTROL DUPLICATE

EPA Method TO-15 Modified Full Scan GC/MS **SDG: LABQC**
Analytical Method: **TO-15**

File: QC05060B.D
Description: ST60421
Can/Tube#:
Sam_Type: LCD
QC_Batch: 050610-MS1
Air Volume: 1000 ml

Date Sampled: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 05/06/10 **Time:** 12:24
Can Dilution Factor: 1.00 2
QC Duplicate: Yes

CAS#	Compound	MDL ppbv	Spike Conc ppbv	Amount ppbv	Matrix Amt ppbv	Spk Amt ppbv	Percent Recovery	LCL %	UCL %	Flag
75-35-4	1,1-Dichloroethene	0.10	1.04	1.19	0.000	1.19	114	70	130	
71-43-2	Benzene	0.10	1.03	1.11	0.000	1.11	108	70	130	
79-01-6	Trichloroethene	0.10	1.03	1.12	0.000	1.12	109	70	130	
108-88-3	Toluene	0.10	1.03	1.09	0.000	1.09	106	70	130	
108-90-7	Chlorobenzene	0.10	1.02	1.21	0.000	1.21	119	70	130	

Surrogate Recovery	Spike Amt. ppbV	Amount ppbV	% Rec.	QC Limits	Flag * = Out
Toluene-d8	10.000	9.133	91	70-130	

Notes: Reported results are to be interpreted to two significant figures.
*ug/m3 calculated assuming conditions at 60 F and 1 atm.

QUALITY CONTROL DUPLICATE

ENVIRONMENTAL
Analytical Service, Inc.

Duplicate of QC Sample

EPA Method TO-15 Modified Full Scan GC/MS **SDG: LABQC**
Analytical Method: TO-15

Dup File: MS05060C.D
Description: 210187-5 + ST60421
Can/Tube#: TBAG
QC_Batch: 050610-MS1

CAS#	Compound	MSD ppbv	MS ppbv	RPD %D	Limit %	Flag * = Out
75-35-4	1,1-Dichloroethene	167.72	204.29	18	25	
71-43-2	Benzene	203.74	212.44	4	25	
79-01-6	Trichloroethene	223.30	219.75	2	25	
108-88-3	Toluene	199.83	204.51	2	25	
108-90-7	Chlorobenzene	198.88	193.50	3	25	

QUALITY CONTROL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

MATRIX SPIKE

EPA Method TO-15 Modified Full Scan GC/MS **SDG: LABQC**
Analytical Method: **TO-15**

File: MS05060A.D
Description: 210187-5 + ST60421
Can/Tube#: TBAG
Sam_Type: MS
QC_Batch: 050610-MS1
Air Volume: 5 ml

Date Sampled: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 05/06/10 **Time:** 17:21
Can Dilution Factor: 1.00 2
QC Duplicate: No

CAS#	Compound	MDL ppbv	Spike Conc ppbv	Amount ppbv	Matrix Amt ppbv	Spk Amt ppbv	Percent Recovery	LCL %	UCL %	Flag
75-35-4	1,1-Dichloroethene	20.20	208.00	204.29	0.000	204.29	98	70	130	
71-43-2	Benzene	20.60	206.00	212.44	0.000	212.44	103	70	130	
79-01-6	Trichloroethene	20.60	206.00	329.75	110.000	219.75	107	70	130	
108-88-3	Toluene	20.60	206.00	204.51	0.000	204.51	99	70	130	
108-90-7	Chlorobenzene	20.40	204.00	193.50	0.000	193.50	95	70	130	

Surrogate Recovery	Spike Amt. ppbV	Amount ppbV	% Rec.	QC Limits	Flag * = Out
Toluene-d8	10.000	9.740	97	70-130	

Notes: Reported results are to be interpreted to two significant figures.
*ug/m3 calculated assuming conditions at 60 F and 1 atm.

QUALITY CONTROL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

MATRIX SPIKE DUPLICATE

EPA Method TO-15 Modified Full Scan GC/MS **SDG: LABQC**
Analytical Method: TO-15

File: MS05060C.D
Description: 210187-5 + ST60421
Can/Tube#: TBAG
Sam_Type: MSD
QC_Batch: 050610-MS1
Air Volume: 5 ml

Date Sampled: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 05/06/10 **Time:** 18:59
Can Dilution Factor: 1.00 2
QC Duplicate: Yes

CAS#	Compound	MDL ppbv	Spike Conc ppbv	Amount ppbv	Matrix Amt ppbv	Spk Amt ppbv	Percent Recovery	LCL %	UCL %	Flag
75-35-4	1,1-Dichloroethene	20.20	208.00	167.72	0.000	167.72	81	70	130	
71-43-2	Benzene	20.60	206.00	203.74	0.000	203.74	99	70	130	
79-01-6	Trichloroethene	20.60	206.00	333.30	110.000	223.30	108	70	130	
108-88-3	Toluene	20.60	206.00	199.83	0.000	199.83	97	70	130	
108-90-7	Chlorobenzene	20.40	204.00	198.88	0.000	198.88	97	70	130	

Surrogate Recovery	Spike Amt. ppbV	Amount ppbV	% Rec.	QC Limits	Flag * = Out
Toluene-d8	10.000	9.268	93	70-130	

Notes: Reported results are to be interpreted to two significant figures.
*ug/m3 calculated assuming conditions at 60 F and 1 atm.

V. ANALYTICAL RESULTS

SDG Number: 210187
Client: Tetra Tech

The following pages contain the certified reports for the analytical methods and the compounds requested. The reports are in order of analytical method then EAS ID number. A brief description of the units that appear on the reports is given below:

ppbV, ppmV, Percent

Parts per billion by volume (also known as mole ratio) and other related units. This is the primary reporting unit for all volatile organic compound analysis except the hydrocarbon speciation and total hydrocarbons. This unit is independent of temperature and pressure.

$$\text{ppbV} = \frac{\text{nanomoles of compound}}{\text{moles of air}}$$

ug/m3, mg/m3

Micrograms of compound per cubic meter of air and other related units. This is the primary reporting unit for semi volatile organic compounds. It is not a primary reporting unit for volatile organic compounds because it is temperature and pressure dependent, so the result will vary depending on the conditions when the sample was collected. EAS provides the units on its analytical reports as a convenience to the client, but they should be used with caution. The following equation can be used to convert from ppbV to ug/m3.

$$\text{ug/m3} = \frac{\text{ppbV x MW compound}}{23.68}$$

23.68 is the molar volume of a gas at 60 F and 1 atm pressure

ppbC, ppmC

Parts per billion by volume as carbon (methane) and other related units. This unit is the primary reporting unit for hydrocarbon analysis, even if it does not appear on the report. This unit is used because the flame ionization detector response is proportional to the number of carbons in the compound, so an accurate concentration can be reported even if the identification of the compound is not known.

$$\text{ppbC} = \text{ppbV x number of carbons in compound}$$

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

ASTM D 1946 GC/TCD | **SDG:** 210187
Analytical Method: ASTM 1946 | **Laboratory Number:** 01

File:	1018701A.D	**Date Sampled:**	05/04/10	**Time:**	14:25
Description:	10-645	**Date Received:**	05/05/10		
Can/Tube#:	TBAG	**Date Extracted:**			
Sam_Type:	SA	**Date Analyzed:**	05/05/10	**Time:**	16:34
QC_Batch:	050510-GC5	**Can Dilution Factor:**	1.00		0
Air Volume:	0.5 ml	**Not Detected Flag:**	U		3

CAS#	Compound	MDL ppmv	MDL %	RL ppmv	RL %	Sample Concentration ppmv	Sample Concentration %	Flag
74-82-8	Methane	10	0.001	30	0.003	630,045	63.004	
124-38-9	Carbon Dioxide	10	0.001	30	0.003	192,929	19.293	
74-85-1	Ethene	10	0.001	30	0.003	10	0.001	U
74-84-0	Ethane	10	0.001	30	0.003	10	0.001	U

Notes: 1) U and ND are Flags used for Not Detected
2) %* Indicates sample concentration is normalized to 100% (only available for complete analysis)
3) J is a flag for a result between the MDL and the RL (or lower quantitation limit, LQL)
4) Argon co-elutes with Oxygen; Atmospheric Argon is 0.946%

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

EPA Method TO-15 Modified Full Scan GC/MS | **SDG:** 210187
Analytical Method: TO-15 | **Laboratory Number:** 01

File:	1018701A.D	**Date Sampled:**	05/04/10	**Time:**	14:25
Description:	10-645	**Date Received:**	05/05/10		
Can/Tube#:	TBAG	**Date Extracted:**			
Sam_Type:	SA	**Date Analyzed:**	05/05/10	**Time:**	18:20
QC_Batch:	050510-MS1	**Can Dilution Factor:**	1.00		2
Air Volume:	5 ml	**Not Detected Flag:**	U		

CAS#	Compound	MDL ppbv	RL ppbv	Amount ppbv	MDL ug/m3	RL ug/m3	Amount ug/m3	Flag
75-71-8	Dichlorodifluoromethane	21	53	21	110	270	110	U
74-87-3	Chloromethane	20	51	20	44	110	44	U
76-14-2	Freon 114	21	52	21	150	380	150	U
75-01-4	Vinyl chloride	21	52	1,500	55	140	3,900	
74-83-9	Bromomethane	21	52	21	83	210	83	U
75-00-3	Chloroethane	21	52	21	57	140	57	U
75-69-4	Trichlorofluoromethane	21	52	21	120	300	120	U
67-64-1	Acetone	23	57	23	56	140	56	U
75-35-4	1,1-Dichloroethene	20	51	20	83	210	83	U
76-13-1	Freon 113	20	51	20	160	400	160	U
75-09-2	Methylene chloride	21	52	21	75	190	75	U
75-15-0	Carbon disulfide	17	43	17	55	140	55	U
156-60-5	trans-1,2-Dichloroethene	13	33	920	54	140	3,800	
75-34-3	1,1-Dichloroethane	20	51	20	84	210	84	U
108-05-4	Vinyl acetate	16	160	16	59	590	59	U
78-93-3	2-Butanone	19	47	19	57	140	57	U
156-59-2	cis-1,2-Dichloroethene	21	52	630	84	210	2,600	
67-66-3	Chloroform	20	51	20	100	260	100	U
71-55-6	1,1,1-Trichloroethane	20	51	20	110	290	110	U
107-06-2	1,2-Dichloroethane	21	52	21	86	220	86	U
71-43-2	Benzene	41	210	41	140	680	140	U
56-23-5	Carbon tetrachloride	20	51	20	130	330	130	U
78-87-5	1,2-Dichloropropane	21	52	21	98	250	98	U
79-01-6	Trichloroethene	21	52	59	110	290	330	
75-27-4	Bromodichloromethane	7	19	7	51	130	51	U
108-10-1	4-Methyl-2-pentanone	14	35	14	59	150	59	U
10061-01-5	cis-1,3-Dichloropropene	21	53	21	99	250	99	U
108-88-3	Toluene	21	52	21	80	200	80	U
10061-02-6	trans-1,3-Dichloropropene	21	52	21	98	240	98	U
79-00-5	1,1,2-Trichloroethane	20	51	20	110	290	110	U
591-78-6	2-Hexanone	13	33	13	55	140	55	U
124-48-1	Dibromochloromethane	7	18	7	65	160	65	U
106-93-4	1,2-Dibromoethane	21	52	21	170	410	170	U
127-18-4	Tetrachloroethene	20	51	20	140	360	140	U
108-90-7	Chlorobenzene	20	51	20	97	240	97	U
100-41-4	Ethylbenzene	21	52	21	93	230	93	U
1330-20-7	m,p-Xylenes	41	100	41	180	460	180	U
100-42-5	Styrene	21	52	21	91	230	91	U
75-25-2	Bromoform	5	12	5	53	130	53	U
95-47-6	o-Xylene	20	51	20	91	230	91	U

CAS#	Compound	MDL ppbv	RL ppbv	Amount ppbv	MDL ug/m3	RL ug/m3	Amount ug/m3	Flag
79-34-5	1,1,2,2-Tetrachloroethane	20	51	20	140	360	140	U
622-96-8	4-Ethyltoluene	11	28	11	58	140	58	U
108-67-8	1,3,5-Trimethylbenzene	21	53	21	110	270	110	U
95-63-6	1,2,4-Trimethylbenzene	20	200	20	100	1,000	100	U
541-73-1	1,3-Dichlorobenzene	20	200	20	130	1,300	130	U
100-44-7	Benzyl chloride	12	29	12	63	160	63	U
106-46-7	1,4-Dichlorobenzene	20	200	20	130	1,300	130	U
95-50-1	1,2-Dichlorobenzene	20	200	20	120	1,200	120	U
120-82-1	1,2,4-Trichlorobenzene	21	52	21	160	400	160	U
87-68-3	Hexachlorobutadiene	21	210	21	230	2,300	230	U

	Surrogate Recovery	Spike Amt. ppbV	Amount ppbV	% Rec.	QC Limits	Flag * = Out
2037-26-5	Toluene-d8	10.00	9.37	94	70-130	

Notes: 1) Reported results are to be interpreted to two significant figures.
2) ug/m3 = ppbV*FW/23.68 calculated assuming conditions at 60 F and 1 atm.
3) MDL and RL are adjusted for sample volume and can dilution.
4) U and ND are Flags used for Not Detected
5) J is a flag for a result between the MDL and the RL (or lower quantitation limit, LQL)

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

ASTM D 1946 GC/TCD | **SDG:** **210187**
Analytical Method: **ASTM 1946** | **Laboratory Number:** **02**

File:	1018702A.D	**Date Sampled:**	05/04/10	**Time:**	15:10
Description:	10-646	**Date Received:**	05/05/10		
Can/Tube#:	TBAG	**Date Extracted:**			
Sam_Type:	SA	**Date Analyzed:**	05/05/10	**Time:**	16:46
QC_Batch:	050510-GC5	**Can Dilution Factor:**	1.00		0
Air Volume:	0.5 ml	**Not Detected Flag:**	U		3

CAS#	Compound	MDL ppmv	MDL %	RL ppmv	RL %	Sample Concentration ppmv	Sample Concentration %	Flag
74-82-8	Methane	10	0.001	30	0.003	704,699	70.470	
124-38-9	Carbon Dioxide	10	0.001	30	0.003	227,045	22.704	
74-85-1	Ethene	10	0.001	30	0.003	10	0.001	U
74-84-0	Ethane	10	0.001	30	0.003	10	0.001	U

Notes: 1) U and ND are Flags used for Not Detected
2) %* Indicates sample concentration is normalized to 100% (only available for complete analysis)
3) J is a flag for a result between the MDL and the RL (or lower quantitation limit, LQL)
4) Argon co-elutes with Oxygen; Atmospheric Argon is 0.946%

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

EPA Method TO-15 Modified Full Scan GC/MS | **SDG: 210187**
Analytical Method: TO-15 | **Laboratory Number: 02**

File:	1018702A.D	**Date Sampled:**	05/04/10	**Time:**	15:10
Description:	10-646	**Date Received:**	05/05/10		
Can/Tube#:	TBAG	**Date Extracted:**			
Sam_Type:	SA	**Date Analyzed:**	05/05/10	**Time:**	19:07
QC_Batch:	050510-MS1	**Can Dilution Factor:**	1.00		2
Air Volume:	5 ml	**Not Detected Flag:**	U		

CAS#	Compound	MDL ppbv	RL ppbv	Amount ppbv	MDL ug/m3	RL ug/m3	Amount ug/m3	Flag
75-71-8	Dichlorodifluoromethane	21	53	21	110	270	110	U
74-87-3	Chloromethane	20	51	20	44	110	44	U
76-14-2	Freon 114	21	52	21	150	380	150	U
75-01-4	Vinyl chloride	21	52	2,700	55	140	7,000	
74-83-9	Bromomethane	21	52	21	83	210	83	U
75-00-3	Chloroethane	21	52	21	57	140	57	U
75-69-4	Trichlorofluoromethane	21	52	21	120	300	120	U
67-64-1	Acetone	23	57	23	56	140	56	U
75-35-4	1,1-Dichloroethene	20	51	20	83	210	83	U
76-13-1	Freon 113	20	51	20	160	400	160	U
75-09-2	Methylene chloride	21	52	21	75	190	75	U
75-15-0	Carbon disulfide	17	43	17	55	140	55	U
156-60-5	trans-1,2-Dichloroethene	13	33	74	54	140	300	
75-34-3	1,1-Dichloroethane	20	51	20	84	210	84	U
108-05-4	Vinyl acetate	16	160	16	59	590	59	U
78-93-3	2-Butanone	19	47	19	57	140	57	U
156-59-2	cis-1,2-Dichloroethene	21	52	21	84	210	84	U
67-66-3	Chloroform	20	51	20	100	260	100	U
71-55-6	1,1,1-Trichloroethane	20	51	20	110	290	110	U
107-06-2	1,2-Dichloroethane	21	52	21	86	220	86	U
71-43-2	Benzene	41	210	41	140	680	140	J
56-23-5	Carbon tetrachloride	20	51	20	130	330	130	U
78-87-5	1,2-Dichloropropane	21	52	21	98	250	98	U
79-01-6	Trichloroethene	21	52	46	110	290	260	J
75-27-4	Bromodichloromethane	7	19	7	51	130	51	U
108-10-1	4-Methyl-2-pentanone	14	35	14	59	150	59	U
10061-01-5	cis-1,3-Dichloropropene	21	53	21	99	250	99	U
108-88-3	Toluene	21	52	21	80	200	80	U
10061-02-6	trans-1,3-Dichloropropene	21	52	21	98	240	98	U
79-00-5	1,1,2-Trichloroethane	20	51	20	110	290	110	U
591-78-6	2-Hexanone	13	33	13	55	140	55	U
124-48-1	Dibromochloromethane	7	18	7	65	160	65	U
106-93-4	1,2-Dibromoethane	21	52	21	170	410	170	U
127-18-4	Tetrachloroethene	20	51	37	140	360	260	J
108-90-7	Chlorobenzene	20	51	20	97	240	97	U
100-41-4	Ethylbenzene	21	52	21	93	230	93	U
1330-20-7	m,p-Xylenes	41	100	41	180	460	180	U
100-42-5	Styrene	21	52	21	91	230	91	U
75-25-2	Bromoform	5	12	5	53	130	53	U
95-47-6	o-Xylene	20	51	20	91	230	91	U

CAS#	Compound	MDL ppbv	RL ppbv	Amount ppbv	MDL ug/m3	RL ug/m3	Amount ug/m3	Flag
79-34-5	1,1,2,2-Tetrachloroethane	20	51	20	140	360	140	U
622-96-8	4-Ethyltoluene	11	28	11	58	140	58	U
108-67-8	1,3,5-Trimethylbenzene	21	53	21	110	270	110	U
95-63-6	1,2,4-Trimethylbenzene	20	200	20	100	1,000	100	U
541-73-1	1,3-Dichlorobenzene	20	200	20	130	1,300	130	U
100-44-7	Benzyl chloride	12	29	12	63	160	63	U
106-46-7	1,4-Dichlorobenzene	20	200	20	130	1,300	130	U
95-50-1	1,2-Dichlorobenzene	20	200	20	120	1,200	120	U
120-82-1	1,2,4-Trichlorobenzene	21	52	21	160	400	160	U
87-68-3	Hexachlorobutadiene	21	210	21	230	2,300	230	U

	Surrogate Recovery	Spike Amt. ppbV	Amount ppbV	% Rec.	QC Limits	Flag * = Out
2037-26-5	Toluene-d8	10.00	9.46	95	70-130	

Notes: 1) Reported results are to be interpreted to two significant figures.
2) ug/m3 = ppbV*FW/23.68 calculated assuming conditions at 60 F and 1 atm.
3) MDL and RL are adjusted for sample volume and can dilution.
4) U and ND are Flags used for Not Detected
5) J is a flag for a result between the MDL and the RL (or lower quantitation limit, LQL)

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

ASTM D 1946 GC/TCD | **SDG:** 210187
Analytical Method: ASTM 1946 | **Laboratory Number:** 03

File:	1018703A.D	**Date Sampled:**	05/04/10	**Time:**	15:50
Description:	10-647	**Date Received:**	05/05/10		
Can/Tube#:	TBAG	**Date Extracted:**			
Sam_Type:	SA	**Date Analyzed:**	05/05/10	**Time:**	17:02
QC_Batch:	050510-GC5	**Can Dilution Factor:**	1.00		0
Air Volume:	0.5 ml	**Not Detected Flag:**	U		3

CAS#	Compound	MDL ppmv	MDL %	RL ppmv	RL %	Sample Concentration ppmv	Sample Concentration %	Flag
74-82-8	Methane	10	0.001	30	0.003	646,348	64.635	
124-38-9	Carbon Dioxide	10	0.001	30	0.003	250,339	25.034	
74-85-1	Ethene	10	0.001	30	0.003	10	0.001	U
74-84-0	Ethane	10	0.001	30	0.003	10	0.001	U

Notes: 1) U and ND are Flags used for Not Detected
2) %* Indicates sample concentration is normalized to 100% (only available for complete analysis)
3) J is a flag for a result between the MDL and the RL (or lower quantitation limit, LQL)
4) Argon co-elutes with Oxygen; Atmospheric Argon is 0.946%

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

EPA Method TO-15 Modified Full Scan GC/MS | **SDG:** 210187
Analytical Method: TO-15 | **Laboratory Number:** 03

File:	1018703A.D	**Date Sampled:**	05/04/10	**Time:**	15:50
Description:	10-647	**Date Received:**	05/05/10		
Can/Tube#:	TBAG	**Date Extracted:**			
Sam_Type:	SA	**Date Analyzed:**	05/05/10	**Time:**	19:54
QC_Batch:	050510-MS1	**Can Dilution Factor:**	1.00		2
Air Volume:	5 ml	**Not Detected Flag:**	U		

CAS#	Compound	MDL ppbv	RL ppbv	Amount ppbv	MDL ug/m3	RL ug/m3	Amount ug/m3	Flag
75-71-8	Dichlorodifluoromethane	21	53	21	110	270	110	U
74-87-3	Chloromethane	20	51	20	44	110	44	U
76-14-2	Freon 114	21	52	21	150	380	150	U
75-01-4	Vinyl chloride	21	52	2,200	55	140	5,700	
74-83-9	Bromomethane	21	52	21	83	210	83	U
75-00-3	Chloroethane	21	52	150	57	140	400	
75-69-4	Trichlorofluoromethane	21	52	21	120	300	120	U
67-64-1	Acetone	23	57	23	56	140	57	J
75-35-4	1,1-Dichloroethene	20	51	20	83	210	83	U
76-13-1	Freon 113	20	51	20	160	400	160	U
75-09-2	Methylene chloride	21	52	21	75	190	75	U
75-15-0	Carbon disulfide	17	43	17	55	140	55	U
156-60-5	trans-1,2-Dichloroethene	13	33	95	54	140	390	
75-34-3	1,1-Dichloroethane	20	51	20	84	210	84	U
108-05-4	Vinyl acetate	16	160	16	59	590	59	U
78-93-3	2-Butanone	19	47	19	57	140	57	U
156-59-2	cis-1,2-Dichloroethene	21	52	590	84	210	2,400	
67-66-3	Chloroform	20	51	20	100	260	100	U
71-55-6	1,1,1-Trichloroethane	20	51	20	110	290	110	U
107-06-2	1,2-Dichloroethane	21	52	21	86	220	86	U
71-43-2	Benzene	41	210	41	140	680	140	U
56-23-5	Carbon tetrachloride	20	51	20	130	330	130	U
78-87-5	1,2-Dichloropropane	21	52	21	98	250	98	U
79-01-6	Trichloroethene	21	52	230	110	290	1,300	
75-27-4	Bromodichloromethane	7	19	7	51	130	51	U
108-10-1	4-Methyl-2-pentanone	14	35	14	59	150	59	U
10061-01-5	cis-1,3-Dichloropropene	21	53	21	99	250	99	U
108-88-3	Toluene	21	52	21	80	200	80	U
10061-02-6	trans-1,3-Dichloropropene	21	52	21	98	240	98	U
79-00-5	1,1,2-Trichloroethane	20	51	20	110	290	110	U
591-78-6	2-Hexanone	13	33	13	55	140	55	U
124-48-1	Dibromochloromethane	7	18	7	65	160	65	U
106-93-4	1,2-Dibromoethane	21	52	21	170	410	170	U
127-18-4	Tetrachloroethene	20	51	110	140	360	800	
108-90-7	Chlorobenzene	20	51	20	97	240	97	U
100-41-4	Ethylbenzene	21	52	21	93	230	93	U
1330-20-7	m,p-Xylenes	41	100	41	180	460	180	U
100-42-5	Styrene	21	52	21	91	230	91	U
75-25-2	Bromoform	5	12	5	53	130	53	U
95-47-6	o-Xylene	20	51	20	91	230	91	U

CAS#	Compound	MDL ppbv	RL ppbv	Amount ppbv	MDL ug/m3	RL ug/m3	Amount ug/m3	Flag
79-34-5	1,1,2,2-Tetrachloroethane	20	51	20	140	360	140	U
622-96-8	4-Ethyltoluene	11	28	11	58	140	58	U
108-67-8	1,3,5-Trimethylbenzene	21	53	21	110	270	110	U
95-63-6	1,2,4-Trimethylbenzene	20	200	20	100	1,000	100	U
541-73-1	1,3-Dichlorobenzene	20	200	20	130	1,300	130	U
100-44-7	Benzyl chloride	12	29	12	63	160	63	U
106-46-7	1,4-Dichlorobenzene	20	200	20	130	1,300	130	U
95-50-1	1,2-Dichlorobenzene	20	200	20	120	1,200	120	U
120-82-1	1,2,4-Trichlorobenzene	21	52	21	160	400	160	U
87-68-3	Hexachlorobutadiene	21	210	21	230	2,300	230	U

	Surrogate Recovery	Spike Amt. ppbV	Amount ppbV	% Rec.	QC Limits	Flag * = Out
2037-26-5	Toluene-d8	10.00	9.56	96	70-130	

Notes: 1) Reported results are to be interpreted to two significant figures.
2) ug/m3 = ppbV*FW/23.68 calculated assuming conditions at 60 F and 1 atm.
3) MDL and RL are adjusted for sample volume and can dilution.
4) U and ND are Flags used for Not Detected
5) J is a flag for a result between the MDL and the RL (or lower quantitation limit, LQL)

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

ASTM D 1946 GC/TCD | **SDG:** **210187**
Analytical Method: **ASTM 1946** | **Laboratory Number:** **04**

File:	1018704A.D	**Date Sampled:**	05/04/10	**Time:**	14:55
Description:	10-648	**Date Received:**	05/05/10		
Can/Tube#:	TBAG	**Date Extracted:**			
Sam_Type:	SA	**Date Analyzed:**	05/05/10	**Time:**	17:33
QC_Batch:	050510-GC5	**Can Dilution Factor:**	1.00		0
Air Volume:	0.5 ml	**Not Detected Flag:**	U		3

CAS#	Compound	MDL ppmv	MDL %	RL ppmv	RL %	Sample Concentration ppmv	Sample Concentration %	Flag
74-82-8	Methane	10	0.001	30	0.003	653,091	65.309	
124-38-9	Carbon Dioxide	10	0.001	30	0.003	259,186	25.919	
74-85-1	Ethene	10	0.001	30	0.003	10	0.001	U
74-84-0	Ethane	10	0.001	30	0.003	10	0.001	U

Notes: 1) U and ND are Flags used for Not Detected
2) %* Indicates sample concentration is normalized to 100% (only available for complete analysis)
3) J is a flag for a result between the MDL and the RL (or lower quantitation limit, LQL)
4) Argon co-elutes with Oxygen; Atmospheric Argon is 0.946%

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

EPA Method TO-15 Modified Full Scan GC/MS | **SDG:** **210187**
Analytical Method: **TO-15** | **Laboratory Number:** **04**

File:	1018704A.D	**Date Sampled:**	05/04/10	**Time:**	14:55
Description:	10-648	**Date Received:**	05/05/10		
Can/Tube#:	TBAG	**Date Extracted:**			
Sam_Type:	SA	**Date Analyzed:**	05/05/10	**Time:**	20:45
QC_Batch:	050510-MS1	**Can Dilution Factor:**	1.00		2
Air Volume:	5 ml	**Not Detected Flag:**	U		

CAS#	Compound	MDL ppbv	RL ppbv	Amount ppbv	MDL ug/m3	RL ug/m3	Amount ug/m3	Flag
75-71-8	Dichlorodifluoromethane	21	53	21	110	270	110	U
74-87-3	Chloromethane	20	51	20	44	110	44	U
76-14-2	Freon 114	21	52	21	150	380	150	U
75-01-4	Vinyl chloride	21	52	1,200	55	140	3,200	
74-83-9	Bromomethane	21	52	21	83	210	83	U
75-00-3	Chloroethane	21	52	21	57	140	57	U
75-69-4	Trichlorofluoromethane	21	52	21	120	300	120	U
67-64-1	Acetone	23	57	23	56	140	56	U
75-35-4	1,1-Dichloroethene	20	51	20	83	210	83	U
76-13-1	Freon 113	20	51	20	160	400	160	U
75-09-2	Methylene chloride	21	52	21	75	190	75	U
75-15-0	Carbon disulfide	17	43	17	55	140	55	U
156-60-5	trans-1,2-Dichloroethene	13	33	550	54	140	2,300	
75-34-3	1,1-Dichloroethane	20	51	20	84	210	84	U
108-05-4	Vinyl acetate	16	160	16	59	590	59	U
78-93-3	2-Butanone	19	47	19	57	140	57	U
156-59-2	cis-1,2-Dichloroethene	21	52	2,200	84	210	9,000	
67-66-3	Chloroform	20	51	20	100	260	100	U
71-55-6	1,1,1-Trichloroethane	20	51	20	110	290	110	U
107-06-2	1,2-Dichloroethane	21	52	21	86	220	86	U
71-43-2	Benzene	41	210	41	140	680	140	U
56-23-5	Carbon tetrachloride	20	51	20	130	330	130	U
78-87-5	1,2-Dichloropropane	21	52	21	98	250	98	U
79-01-6	Trichloroethene	21	52	1,700	110	290	9,300	
75-27-4	Bromodichloromethane	7	19	7	51	130	51	U
108-10-1	4-Methyl-2-pentanone	14	35	14	59	150	59	U
10061-01-5	cis-1,3-Dichloropropene	21	53	21	99	250	99	U
108-88-3	Toluene	21	52	21	80	200	80	U
10061-02-6	trans-1,3-Dichloropropene	21	52	21	98	240	98	U
79-00-5	1,1,2-Trichloroethane	20	51	20	110	290	110	U
591-78-6	2-Hexanone	13	33	13	55	140	55	U
124-48-1	Dibromochloromethane	7	18	7	65	160	65	U
106-93-4	1,2-Dibromoethane	21	52	21	170	410	170	U
127-18-4	Tetrachloroethene	20	51	25	140	360	180	J
108-90-7	Chlorobenzene	20	51	20	97	240	97	U
100-41-4	Ethylbenzene	21	52	21	93	230	93	U
1330-20-7	m,p-Xylenes	41	100	41	180	460	180	U
100-42-5	Styrene	21	52	21	91	230	91	U
75-25-2	Bromoform	5	12	5	53	130	53	U
95-47-6	o-Xylene	20	51	20	91	230	91	U

CAS#	Compound	MDL ppbv	RL ppbv	Amount ppbv	MDL ug/m3	RL ug/m3	Amount ug/m3	Flag
79-34-5	1,1,2,2-Tetrachloroethane	20	51	20	140	360	140	U
622-96-8	4-Ethyltoluene	11	28	11	58	140	58	U
108-67-8	1,3,5-Trimethylbenzene	21	53	21	110	270	110	U
95-63-6	1,2,4-Trimethylbenzene	20	200	20	100	1,000	100	U
541-73-1	1,3-Dichlorobenzene	20	200	20	130	1,300	130	U
100-44-7	Benzyl chloride	12	29	12	63	160	63	U
106-46-7	1,4-Dichlorobenzene	20	200	20	130	1,300	130	U
95-50-1	1,2-Dichlorobenzene	20	200	20	120	1,200	120	U
120-82-1	1,2,4-Trichlorobenzene	21	52	21	160	400	160	U
87-68-3	Hexachlorobutadiene	21	210	21	230	2,300	230	U

	Surrogate Recovery	Spike Amt. ppbV	Amount ppbV	% Rec.	QC Limits	Flag * = Out
2037-26-5	Toluene-d8	10.00	9.91	99	70-130	

Notes: 1) Reported results are to be interpreted to two significant figures.
2) ug/m3 = ppbV*FW/23.68 calculated assuming conditions at 60 F and 1 atm.
3) MDL and RL are adjusted for sample volume and can dilution.
4) U and ND are Flags used for Not Detected
5) J is a flag for a result between the MDL and the RL (or lower quantitation limit, LQL)

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

ASTM D 1946 GC/TCD | **SDG:** **210187**
Analytical Method: **ASTM 1946** | **Laboratory Number:** **05**

File:	1018705A.D	**Date Sampled:**	05/04/10	**Time:**	15:35
Description:	10-649	**Date Received:**	05/05/10		
Can/Tube#:	TBAG	**Date Extracted:**			
Sam_Type:	SA	**Date Analyzed:**	05/05/10	**Time:**	17:44
QC_Batch:	050510-GC5	**Can Dilution Factor:**	1.00		0
Air Volume:	0.5 ml	**Not Detected Flag:**	U		3

CAS#	Compound	MDL ppmv	MDL %	RL ppmv	RL %	Sample Concentration ppmv	Sample Concentration %	Flag
74-82-8	Methane	10	0.001	30	0.003	661,213	66.121	
124-38-9	Carbon Dioxide	10	0.001	30	0.003	278,969	27.897	
74-85-1	Ethene	10	0.001	30	0.003	10	0.001	U
74-84-0	Ethane	10	0.001	30	0.003	10	0.001	U

Notes: 1) U and ND are Flags used for Not Detected
2) %* Indicates sample concentration is normalized to 100% (only available for complete analysis)
3) J is a flag for a result between the MDL and the RL (or lower quantitation limit, LQL)
4) Argon co-elutes with Oxygen; Atmospheric Argon is 0.946%

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

EPA Method TO-15 Modified Full Scan GC/MS | **SDG:** **210187**
Analytical Method: **TO-15** | **Laboratory Number:** **05**

File:	1018705A.D	**Date Sampled:**	05/04/10	**Time:**	15:35
Description:	10-649	**Date Received:**	05/05/10		
Can/Tube#:	TBAG	**Date Extracted:**			
Sam_Type:	SA	**Date Analyzed:**	05/06/10	**Time:**	15:36
QC_Batch:	050610-MS1	**Can Dilution Factor:**	1.00		2
Air Volume:	5 ml	**Not Detected Flag:**	U		

CAS#	Compound	MDL ppbv	RL ppbv	Amount ppbv	MDL ug/m3	RL ug/m3	Amount ug/m3	Flag
75-71-8	Dichlorodifluoromethane	21	53	21	110	270	110	U
74-87-3	Chloromethane	20	51	20	44	110	44	U
76-14-2	Freon 114	21	52	21	150	380	150	U
75-01-4	Vinyl chloride	21	52	610	55	140	1,600	
74-83-9	Bromomethane	21	52	21	83	210	83	U
75-00-3	Chloroethane	21	52	140	57	140	380	
75-69-4	Trichlorofluoromethane	21	52	21	120	300	120	U
67-64-1	Acetone	23	57	23	56	140	56	U
75-35-4	1,1-Dichloroethene	20	51	20	83	210	83	U
76-13-1	Freon 113	20	51	20	160	400	160	U
75-09-2	Methylene chloride	21	52	21	75	190	75	U
75-15-0	Carbon disulfide	17	43	17	55	140	55	U
156-60-5	trans-1,2-Dichloroethene	13	33	24	54	140	98	J
75-34-3	1,1-Dichloroethane	20	51	20	84	210	84	U
108-05-4	Vinyl acetate	16	160	16	59	590	59	U
78-93-3	2-Butanone	19	47	19	57	140	57	U
156-59-2	cis-1,2-Dichloroethene	21	52	90	84	210	370	
67-66-3	Chloroform	20	51	20	100	260	100	U
71-55-6	1,1,1-Trichloroethane	20	51	20	110	290	110	U
107-06-2	1,2-Dichloroethane	21	52	21	86	220	86	U
71-43-2	Benzene	41	210	41	140	680	140	U
56-23-5	Carbon tetrachloride	20	51	20	130	330	130	U
78-87-5	1,2-Dichloropropane	21	52	21	98	250	98	U
79-01-6	Trichloroethene	21	52	110	110	290	640	
75-27-4	Bromodichloromethane	7	19	7	51	130	51	U
108-10-1	4-Methyl-2-pentanone	14	35	14	59	150	59	U
10061-01-5	cis-1,3-Dichloropropene	21	53	21	99	250	99	U
108-88-3	Toluene	21	52	21	80	200	80	U
10061-02-6	trans-1,3-Dichloropropene	21	52	21	98	240	98	U
79-00-5	1,1,2-Trichloroethane	20	51	20	110	290	110	U
591-78-6	2-Hexanone	13	33	13	55	140	55	U
124-48-1	Dibromochloromethane	7	18	7	65	160	65	U
106-93-4	1,2-Dibromoethane	21	52	21	170	410	170	U
127-18-4	Tetrachloroethene	20	51	27	140	360	190	J
108-90-7	Chlorobenzene	20	51	20	97	240	97	U
100-41-4	Ethylbenzene	21	52	21	93	230	93	U
1330-20-7	m,p-Xylenes	41	100	41	180	460	180	U
100-42-5	Styrene	21	52	21	91	230	91	U
75-25-2	Bromoform	5	12	5	53	130	53	U
95-47-6	o-Xylene	20	51	20	91	230	91	U

CAS#	Compound	MDL ppbv	RL ppbv	Amount ppbv	MDL ug/m3	RL ug/m3	Amount ug/m3	Flag
79-34-5	1,1,2,2-Tetrachloroethane	20	51	20	140	360	140	U
622-96-8	4-Ethyltoluene	11	28	11	58	140	58	U
108-67-8	1,3,5-Trimethylbenzene	21	53	21	110	270	110	U
95-63-6	1,2,4-Trimethylbenzene	20	200	20	100	1,000	100	U
541-73-1	1,3-Dichlorobenzene	20	200	20	130	1,300	130	U
100-44-7	Benzyl chloride	12	29	12	63	160	63	U
106-46-7	1,4-Dichlorobenzene	20	200	20	130	1,300	130	U
95-50-1	1,2-Dichlorobenzene	20	200	20	120	1,200	120	U
120-82-1	1,2,4-Trichlorobenzene	21	52	21	160	400	160	U
87-68-3	Hexachlorobutadiene	21	210	21	230	2,300	230	U

	Surrogate Recovery	Spike Amt. ppbV	Amount ppbV	% Rec.	QC Limits	Flag * = Out
2037-26-5	Toluene-d8	10.00	9.06	91	70-130	

Notes: 1) Reported results are to be interpreted to two significant figures.
2) ug/m3 = ppbV*FW/23.68 calculated assuming conditions at 60 F and 1 atm.
3) MDL and RL are adjusted for sample volume and can dilution.
4) U and ND are Flags used for Not Detected
5) J is a flag for a result between the MDL and the RL (or lower quantitation limit, LQL)

Data Qualifiers, Abbreviations and Definitions

ENVIRONMENTAL
Analytical Service, Inc.

Qualifiers

*	See Case Narrative
B	This compound was detected in the blank above the Reporting Limit (RL)
D	This report was calculated from a secondary dilution factor
E	Compound exceeds the calibration range and is an estimated value
J	The amount reported is an estimated value because it is between the Reporting Limit (RL) and the Method Detection Limit (MDL)
F	Higher detection limit due to sample matrix
G	Higher detection limit due to limited sample size
Q	Compound secondary ion ratio qualifiers are outside the standard acceptance criteria
R	Compound secondary retention time (RT) is outside the acceptance criteria for the method
U	Compound is less than the Method Detection Limit (MDL)

Abbreviations

MDL Minimum Detection Limit – Instrument detection limit

The minimum detectable level (MDL) is the lowest concentration of a substance that can be measured with confidence. The MDL is calculated at the 99% confidence level from seven repetitive measurements on a sample whose concentration does not exceed 10 times the estimated MDL (Glasser et. al. 1981; Long and Winefordner, 1983). Generating an MDL study, a sample is prepared in the appropriate matrix with components near the estimated MDL, which is about 3 times the instrument noise level. This sample is run seven consecutive times and the standard deviation (S) is calculated. The MDL is determined using the following formula: MDL = 3.14*S

ND Not Detected – a reported limit
NA Not Applicable
RPD Relative Percent Difference

The relative percent difference for a pair of duplicate samples is calculated from repetitive runs on sample pairs representative of the types of samples that are analyzed. The RPD provides information on the precision or reproducibility of the actual measurement process. The RPD is calculated for a particular compound from the average using the following formula:

$$RPD(\%) = \frac{\text{Difference} * 100}{\text{Average}}$$

RSD Relative Standard Deviation

The relative standard deviation is reported as a percentage deviation at a particular concentration using the following equation:

$$RSD\ (\%) = \frac{S * 100}{\text{Average}}$$

Definitions

ppbV $= \frac{\text{\# nanomoles cmpd}}{\text{\# moles air}} = \frac{\text{ppbC}}{\text{\# carbons in cmpd}}$

Compound is reported as ppb of compound by Volume

This unit is temperature independent

ug/m^3 $= \text{ppbV} \times \frac{\text{MW compound}}{23.68}$

Compound is reported as ug of a compound in a m^3 of air

23.68 is the molar volume of a gas at 60 ° F and 1 atm pressure

MW = molecular weight

This unit is temperature dependent

ppbC = ppbV x # carbons in compound

TETRA TECH
1230 Columbia Street, Suite 750
San Diego, CA 92101 (619) 234-8696

CHAIN-OF-CUSTODY RECORD

NUMBER 40891

ENTERED

PROJECT NAME: Seal Beach NWS	PURCHASE ORDER NO.: 61509
PROJECT LOCATION: IRP Site 40	PROJECT NO.: 3210.010
SAMPLER NAME: Wendy Bryant	AIRBILL NUMBER: FedEx
PROJECT CONTACT: S. Sodoku	PROJECT CONTACT PHONE NUMBER: 949-309-5022

LABORATORY NAME: Microbial Insights

LABORATORY ID (FOR LABORATORY): 02614E

Project Information Section Do not submit to Laboratory

5-21

ANALYSES REQUIRED: Q-PCR DNA; SCLFD VFA; White 1979 PAH

SAMPLE ID	DATE COLLECTED	TIME COLLECTED	NO. OF CONTAINER	LEVEL 3	LEVEL 4	TYPE	TAT	Q-PCR DNA	SCLFD VFA	White 1979 PAH	COMMENTS	LOCATION	DEPTH START	DEPTH END	QC
10-257	5/6/10	0920	6	X		W	10 Day	X	X	X		MW-40-34			N
10-260	5/6/10	1009	6		X	W	10 Day	X	X	X		MW-40-37			N
10-261	5/6/10	1243	6	X		W	10 Day	X	X	X		MW-40-318*			N
10-266	5/6/10	1140	6	X		W	10 Day	X	X	X		MW-40-07			N
10-272	5/6/10	1346	6	X		W	10 Day	X	X	X		~~MW-40-35~~			N
												MW-6			
												MW 5/6/10			

RELINQUISHED BY (Signature): [signature]	DATE: 5/6/10	RECEIVED BY (Signature): FedEx	LABORATORY INSTRUCTIONS/COMMENTS
COMPANY: TETC	TIME: 1700	COMPANY: FedEx	
RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)	COMPOSITE DESCRIPTION
COMPANY	TIME	COMPANY	
RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)	SAMPLE CONDITION UPON RECEIPT (FOR LABORATORY)
COMPANY	TIME	COMPANY	TEMPERATURE: _____ SAMPLE CONDITION: ☐ INTACT ☐ BROKEN COOLER SEAL: ☐ INTACT ☐ BROKEN

SAMPLING COMMENT:
* Should be "30" 5/10/10 SUDOKU
H

White - Laboratory; Pink - Laboratory; Canary - Project File; Manila - Data Management

2340 Stock Creek Blvd.
Rockford TN 37853-3044
Phone: (865) 573-8188
Fax: (865) 573-8133
Email: info@microbe.com

Client: Sabina Sudoko
Tetra Tech , Inc.
17885 Von Karman Avenue
Suite 500
Irvine, CA 92614

Phone: 949.809.5022

Fax:

Identifier: 026HE **Date Rec:** 05/07/2010 **Report Date:** 05/25/2010

Client Project #: 3210.010 **Client Project Name:** Naval Weapons Station in Seal Beach

Purchase Order #: 61509

Analysis Requested: CENSUS, PLFA, VFA

Reviewed By:

NOTICE: This report is intended only for the addressee shown above and may contain confidential or privileged information. If the recipient of this material is not the intended recipient or if you have received this in error, please notify Microbial Insights, Inc. immediately. The data and other information in this report represent only the sample(s) analyzed and are rendered upon condition that it is not to be reproduced without approval from Microbial Insights, Inc. Thank you for your cooperation.

MICROBIAL INSIGHTS, INC.

2340 Stock Creek Blvd. Rockford, TN 37853-3044
Tel. (865) 573-8188 Fax. (865) 573-8133

CENSUS

Client: **Tetra Tech , Inc.**
Project: Naval Weapons Station in Seal Beach

MI Project Number: **026HE**
Date Received: 05/07/2010

Sample Information

Client Sample ID:		**10-257**	**10-260**	**10-261**	**10-266**	**10-272**
Sample Date:		05/06/2010	05/06/2010	05/06/2010	05/06/2010	05/06/2010
Units:		cells/mL	cells/mL	cells/mL	cells/mL	cells/mL
Analyst:		CT	CT	CT	CT	CT
Dechlorinating Bacteria						
Dehalococcoides spp.	DHC	**2.63E+01**	**1.50E+02**	**2.50E+03**	**1.14E+04**	**5.79E+01**

Legend:
NA = Not Analyzed NS = Not Sampled J = Estimated gene copies below PQL but above LQL I = Inhibited
< = Result not detected

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Email: info@microbe.com

Identifier: 026HE **Date Rec:** 05/07/2010 **Report Date:** 05/25/2010

Client Project #: 3210.010 **Client Project Name:** Naval Weapons Station in Seal Beach

Purchase Order #: 61509

Comments:

MICROBIAL INSIGHTS, INC.

2340 Stock Creek Blvd. Rockford, TN 37853-3044
Tel. (865) 573-8188 Fax. (865) 573-8133

PLFA

Client: **Tetra Tech , Inc.**
Project: Naval Weapons Station in Seal Beach

MI Project Number: **026HE**
Date Received: 05/07/2010

Sample Information

Sample Name:	**10-257**	**10-260**	**10-261**	**10-266**	**10-272**
Sample Date:	05/06/2010	05/06/2010	05/06/2010	05/06/2010	05/06/2010
Sample Matrix:	Water	Water	Water	Water	Water
Analyst:	bj	bj	bj	bj	bj

Biomass

Total Biomass (cells/mL)	**4.83E+05**	**6.39E+05**	**1.11E+06**	**1.20E+06**	**1.62E+06**

Community Structure (% total PLFA)

Firmicutes (TerBrSats)	**23.56**	**7.20**	**24.67**	**18.67**	**21.27**
Proteobacteria (Monos)	**52.43**	**79.13**	**47.79**	**54.02**	**46.66**
Anaerobic metal reducers (BrMonos)	**2.47**	**0.70**	**7.47**	**2.11**	**10.30**
SRB/Actinomycetes (MidBrSats)	**3.18**	**1.76**	**3.48**	**1.28**	**0.48**
General (Nsats)	**17.81**	**10.22**	**16.47**	**23.41**	**20.63**
Eukaryotes (polyenoics)	**0.56**	**0.95**	**0.14**	**0.46**	**0.65**

Physiological Status (Proteobacteria only)

Slowed Growth	**0.15**	**1.29**	**0.24**	**0.04**	**0.85**
Decreased Permeability	**0.11**	**0.23**	**0.35**	**0.09**	**0.07**

Legend:
NA = Not Analyzed NS = Not Sampled

MICROBIAL INSIGHTS, INC.

2340 Stock Creek Blvd. Rockford, TN 37853-3044
Tel. (865) 573-8188 Fax. (865) 573-8133

PLFA

Client: **Tetra Tech , Inc.**
Project: Naval Weapons Station in Seal Beach

MI Project Number: **026HE**
Date Received: 05/07/2010

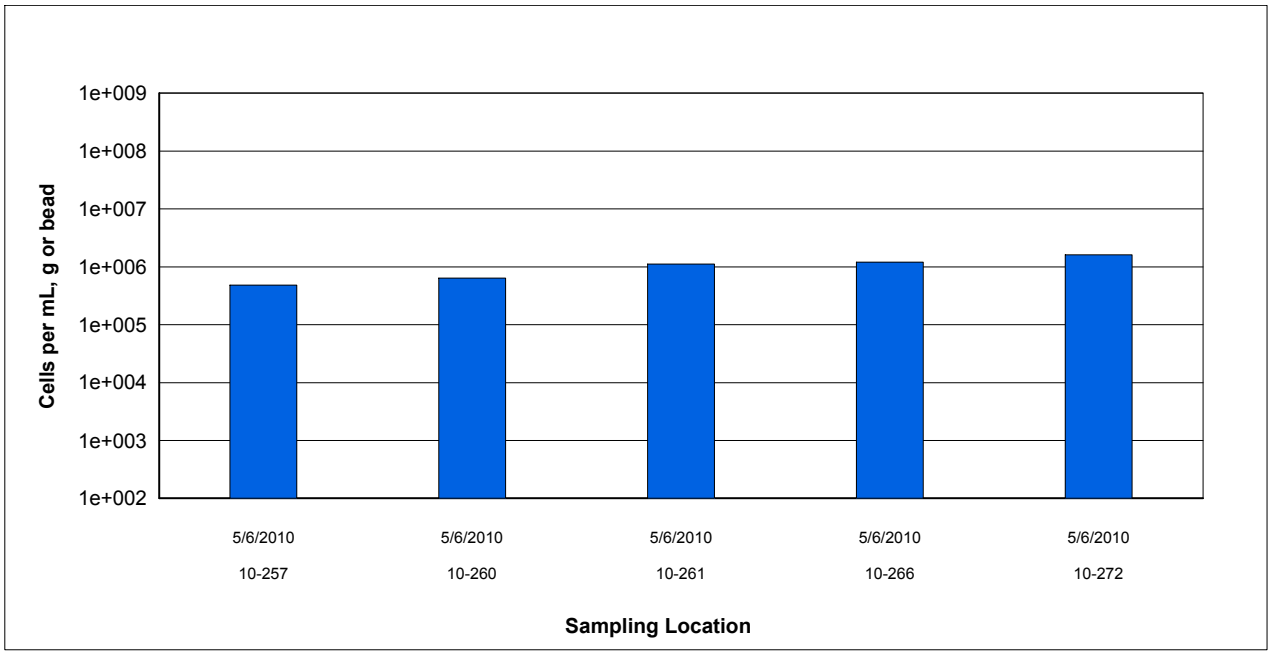

Figure 1. Biomass content is presented as a cell equivalent based on the total amount of phospholipid fatty acids (PLFA) extracted from a given sample. Total biomass is calculated based upon PLFA attributed to bacterial and eukaryotic biomass

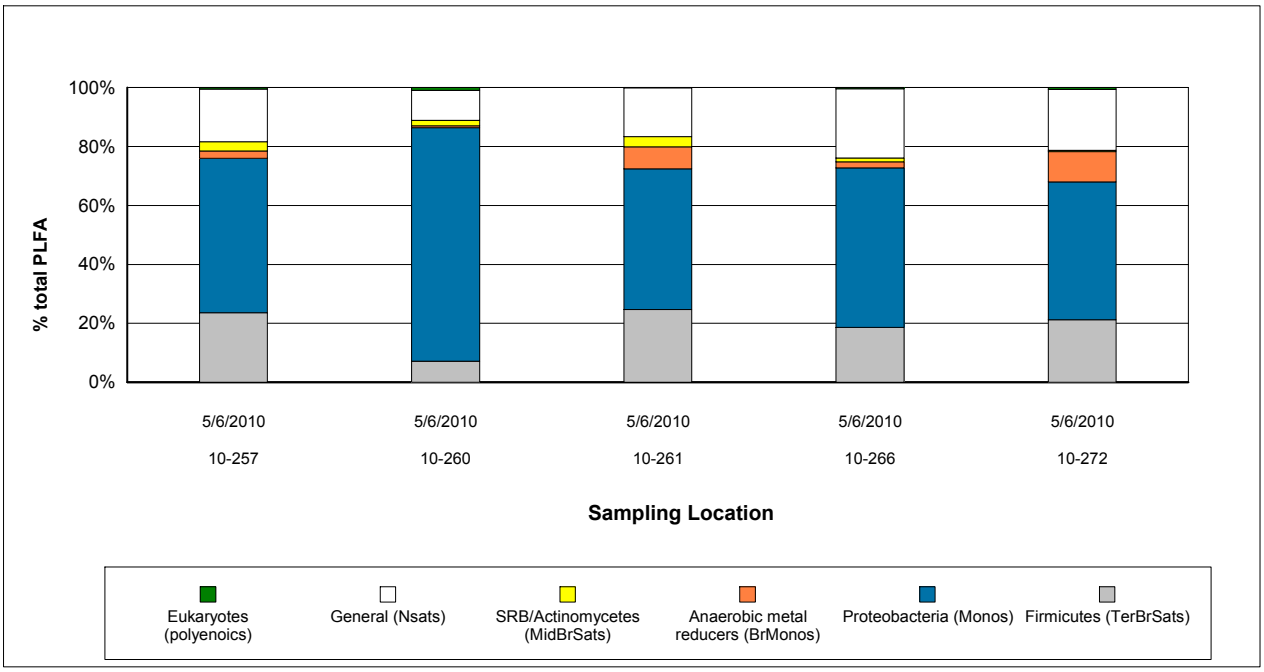

Figure 2. Relative percentages of total PLFA structural groups in the samples analyzed. Structural groups are assigned according to PLFA chemical structure, which is related to fatty acid biosynthesis.

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Email: info@microbe.com

Analysis Summary Report

Sample Name:	Date Sampled	Date Received	Arrival Condition:	Metabolic Acids (mg/L) Pyruvic	Lactic	Formic	Acetic	Propionic	Butyric
10-257	05/06/2010	05/07/2010	Intact	<0.150	<0.100	<0.100	<0.070	<0.050	<0.050
10-260	05/06/2010	05/07/2010	Intact	<0.150	<0.100	<0.100	<0.070	<0.050	<0.050
10-261	05/06/2010	05/07/2010	Intact	<0.150	<0.100	<0.100	1.300	0.310	0.056
10-266	05/06/2010	05/07/2010	Intact	0.370	0.130	0.290	10.000	14.000	0.700
10-272	05/06/2010	05/07/2010	Intact	14.000	170.000	8.200	470.000	710.000	11.000

APPENDIX D

GROUNDWATER SAMPLING FIELD DATA

(ON CD ONLY)

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TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Date 5/6/10

Well Name MW-40-07

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/6/10

Sampling Personnel

Wendy Bryant WB

Sample ID 10-261

Duplicate ID

Screen Interval 20-30

Immiscible Phases Present ☐ Yes ☒ No

Static Water Level (from TOC) / Time 8.75 / 1225

Reference Point TOC

PID Reading (TOC) 0.0

Explosive Gas Reading 0.0 % LEL

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
1225							0.0	TOC	0.0	8.75	Start Purge
1230	0.4	1.11	6.58	-110	23.88	2610	2.0	TOC	0.0	8.75	yellow tint, clear
1233	0.4	0.83	6.57	-130	23.80	2510	3.2	TOC	0.0	8.75	
1236	0.4	0.25	6.58	-143	23.78	2600	4.4	TOC	0.0	8.75	
1239	0.4	0.21	6.58	-152	23.82	2610	5.6	TOC	0.0	8.75	
1242	0.4	0.18	6.58	-156	23.80	2620	6.8	TOC		8.75	
1243											Collect Sample

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
SAMPLE RATE							
.2	.2	.2	.2	.2	.2	.2	.2

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well:

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 20D.04

Temperature Meter YSI 556 Flow Cell — Serial Number

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number

ORP Meter YSI 556 Flow Cell — Serial Number

D.O. Meter YSI 556 Flow Cell — Serial Number

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000.07

Pump QED P1101M / QED Sample Pro — Serial Number

Number of Bottles 17

Field Notebook #1

Sample Method

Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Date 5/6/10

Well Name MW-40-08

Screen Interval 20-30

Immiscible Phases Present ☐ Yes ☒ No

Project: Seal Beach NWS

Project No. 3210.010E

Static Water Level (from TOC) / Time 8.94 / 1800

Well Location IRP Site 40

Sample Date

Reference Point TOC

Sampling Personnel GB

Wendy Bryant

PID Reading (TOC) 0.0

Explosive Gas Reading 0.0 % LEL

Sample ID 10-265

Duplicate ID

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
1800	—					—	0.0	TOC	0.0	8.94	Start Pump
1805	0.2	0.57	6.86	-99	19.43	1680	1.0	TOC	0.0	8.96	clear, slight rotten egg smell
1808	0.2	0.12	6.75	-127	19.68	1680	1.6	TOC	0.0	8.97	
1811	0.2	0.11	6.74	-130	19.70	1690	2.2	TOC	0.0	8.97	
1814	0.2	0.10	6.75	-134	19.74	170	2.8	TOC	0.0	8.98	
1815	—										Collect Sample

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
SAMPLE RATE							
0.2	0.2	—	0.2	—	0.2	0.2	—

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well: Good

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 20D.04

Temperature Meter YSI 556 Flow Cell — Serial Number 20D.04

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number 20D.04

ORP Meter YSI 556 Flow Cell — Serial Number 20D.04

D.O. Meter YSI 556 Flow Cell — Serial Number 20D.04

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000.07

Pump QED P1101M / QED Sample Pro — Serial Number —

Number of Bottles 8

Field Notebook #1

Sample Method Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Page 1 of 1

Date 5/6/10

Well Name MW-40-13

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/6/10

Sampling Personnel

Wendy Bryant

Sample ID 10-262

Duplicate ID

Screen Interval 45-55

Static Water Level (from TOC) / Time 1702 / 8.84

Reference Point TOC

PID Reading (TOC) 0.0

Explosive Gas Reading 0.0 % LEL

Immiscible Phases Present ☐ Yes ☒ No

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
1702	—					—	0.0	TOC	0.0	8.84	Start Pump
1705	0.2	0.60	6.61	-88	24.11	10190	0.6	TOC	0.0	8.86	Clear, biofouling flake present
1708	0.2	0.08	6.61	-117	23.78	10440	1.2	TOC	0.0	8.87	
1711	0.2	0.10	6.62	-116	23.83	10460	1.8	TOC	0.0	8.87	
1714	0.2	0.10	6.62	-116	23.80	10460	2.4	TOC	0.0	8.89	
1715	—					—	—		Collect	Sample	

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
SAMPLE RATE							
0.2	—	—	0.2	—	—	—	—

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well: Good

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 200.04

Temperature Meter YSI 556 Flow Cell — Serial Number 200.04

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number 200.04

ORP Meter YSI 556 Flow Cell — Serial Number 200.04

D.O. Meter YSI 556 Flow Cell — Serial Number 200.04

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000.07

Pump QED P1101M / QED Sample Pro — Serial Number —

Number of Bottles 4

Field Notebook #1

Sample Method Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Date 5/6/10

Well Name MW-40-14

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/6/10

Sampling Personnel GB

Wendy Bryant

Sample ID 10-256

Duplicate ID

Screen Interval 30-40

Immiscible Phases Present ☐ Yes ☒ No

Static Water Level (from TOC) / Time 9.17 / 1410

Reference Point TOC

PID Reading (TOC) 0.0

Explosive Gas Reading 0.0 % LEL

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
1410	0.2	—				—	0	TOC	0.0	9.17	Start Pump
1415	0.2	0.37	6.47	-209	20.07	3330	1.0	TOC	0.0	9.17	clear, strong H2S odor
1418	0.2	0.36	6.46	-203	19.83	3270	1.6	TOC	0.0	9.17	
1421	0.2	0.36	6.46	-200	19.72	3260	2.2	TOC	0.0	9.17	
1424	0.2	0.36	6.46	-200	19.72	3260	2.8	TOC	0.0	9.17	
1425	—										Collect Sample

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC

SAMPLE RATE

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
0.2	0.2	0.	.2	—	.2	—	.2

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well:

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number ~~D22~~ 20D.02

Temperature Meter YSI 556 Flow Cell — Serial Number 20D.02

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number 20D.02

ORP Meter YSI 556 Flow Cell — Serial Number 20D.02

D.O. Meter YSI 556 Flow Cell — Serial Number 20D.02

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000.07

Pump QED P1101M / QED Sample Pro — Serial Number

Number of Bottles

Field Notebook #1

Sample Method

Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Page 1 of 1

Date 5/6/10

Well Name MW-40-22

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/6/10

Sampling Personnel GB

Wendy Bryant

Sample ID 10-255

Duplicate ID

Screen Interval 15.3 - 35.5

Immiscible Phases Present ☐ Yes ☒ No

Static Water Level (from TOC) / Time 9.01 / 1618

Reference Point TOC

PID Reading (TOC) 0.0

Explosive Gas Reading 0.0 % LEL

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
1618	—						0.0	TOC	0.0	9.01	Start Pump
1623	0.2	0.71	6.85	-148	23.92	2940	1.0	TOC	0.0	9.03	clear, yellow tint sulfur smell
1626	0.2	0.23	6.82	-156	23.59	2950	1.6	TOC	0.0	9.03	
1629	0.2	0.14	6.82	-160	23.45	2960	2.2	TOC	0.0	9.03	
1632	0.2	0.09	6.82	-167	23.31	2970	2.8	TOC	0.0	9.03	
1635	0.2	0.08	6.82	-169	23.27	2970	3.4	TOC	0.0	9.03	
1638	0.2	0.08	6.82	-171	23.22	2960	4.0	TOC	0.0	9.03	
1639	—										Collect Sample

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
SAMPLE RATE							
0.2	—	—	0.2	—	—	0.2	—

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well: OK

Remarks:

FIELD EQUIPMENT

pH Meter	YSI 556 Flow Cell	Serial Number	200-04
Temperature Meter	YSI 556 Flow Cell	Serial Number	
Turbidity Meter	NA	Serial Number	NA
Spec. Elec. Cond. Meter	YSI 556 Flow Cell	Serial Number	
ORP Meter	YSI 556 Flow Cell	Serial Number	
D.O. Meter	YSI 556 Flow Cell	Serial Number	
Interface Probe	NA	Serial Number	NA
PID/OVA	MiniRAE 2000	Serial Number	2000.07
Pump	QED P1101M / QED Sample Pro	Serial Number	—

Number of Bottles 5

Field Notebook #1

Sample Method Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Page 1 of 1

Date 5/6/10

Well Name MW-40-30

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/6/10

Sampling Personnel GB

Wendy Bryant

Sample ID TO-2666

Duplicate ID

Screen Interval 15-30'

Static Water Level (from TOC) / Time 8.28 / 1125

Reference Point TOC

PID Reading (TOC) 0.0

Immiscible Phases Present ☐ Yes ☒ No

Explosive Gas Reading 0.0 % LEL

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
1125	—	—	—	—	—	—	0.0	TOC	0.0	8.28	Start Pump
1130	0.4	0.16	6.49	-135	21.58	2240	2.0	TOC	0.0	8.32	Yellow tinge to water
1133	0.4	0.11	6.49	-142	21.56	2250	3.2	TOC	0.0	8.32	
1136	0.4	0.09	6.49	-144	21.52	2250	4.4	TOC	0.0	8.32	
1139	0.4	0.09	6.50	-147	21.56	2250	5.6	TOC	0.0	8.33	
1140	—	—	—	—	—	—	—	—	—	—	Collect Sample

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
SAMPLE RATE							
.2	.2	.2	.2	.2	.2	—	.2

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well:

Remarks: Possible that some of water in vault went down well removed water, cleaned seal, put lid back on

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 20D.04

Temperature Meter YSI 556 Flow Cell — Serial Number

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number

ORP Meter YSI 556 Flow Cell — Serial Number

D.O. Meter YSI 556 Flow Cell — Serial Number

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000.07

Pump QED P1101M / QED Sample Pro — Serial Number

Number of Bottles 17

Field Notebook #1

Sample Method Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Page 1 of 1

Date 5/6/10

Well Name MW-40-31

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/6/10

Sampling Personnel

Wendy Bryant / G. Bean

Sample ID 10-267

Duplicate ID

Screen Interval 35-55

Static Water Level (from TOC) / Time 9.03 / 1056

Reference Point TOC

PID Reading (TOC) 0.0

Immiscible Phases Present ☐ Yes ☒ No

Explosive Gas Reading % LEL

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
1057							0.0	TOC	0.0	9.03	Start Pump
1102	0.2	0.14	6.80	-148	22.15	4970	1.0	TOC	0.0	9.07	clear, some biofouling flakes in water
1105	0.2	0.13	6.79	-150	22.15	4950	1.6	TOC	0.0	9.08	
1108	0.2	0.10	6.79	-152	22.18	4950	2.2	TOC	0.0	9.08	
1111	0.2	0.09	6.79	-153	22.17	4950	2.8	TOC	0.0	9.09	
1112											Collect Sample

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC

SAMPLE RATE

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
0.2			0.2				

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well:

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 200.04

Temperature Meter YSI 556 Flow Cell — Serial Number

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number

ORP Meter YSI 556 Flow Cell — Serial Number

D.O. Meter YSI 556 Flow Cell — Serial Number

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000.07

Pump QED P1101M / QED Sample Pro — Serial Number

Number of Bottles 6

Field Notebook #1

Sample Method

Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Page 1 of 1

Date 5/6/10

Well Name MW-40-32

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/6/10

Sampling Personnel CBB

Wendy Bryant

Sample ID 10-268

Duplicate ID

Screen Interval 15-35

Immiscible Phases Present ☐ Yes ☒ No

Static Water Level (from TOC) / Time 8.51 / 1836

Reference Point TOC

PID Reading (TOC) 0.0 Explosive Gas Reading 0.0 % LEL

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
1836	—						0.0	TOC	0.0	8.51	
1841	0.2	0.13	6.53	-143	20.62	2240	1.0	TOC	0.0	8.57	Clear
1844	0.2	0.09	6.53	-157	20.71	2280	1.6	TOC	0.0	8.59	
1847	0.2	0.07	6.53	-165	20.70	2280	2.2	TOC	0.0	8.59	
1850	0.2	0.06	6.53	-168	20.70	2290	2.8	TOC	0.0	8.58	
1853	0.2	0.06	6.53	-168	20.70	2280	3.2	TOC	0.0	8.58	
1854	—									—	Collect Sample

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
SAMPLE RATE							
0.2	0.2	—	0.2	—	—	0.2	—

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well: Good

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 200.04

Temperature Meter YSI 556 Flow Cell — Serial Number

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number

ORP Meter YSI 556 Flow Cell — Serial Number

D.O. Meter YSI 556 Flow Cell — Serial Number

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000.07

Pump QED P1101M / QED Sample Pro — Serial Number —

Number of Bottles 9

Field Notebook #1

Sample Method

Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Date 5/6/10

Well Name MW-40-34

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/6/10

Sampling Personnel CB

Wendy Bryant

Sample ID 10-257

Duplicate ID

Screen Interval 15-35

Immiscible Phases Present ☐ Yes ☒ No

Static Water Level (from TOC) / Time 8.01 / 0903

Reference Point TOC

PID Reading (TOC) 0.0

Explosive Gas Reading 0.0 % LEL

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
0905	—	—	—	—	—	—	0.0	TOC	0.0	8.01	Start Pump
0910	0.3	0.20	6.36	-122	21.57	~~1169~~ 1168	1.5	TOC	0.0	8.04	Clear, no odor
0913	0.3	0.15	6.38	-128	21.79	1135	2.4	TOC	0.0	8.04	
0916	0.3	0.15	6.37	-131	21.79	1133	3.3	TOC	0.0	8.05	
0919	0.3	0.13	6.38	-134	21.74	1133	4.2	TOC	0.0	8.05	
0920	—	—	—	—	—	—	—	—	—	—	Collect Sample

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC

SAMPLE RATE

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
.2	.2	.2	.2	.2	.2	—	.2

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well:

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 20D.04

Temperature Meter YSI 556 Flow Cell — Serial Number 20D.04

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number 20D.04

ORP Meter YSI 556 Flow Cell — Serial Number 20D.04

D.O. Meter YSI 556 Flow Cell — Serial Number 20D.04

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000 07

Pump QED P1101M / QED Sample Pro — Serial Number —

Number of Bottles 17

Field Notebook #1

Sample Method Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Page 1 of 1

Date 5/6/10

Well Name MW-40-35

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/6/10

Sampling Personnel GB

Wendy Bryant

Sample ID 10-258

Duplicate ID

Screen Interval 35-55

Static Water Level (from TOC) / Time 9.21 / 1500

Reference Point TOC

PID Reading (TOC) 0.0

Immiscible Phases Present ☐ Yes ☒ No

Explosive Gas Reading 0.0 % LEL

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
1500	0.2	—	—	—	—	—	0.0	TOC	0.0	9.21	Start Purge
1505	0.2	0.06	7.08	-209	23.09	8250	1.0	TOC	0.0	9.23	slightly cloudy, sulfur odor, ~~clear~~
1510	0.2	0.06	7.08	-210	23.09	8240	2.0	TOC	0.0	9.24	no color
1515	0.2	0.06	7.08	-209	23.07	8240	3.0	TOC	0.0	9.24	
1520	0.2	0.06	7.08	-209	23.05	8250	4.0	TOC	0.0	9.24	
1522											Collect sample

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
SAMPLE RATE							
.2	—	—	.2	—	—	—	—

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well:

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 20D.04

Temperature Meter YSI 556 Flow Cell — Serial Number 20D.04

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number 20D.04

ORP Meter YSI 556 Flow Cell — Serial Number 20D.04

D.O. Meter YSI 556 Flow Cell — Serial Number 20D.04

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000.07

Pump QED P1101M / QED Sample Pro — Serial Number —

Number of Bottles 4

Field Notebook #1

Sample Method Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Page 1 of 1

Date 5/6/10

Well Name MW-40-36

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/6/10

Sampling Personnel GD

Wendy Bryant

Sample ID 10-259

Duplicate ID

Screen Interval 15-35

Static Water Level (from TOC) / Time 9.32 / 1541

Reference Point TOC

PID Reading (TOC) 0.0

Immiscible Phases Present ☐ Yes ☒ No

Explosive Gas Reading 0.0 % LEL

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
1541	—						0.0	TOC	0.0	9.32	Start Pump
1546	0.2	0.11	6.40	-196	23.16	2070	1.0	TOC	0.0	9.34	yellow-brown tint clear, bio odor
1549	0.2	0.10	6.39	-197	23.17	2080	1.6	TOC	0.0	9.35	
1552	0.2	0.08	6.39	-200	23.18	2080	2.2	TOC	0.0	9.35	
1555	0.2	0.08	6.38	-200	23.21	2080	2.8	TOC	0.0	9.35	
1556	—										Collect Sample

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
SAMPLE RATE							
.2	.2	—	.2	—	—	—	—

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well: OK

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 20D.04

Temperature Meter YSI 556 Flow Cell — Serial Number 20D.04

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number 20D.04

ORP Meter YSI 556 Flow Cell — Serial Number 20D.04

D.O. Meter YSI 556 Flow Cell — Serial Number 20D.04

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000.07

Pump QED P1101M / QED Sample Pro — Serial Number

Number of Bottles 7

Field Notebook #1

Sample Method Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Page 1 of 1

Date 5/6/10

Well Name MW-40-37

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/6/10

Sampling Personnel

Wendy Bryant / G. Bean

Sample ID 10-260

Duplicate ID —

Screen Interval 15 - 35

Immiscible Phases Present ☐ Yes ☒ No

Static Water Level (from TOC) / Time 8.79 / 0949

Reference Point TOC

PID Reading (TOC) 0.0

Explosive Gas Reading 0 % LEL

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
0950		~~0.0~~			~~22.75~~ 2		0.0	TOC	0.0	8.79	Start Pump
0955	0.4	0.41	6.49	-89	22.75	2510	2.0	TOC	0.0	8.76	Clear, no odor
1000	0.4	0.29	6.52	-85	23.18	2650	4.0	TOC	0.0	8.76	
1003	0.4	0.26	6.51	-84	23.19	2660	5.2	TOC	0.0	8.79	
1006	0.4	0.25	6.52	-84	23.21	2670	6.4	TOC	0.0	8.79	
1008	—								—	—	Collect Sample

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
.2	.2	.2	.2	.2 —	.2	—	.2

SAMPLE RATE

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well:

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 20D 104

Temperature Meter YSI 556 Flow Cell — Serial Number 20D.04

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number 20D-04

ORP Meter YSI 556 Flow Cell — Serial Number 20D-04

D.O. Meter YSI 556 Flow Cell — Serial Number 20D-04

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 200-487

Pump QED P1101M / QED Sample Pro — Serial Number —

Number of Bottles 17

Field Notebook #1

Sample Method Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Date 5/6/10

Well Name MW-40-39

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/6/10

Sampling Personnel [illegible]

Wendy Bryant

Screen Interval 20-30

Static Water Level (from TOC) / Time 8.80 / 1727

Reference Point TOC

PID Reading (TOC) 0.0

Immiscible Phases Present ☐ Yes ☒ No

Explosive Gas Reading 0.0 % LEL

Sample ID 10-263

Duplicate ID 10-264

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
1727	—				~~22.50~~ 22.50	~~2930~~	0.0	TOC	0.0	8.80	Start Pump
1732	0.2	0.59	7.08	-47	22.50	2930	1.0	TOC	0.0	8.83	clear, yellow tint
1735	0.2	0.21	7.08	-45	22.54	2860	1.6	TOC	0.0	8.83	
1738	0.2	0.21	7.08	-43	22.55	2860	2.2	TOC	0.0	8.83	
1741	0.2	0.19	7.07	-42	22.57	2860	2.8	TOC	0.0	8.84	
1742	—										collect sample
1747	—										collect Dup

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
SAMPLE RATE							
0.2	—	—	0.2	—	—	0.2	—

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well: OK

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 20D.04

Temperature Meter YSI 556 Flow Cell — Serial Number 20D.04

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number 20D.04

ORP Meter YSI 556 Flow Cell — Serial Number 20D.04

D.O. Meter YSI 556 Flow Cell — Serial Number 20D.04

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000.07

Pump QED P1101M / QED Sample Pro — Serial Number —

Number of Bottles 10

Field Notebook #1

Sample Method Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Page 1 of 1

Date 5/7/10

Well Name IW-1

Screen Interval 15-35

Immiscible Phases Present ☐ Yes ☒ No

Project: Seal Beach NWS

Project No. 3210.010E

Static Water Level (from TOC) / Time 9.59 / 0814

Well Location IRP Site 40

Sample Date 5/7/10

Reference Point TOC

Sampling Personnel GB

PID Reading (TOC) 0.0

Explosive Gas Reading 0.0 % LEL

Wendy Bryant

Sample ID 10-269

Duplicate ID ~~10-270~~ 63

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
0814	—	—	—	—	—	—	0.0	TOC	0.0	9.59	Start Pump
0819	0.2	1.00	6.49	-125	19.82	2060	1.0	TOC	0.0	9.60	clear
0822	0.2	0.70	6.43	-126	20.08	2070	1.6	TOC	0.0	9.60	
0825	0.2	0.40	6.40	-126	20.11	2060	2.2	TOC	0.0	9.60	
0828	0.2	0.38	6.40	-128	20.15	2070	2.8	TOC	0.0	9.60	
0831	0.2	0.37	6.40	-129	20.15	2070	3.4	TOC	0.0	9.60	
0832	—	—	—	—	—	—	—	—	—	Collect Sample	

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
SAMPLE RATE							
0.2	—	0.2	0.2	—	—	0.2	0.2

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well: OK

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 20D.04

Temperature Meter YSI 556 Flow Cell — Serial Number 20D.04

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number 20D.04

ORP Meter YSI 556 Flow Cell — Serial Number 20D.04

D.O. Meter YSI 556 Flow Cell — Serial Number 20D.04

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number ~~20D.04~~ 2000 04

Pump QED P1101M / QED Sample Pro — Serial Number —

Number of Bottles 8

Field Notebook #1

Sample Method Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Page 1 of 1

Date 5/7/10

Well Name IW4

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/7/10

Sampling Personnel

Wendy Bryant

Sample ID 10-271

Duplicate ID

Screen Interval 15-35

Immiscible Phases Present ☐ Yes ☒ No

Static Water Level (from TOC) / Time 8.70 / 0859

Reference Point TOC

PID Reading (TOC) 0.0

Explosive Gas Reading 0.0 % LEL

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
0905	—						0.0	TOC	0.0	08.59	Start Pump
0910	0.2	0.90	6.55	-123	21.47	1329	1.0	TOC	0.0	08.69	gray tint, clear
0913	0.2	1.06	6.59	-135	21.33	1330	1.6	TOC	0.0	8.69	
0916	0.2	1.09	6.60	-141	21.32	1331	2.2	TOC	0.0	8.69	
0919	0.2	1.12	6.61	-151	21.29	1330	2.8	TOC	0.0	8.69	
0922	0.2	1.14	6.61	-156	21.26	1331	3.4	TOC	0.0	8.69	
0923	—										Collect sample

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
SAMPLE RATE							
0.2	—	—	0.2	—	—	—	—

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well: ok

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 20D-04

Temperature Meter YSI 556 Flow Cell — Serial Number 20D-04

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number 20D-04

ORP Meter YSI 556 Flow Cell — Serial Number 20D-04

D.O. Meter YSI 556 Flow Cell — Serial Number 20D-04

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000-07

Pump QED P1101M / QED Sample Pro — Serial Number

Number of Bottles 4

Field Notebook #1

Sample Method

Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Page _____ of _____

Date 5/6/10

Well Name IW-6

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/6/10

Sampling Personnel GB

Wendy Bryant

Sample ID 10-272

Duplicate ID _____

Screen Interval 15-35

Immiscible Phases Present ☐ Yes ☒ No

Static Water Level (from TOC) / Time 9.22 / 1328

Reference Point TOC

PID Reading (TOC) 0.0 Explosive Gas Reading 0.0 % LEL

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
1328	0.2	—				—	0	TOC	0.0	9.22	Start Pump
1333	0.2	0.71	6.30	-116	22.44	2900	1.0	TOC	0.0	9.22	yellow tint, clear sulfur odor,
1336	0.2	0.52	6.30	-120	22.19	2940	1.6	TOC	0.0	9.22	black tint
1339	0.2	0.41	6.30	-142	22.00	2940	2.2	TOC	0.0	9.22	
1342	0.2	0.38	6.30	-145	21.95	2970	2.8	TOC	0.0	9.22	
1345	0.2	0.39	6.3	-148	22.05	2940	3.4	TOC	0.0	9.22	
1346	—	—	—	—	—	—	—	—	—	—	Collect Sample

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC

SAMPLE RATE

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
0.2	0.2	0.2	0.2	0.2	0.2	~~0.2~~	0.2

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well: _____

Remarks: _____

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 200.04

Temperature Meter YSI 556 Flow Cell — Serial Number _____

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number _____

ORP Meter YSI 556 Flow Cell — Serial Number _____

D.O. Meter YSI 556 Flow Cell — Serial Number _____

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000.07

Pump QED P1101M / QED Sample Pro — Serial Number MP10

Number of Bottles 17

Field Notebook #1

Sample Method Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Date 5/7/10

Well Name IW-12

Screen Interval 15-35

Immiscible Phases Present ☐ Yes ☒ No

Project: Seal Beach NWS

Project No. 3210.010E

Static Water Level (from TOC) / Time 8.56 / 1111

Well Location IRP Site 40

Sample Date 5/7/10

Reference Point TOC

Sampling Personnel CB

PID Reading (TOC) 0.0

Explosive Gas Reading 0.0 % LEL

Wendy Bryant

Sample ID 10-273

Duplicate ID

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
1111	—					—	0.0	TOC	0.0	8.56	Start Pump
1116	0.2	0.34	6.38	-233	22.22	1840	1.0	TOC	0.0	8.62	Dark gray slightly turbid
1119	0.2	0.21	6.37	-235	22.25	1830	1.6	TOC	0.0	8.63	
1122	0.2	0.21	6.37	-227	22.28	1830	2.2	TOC	0.0	8.63	
1125	0.2	0.19	6.36	-231	22.28	1830	2.8	TOC	0.0	8.63	
1126	—										Collect samples

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
SAMPLE RATE							
0.2	—	—	0.2	—	—	—	—

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well: OK

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 20D.04

Temperature Meter YSI 556 Flow Cell — Serial Number 20D.04

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number 20D.04

ORP Meter YSI 556 Flow Cell — Serial Number 20D.04

D.O. Meter YSI 556 Flow Cell — Serial Number 20D.04

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000.07

Pump QED P1101M / QED Sample Pro — Serial Number —

Number of Bottles 4

Field Notebook #1

Sample Method Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Page 1 of 1

Date 5/7/10

Well Name IW-14

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/7/10

Sampling Personnel CD

Wendy Bryant

Sample ID 10-274

Duplicate ID

Screen Interval 15-35

Static Water Level (from TOC) / Time 8.75 / 0942

Reference Point TOC

PID Reading (TOC) 0.0

Immiscible Phases Present ☐ Yes ☒ No

Explosive Gas Reading 0.0 % LEL

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
0942	—	—	—	—	—	—	0.0	TOC	0.0	8.75	Start Pump
0947	0.2	0.50	5.25	-129	22.86	2000	1.0	TOC	0.0	8.81	clear, yellow tint injectate order
0950	0.2	0.30	5.23	-131	22.93	1990	1.6	TOC	0.0	8.82	
0953	0.2	0.27	5.21	-132	22.98	1990	2.2	TOC	0.0	8.82	
0956	0.2	0.26	5.22	-134	23.01	1990	2.8	TOC	0.0	8.82	
0959	0.2	0.25	5.21	-135	23.03	1990	3.4	TOC	0.0	8.82	
1000	—	—	—	—	—	—	—	—	—	—	Collect Sample

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
SAMPLE RATE							
0.2	–	–	0.2	–	–	–	–

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well: OK

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 20D.04

Temperature Meter YSI 556 Flow Cell — Serial Number 20D.04

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number 20D.04

ORP Meter YSI 556 Flow Cell — Serial Number 20D.04

D.O. Meter YSI 556 Flow Cell — Serial Number 20D.04

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000.07

Pump QED P1101M / QED Sample Pro — Serial Number —

Number of Bottles 4

Field Notebook #1

Sample Method Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

TETRA TECH EC, INC.

LOW-FLOW GROUNDWATER SAMPLING DATA SHEET

Page 1 of 1

Date 5/7/10

Well Name IW-16

Project: Seal Beach NWS

Project No. 3210.010E

Well Location IRP Site 40

Sample Date 5/7/10

Sampling Personnel GB

Wendy Bryant

Screen Interval 15-35

Static Water Level (from TOC) / Time 8.40 / 1023

Reference Point TOC

PID Reading (TOC) 0.0

Explosive Gas Reading 0.0 % LEL

Immiscible Phases Present ☐ Yes ☒ No

Sample ID 10-275

Duplicate ID 10-276

PURGING

Time	Discharge Rate[1] (L/min)	+- 10% Dissolved Oxygen (mg/L)	+-0.5 pH	+- 10% Eh/ORP (mV)	+- 10% Temp. (°C)	+- 10% Specific Conduct. (µmhos/cm at °C)	Cumulative Volume of Water Removed/Purged (Liters)	PID/OVA Reading Location	PID/OVA Reading Value	Depth to Water[2] (ft)	Comments
1024	—					—	0.0	TOC	0.0	8.40	Start Pump
1029	0.2	0.82	6.78	-238	20.55	1400	1.0	TOC	0.0	8.42	clear, gray tint
1034	0.2	0.50	6.81	-250	20.60	1400	2.0	TOC	0.0	8.43	
1037	0.2	0.40	6.83	-254	20.61	1402	2.6	TOC	0.0	8.43	
1040	0.2	0.39	6.84	-257	20.64	1402	3.2	TOC	0.0	8.43	
1043	0.2	0.37	6.84	-259	20.70	1402	3.8	TOC	0.0	8.43	
1044	—									—	Collect Sample
1045	—									—	Collect Duplicate Sample

Notes:
1. Purge rate = 0.2 - 0.5 L/minute
2. Drawdown shall be <0.33 foot

SAMPLE PARAMETERS

VOCs	RSK 175	ALK / Anions	COD	DNA / VFAs / PLFAs	Metals	TDS	TOC
SAMPLE RATE							
0.2	–	–	0.2	–	–	–	–

Notes:
1. Sample rate for VOCs analysis = 0.1 - 0.2 L/minute
2. Sample rate for non-VOCs analysis = purge rate = 0.2 - 0.5 L/minute

Condition of Well: OK

Remarks:

FIELD EQUIPMENT

pH Meter YSI 556 Flow Cell — Serial Number 20D.04

Temperature Meter YSI 556 Flow Cell — Serial Number 20D.04

Turbidity Meter NA — Serial Number NA

Spec. Elec. Cond. Meter YSI 556 Flow Cell — Serial Number 20D.04

ORP Meter YSI 556 Flow Cell — Serial Number 20D.04

D.O. Meter YSI 556 Flow Cell — Serial Number 20D.04

Interface Probe NA — Serial Number NA

PID/OVA MiniRAE 2000 — Serial Number 2000.07

Pump QED P1101M / QED Sample Pro — Serial Number —

Number of Bottles 8

Field Notebook #1

Sample Method Low-Flow

Discharge Water Containerized ☒ Yes ☐ No

EQUIPMENT / INSTRUMENT CALIBRATION AND MAINTENANCE FORM

INSTRUMENT (NAME/ MODEL NO./ SERIAL): MiniRAE 2000.70

MANUFACTURER: RAE

DATE PURCHASED OR LEASED: May 3, 2010

CALIBRATION LOGSHEET

CALIBRATION DATE	INITIAL SETTINGS	STANDARD(S) USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
5/4/10	84.5	Isobutylene - VOC - 100ppm	Calibration	Yes	100	WZ	
	—	Fresh Air - VOC - 0ppm	Calibration	↓	0	WZ	

MAINTENANCE LOGSHEET

CALIBRATION DATE	REASON FOR MAINENANCE	MAINTENANCE PERFORMED	SIGNATURE	COMMENTS

PROJECT: NWS Seal Beach

EQUIPMENT / INSTRUMENT CALIBRATION AND MAINTENANCE FORM

INSTRUMENT (NAME/ MODEL NO./ SERIAL): GEM 2000 / GEM 2000.07

MANUFACTURER: LANDTEC

DATE PURCHASED OR LEASED: May 3, 2010

CALIBRATION LOGSHEET

CALIBRATION DATE	INITIAL SETTINGS	STANDARD(S) USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
5/4/10	38	CO_2 - 35%	Calibration	yes	35%	[illegible]	
	51	CH_4 - 50%	Calibration		50%	[illegible]	
	26	H_2S - 25ppm	Calibration		25	[illegible]	
	48	CO - 50ppm	Calibration		50	[illegible]	
	31	LEL - 40%	Calibration		40	[illegible]	
✓	21.4	Oxygen - 20.9%	Calibration	✓	20.9	[illegible]	

MAINTENANCE LOGSHEET

CALIBRATION DATE	REASON FOR MAINENANCE	MAINTENANCE PERFORMED	SIGNATURE	COMMENTS

PROJECT: NWS Seal Beach

EQUIPMENT / INSTRUMENT CALIBRATION AND MAINTENANCE FORM

INSTRUMENT (NAME/ MODEL NO./ SERIAL): MiniRAE 2000.70

MANUFACTURER: RAE

DATE PURCHASED OR LEASED: May 3, 2010

CALIBRATION LOGSHEET

CALIBRATION DATE	INITIAL SETTINGS	STANDARD(S) USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
5/6/10	97.4	Isobutylene - VOC - 100ppm	Calibration	yes	100	CWB	
	—	Fresh Air - VOC - 0ppm	Calibration	x	0	CWB	

MAINTENANCE LOGSHEET

CALIBRATION DATE	REASON FOR MAINENANCE	MAINTENANCE PERFORMED	SIGNATURE	COMMENTS

PROJECT: NWS Seal Beach

EQUIPMENT / INSTRUMENT CALIBRATION AND MAINTENANCE FORM

INSTRUMENT (NAME/ MODEL NO./ SERIAL): GEM 2000 / GEM 2000.07

MANUFACTURER: LANDTEC

DATE PURCHASED OR LEASED: May 3, 2010

CALIBRATION LOGSHEET

CALIBRATION DATE	INITIAL SETTINGS	STANDARD(S) USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
5/6/10	29	CO_2 - 35%	Calibration	yes	35	[illegible]	
	47	CH_4 - 50%	Calibration		50	[illegible]	
	27	H_2S - 25ppm	Calibration		25	[illegible]	
	43	CO - 50ppm	Calibration		50	[illegible]	
	31	LEL - 40%	Calibration		40	[illegible]	
	20.4	Oxygen - 20.9%	Calibration		20.8	[illegible]	

MAINTENANCE LOGSHEET

CALIBRATION DATE	REASON FOR MAINENANCE	MAINTENANCE PERFORMED	SIGNATURE	COMMENTS

PROJECT: NWS Seal Beach

EQUIPMENT / INSTRUMENT CALIBRATION AND MAINTENANCE FORM

INSTRUMENT (NAME/ MODEL NO./ SERIAL): QED MP-20 / MP20D.04

MANUFACTURER: QED

DATE PURCHASED OR LEASED: May 3, 2010

CALIBRATION LOGSHEET

CALIBRATION DATE	INITIAL SETTINGS	STANDARD(S) USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
5/6/10	3.74	pH 4	Calibration	~~3.99~~	3.99	CWS	
	6.41	pH 7	Calibration		6.97	CWS	
	9.36	pH 10	Calibration		9.93	CWS	
	248.9	ORP - 237.5	Calibration		238.4	CWS	
	972	Conductivity 1000 µS/cm	Calibration		1000	CWS	

MAINTENANCE LOGSHEET

CALIBRATION DATE	REASON FOR MAINENANCE	MAINTENANCE PERFORMED	SIGNATURE	COMMENTS

PROJECT: NWS Seal Beach

EQUIPMENT / INSTRUMENT CALIBRATION AND MAINTENANCE FORM

INSTRUMENT (NAME/ MODEL NO./ SERIAL): MiniRAE 2000.70

MANUFACTURER: RAE

DATE PURCHASED OR LEASED: May 3, 2010

CALIBRATION LOGSHEET

CALIBRATION DATE	INITIAL SETTINGS	STANDARD(S) USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
5/7/10	81.4	Isobutylene - VOC - 100ppm	Calibration	yes	100	UB	
	—	Fresh Air - VOC - 0ppm	Calibration	↓	0	UB	

MAINTENANCE LOGSHEET

CALIBRATION DATE	REASON FOR MAINENANCE	MAINTENANCE PERFORMED	SIGNATURE	COMMENTS

PROJECT: NWS Seal Beach

EQUIPMENT / INSTRUMENT CALIBRATION AND MAINTENANCE FORM

INSTRUMENT (NAME/ MODEL NO./ SERIAL): GEM 2000 / GEM 2000.07

MANUFACTURER: LANDTEC

DATE PURCHASED OR LEASED: May 3, 2010

CALIBRATION LOGSHEET

CALIBRATION DATE	INITIAL SETTINGS	STANDARD(S) USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
5/7/10	31	CO_2 - 35%	Calibration	yes	35	[illegible]	
	49	CH_4 - 50%	Calibration		50	[illegible]	
	23	H_2S - 25ppm	Calibration		25	[illegible]	
	47	CO - 50ppm	Calibration		50	[illegible]	
	43	LEL - 40%	Calibration		40	[illegible]	
	21.7	Oxygen - 20.9%	Calibration		20.9	[illegible]	

MAINTENANCE LOGSHEET

CALIBRATION DATE	REASON FOR MAINENANCE	MAINTENANCE PERFORMED	SIGNATURE	COMMENTS

PROJECT: NWS Seal Beach

EQUIPMENT / INSTRUMENT CALIBRATION AND MAINTENANCE FORM

INSTRUMENT (NAME/ MODEL NO./ SERIAL): QED MP-20 / MP20D.04

MANUFACTURER: QED

DATE PURCHASED OR LEASED: May 3, 2010

CALIBRATION LOGSHEET

CALIBRATION DATE	INITIAL SETTINGS	STANDARD(S) USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
5/7/10	3.94	pH 4	Calibration	yes	3.98	WB	
	7.12	pH 7	Calibration		7.02	WB	
	10.14	pH 10	Calibration		10.01	WB	
	247.3	ORP - 237.5	Calibration		237.4	WB	
	994	Conductivity 1000 µS/cm	Calibration		1000	WB	

MAINTENANCE LOGSHEET

CALIBRATION DATE	REASON FOR MAINENANCE	MAINTENANCE PERFORMED	SIGNATURE	COMMENTS

PROJECT: NWS Seal Beach

APPENDIX E

SOIL GAS MONITORING RESULTS

(ON CD ONLY)

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Soil Vapor/Gas Monitoring
11/01/2005

Date: November 1, 2005 Technician: Nicholas Wienberger Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Time	Methane (%LEL)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (%)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet bgs)	Well Depth (feet bgs)
VW-40-01	0713	72.8	0.1	0	28.5	NA		2	7.5	8
VW-40-02	0711	67.9	0	0	33.1	NA		2	7.5	8
VW-40-03	0740	71.6	0	0	28.2	NA		2	10.0	10.0
VW-40-04	0809	0	20.1	0	0.7	NA		2	10.0	10.0
VW-40-05	0807	0.1	17.2	0	1.7	NA		2	10.0	10.0
VW-40-06	0812	88.9	0	0	8.5	NA		2	10.0	10.0
IW-1	0705	63.8	0.00	0	24.3	NA		0.5	10.0	10.0
IW-2	0753	54.4	0.10	0	29.8	NA		0.5	10.0	10.0
IW-3	0751	82.3	0.00	0	5.1	NA		0.5	10.0	10.0
IW-4	0757	42	0.00	0	4.2	NA		0.5	10.0	10.0
IW-5	There is no probe in this well, which is the former Pilot Test well MW-40-27									
IW-6	0741	62.2	0.00	0	36.5	NA		0.5	10.0	10.0
IW-7	0743	89.3	0.00	0	8.5	NA		0.5	10.0	10.0
IW-8	0825	62.1	0.10	0	36.1	NA		0.5	10.0	10.0
IW-9	0800	74.7	0.00	0	3.8	NA		0.5	10.0	10.0
IW-10	0805	80.3	0.00	0	16.1	NA		0.5	10.0	10.0
IW-11	0724	84.9	0.00	0	14.3	NA		0.5	10.0	10.0
IW-12	0726	90.2	0.00	0	9.5	NA		0.5	10.0	10.0
IW-13	0748	11.8	17.30	0	3.4	NA		0.5	10.0	10.0
IW-14	0823	91.4	0.00	0	5.7	NA		0.5	10.0	10.0
IW-15	0829	71.1	0.00	0	26.1	NA		0.5	10.0	10.0
IW-16	0729	0	12.80	0	9.2	NA		0.5	10.0	10.0
IW-17	0737	90.1	0.00	0	3.5	NA		0.5	10.0	10.0
MW-40-30	Full of water									
MW-40-31	Full of water									
MW-40-32	0802	88.9	0.00	0	10.1	NA		0.5	10.0	10.0
MW-40-33	0728	0.2	13.60	0	0.7	NA		0.5	10.0	10.0
MW-40-34	0735	77.8	0.00	0	8.4	NA		0.5	10.0	10.0
MW-40-35	0745	84.4	0.00	0	7.5	NA		0.5	10.0	10.0
MW-40-36	0819	84.8	0.00	0	6.2	NA		0.5	10.0	10.0
MW-40-37	0839	84.9	0.00	0	10.7	NA		0.5	10.0	10.0
MW-40-38	0755	0.1	9.20	0	1.7	NA		0.5	10.0	10.0
MW-40-39	0931	0	16.20	2	1.6	NA		0.5	10.0	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
01/06/2006

Date: January 6, 2006 Technician: Nicholas Weinberger Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Date and Time	Methane (%LEL)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet bgs)	Well Depth (feet bgs)
VW-40-01	1428	66.5	0.2	NA	28.5	15	17.1	---	2	7.5	8
VW-40-02	1432	64.5	0.2	NA	30.4	16	8.9	---	2	7.5	8
VW-40-03	1438	67.6	0.2	NA	26.5	18	80	---	2	10.0	10.0
VW-40-04	1632	0	16.5	NA	0.4	0	4.2	---	2	10.0	10.0
VW-40-05	1624	0	14.5	NA	2	3	5.8	---	2	10.0	10.0
VW-40-06	1618	84.5	0	NA	9.2	14	0	---	2	10.0	10.0
IW-1	1421	67.3	0.2	NA	25.4	11	0	---	0.5	10.0	10.0
IW-2	1713	52.6	0.1	NA	20.5	0	0	---	0.5	10.0	10.0
IW-3	1655	86.4	0	NA	6.6	12	0	---	0.5	10.0	10.0
IW-4	1700	77.6	0.1	NA	8.9	6	0	---	0.5	10.0	10.0
IW-5	There is no probe in this well, which is the former Pilot Test well MW-40-27										
IW-6	1458	57.6	0.1	NA	39.1	25	31.6	---	0.5	10.0	10.0
IW-7	1508	77.4	0.7	NA	14.4	34	152	---	0.5	10.0	10.0
IW-8	1721	62.2	0	NA	34.1	21	0	---	0.5	10.0	10.0
IW-9	1644	85.6	0.1	NA	3.6	7	0	---	0.5	10.0	10.0
IW-10	1635	65.1	0.2	NA	16.6	7	0	---	0.5	10.0	10.0
IW-11	1521	75.4	0.1	NA	18.6	10	0	---	0.5	10.0	10.0
IW-12	1534	72.3	0	NA	22	18	0	---	0.5	10.0	10.0
IW-13	1519	15.5	17.3	NA	2.9	14	0	---	0.5	10.0	10.0
IW-14	1556	80.7	0.2	NA	12.9	25	0	---	0.5	10.0	10.0
IW-15	1559	68.5	0.1	NA	26	23	0	---	0.5	10.0	10.0
IW-16	1541	81	0.2	NA	2.3	10	0	---	0.5	10.0	10.0
IW-17	1553	88.7	0.1	NA	1.7	8	0	---	0.5	10.0	10.0
MW-40-30	Full of water										
MW-40-31	Full of water										
MW-40-32	1639	83.4	0	NA	10.7	7	0	---	0.5	10.0	10.0
MW-40-33	1526	0	18.5	NA	0.2	4	8.5	---	0.5	10.0	10.0
MW-40-34	1550	87	0	NA	6.5	6	0	---	0.5	10.0	10.0
MW-40-35	1516	67.9	0	NA	27	11	0	---	0.5	10.0	10.0
MW-40-36	1613	78.8	0	NA	12.7	12	0	---	0.5	10.0	10.0
MW-40-37	1601	81.8	0.1	NA	9.6	20	0	---	0.5	10.0	10.0
MW-40-38	1704	10.3	0.2	NA	2	0	0	---	0.5	10.0	10.0
MW-40-39	1607	0	15.4	NA	1.8	7	5.8	---	0.5	10.0	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
01/24/2006

Date: January 24, 2006 Technician: Nicholas Weinberger Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Date and Time	Methane (%LEL)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet bgs)	Well Depth (feet bgs)
VW-40-01	0735	75.2	0.2	0	25.7	12	NA	---	2	7.5	8
VW-40-02	0738	72.8	0.3	0	26.7	16	NA	---	2	7.5	8
VW-40-03	0743	74.7	0.1	0	24	17	NA	---	2	10.0	10.0
VW-40-04	0941	0	15.1	0	0.6	0	NA	---	2	10.0	10.0
VW-40-05	0930	0	16.8	0	0.7	0	NA	---	2	10.0	10.0
VW-40-06	0920	91.4	0	0	8.3	15	NA	---	2	10.0	10.0
IW-1	0730	76.2	0.1	0	22.4	17	NA	---	0.5	10.0	10.0
IW-2	1026	75.7	0	0	17.8	18	NA	---	0.5	10.0	10.0
IW-3	1002	92.5	0	0	6.5	34	NA	---	0.5	10.0	10.0
IW-4	1007	84.3	0	0	7.5	19	NA	---	0.5	10.0	10.0
IW-5	There is no probe in this well, which is the former Pilot Test well MW-40-27										
IW-6	0748	62.8	0.2	0	33.9	24	NA	---	0.5	10.0	10.0
IW-7	0755	86.4	0.1	0	12.8	50	NA	---	0.5	10.0	10.0
IW-8	0957	66.9	0.1	0	28.2	28	NA	---	0.5	10.0	10.0
IW-9	0951	92.3	0.2	0	3.3	14	NA	---	0.5	10.0	10.0
IW-10	0942	70.9	0.1	0	14	15	NA	---	0.5	10.0	10.0
IW-11	0817	83.7	0.2	0	15.9	13	NA	---	0.5	10.0	10.0
IW-12	0822	78.8	0.1	0	20.7	21	NA	---	0.5	10.0	10.0
IW-13	0807	71.2	3.1	0	13.7	66	NA	---	0.5	10.0	10.0
IW-14	0907	87.8	0.1	0	12.1	33	NA	---	0.5	10.0	10.0
IW-15	0902	78.2	0.1	0	20.6	26	NA	---	0.5	10.0	10.0
IW-16	0835	90.6	0.1	0	2.3	16	NA	---	0.5	10.0	10.0
IW-17	0842	98.2	0.1	0	1.3	14	NA	---	0.5	10.0	10.0
MW-40-30	Full of water										
MW-40-31	Full of water										
MW-40-32	0947	89.9	0	0	9.5	15	NA	---	0.5	10.0	10.0
MW-40-33	0830	0	17.2	0	0.3	10	NA	---	0.5	10.0	10.0
MW-40-34	0839	93.7	0.1	0	6.1	18	NA	---	0.5	10.0	10.0
MW-40-35	0800	76	0.1	0	23.2	18	NA	---	0.5	10.0	10.0
MW-40-36	0912	85.5	0.1	0	11.7	25	NA	---	0.5	10.0	10.0
MW-40-37	0855	88.5	0.1	0	9.1	21	NA	---	0.5	10.0	10.0
MW-40-38	1020	13.6	0.5	0	1.2	13	NA	---	0.5	10.0	10.0
MW-40-39	0849	0	14.2	0	1.7	0	NA	---	0.5	10.0	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
02/24/2006

Date: February 24, 2006 Technician: Nicholas Weinberger Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Time	Methane (%)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (%)	Carbon Monoxide (%)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet	Well Depth (feet bgs)
VW-40-01	0923	75.3	0.2	0	24.1	0	0	---	2	2.5 to 7.5	8
VW-40-02	0928	73.8	0.3	1	25.1	0	0	---	2	2.5 to 7.5	8
VW-40-03	0934	75	0.2	0	23.7	0	0	---	2	3.5 to 10	10.0
VW-40-04	1135	0	18.8	0	0.1	0	7.1	---	2	3.5 to 10	10.0
VW-40-05	1140	0	18	0	0.3	0	6.3	---	2	3.5 to 10	10.0
VW-40-06	1110	90	0.2	7	8.5	0	15.1	---	2	3.5 to 10	10.0
IW-1	0917	76.7	0.6	17	21.9	0	12.7	---	0.5	3.5 to 10	10.0
IW-2	1219	73.7	0.3	14	16.1	0	10.2	---	0.5	3.5 to 10	10.0
IW-3	1202	88.5	0	11	8.5	0	47.6	---	0.5	3.5 to 10	10.0
IW-4	1208	87.6	0.1	18	5.7	0	13.6	---	0.5	3.5 to 10	10.0
IW-5	There is no probe in this well, which is the former Pilot Test well MW-40-27										
IW-6	0938	65.9	0.4	4	30.5	0	7.7	---	0.5	3.5 to 10	10.0
IW-7	0944	87.2	0.7	15	12.9	0	0	---	0.5	3.5 to 10	10.0
IW-8	1130	71.7	0	13	23.4	0	17.1	---	0.5	3.5 to 10	10.0
IW-9	1155	84.2	0.1	26	2.1	0	24.7	---	0.5	3.5 to 10	10.0
IW-10	1145	73	0	3	12.2	0	12.2	---	0.5	3.5 to 10	10.0
IW-11	0959	81.3	0.6	3	17.3	0	41	---	0.5	3.5 to 10	10.0
IW-12	1004	76.9	0.2	13	20.2	0	54.3	---	0.5	3.5 to 10	10.0
IW-13	0954	83.4	0.5	20	16.3	0	87.3	---	0.5	3.5 to 10	10.0
IW-14	1116	83.3	0.1	3	14.6	0	26.3	---	0.5	3.5 to 10	10.0
IW-15	1102	79.5	0.1	10	17.3	0	16.2	---	0.5	3.5 to 10	10.0
IW-16	1015	80.5	0.4	6	6.7	0	10.1	---	0.5	3.5 to 10	10.0
IW-17	1032	96.1	0.2	0	2	0	8.2	---	0.5	3.5 to 10	10.0
MW-40-30	NA	NA	NA	NA	NA	NA	NA	WATER	0.5	3.5 to 10	10.0
MW-40-31	NA	NA	NA	NA	NA	NA	NA	WATER	0.5	3.5 to 10	10.0
MW-40-32	1150	87.9	0.1	0	10.6	0	21.6	---	0.5	3.5 to 10	10.0
MW-40-33	1009	0	15..9	0	0.2	0	22	---	0.5	3.5 to 10	10.0
MW-40-34	1024	90.7	0.0	0	8.2	0	6.3	---	0.5	3.5 to 10	10.0
MW-40-35	0949	74.1	0.3	0	23.2	0	0	---	0.5	3.5 to 10	10.0
MW-40-36	1123	80.8	0.1	1	14.1	0	27.2	---	0.5	3.5 to 10	10.0
MW-40-37	1055	88.9	0.3	3	9.1	0	6.4	---	0.5	3.5 to 10	10.0
MW-40-38	1213	22.7	0.2	0	1.6	0	8.6	---	0.5	3.5 to 10	10.0
MW-40-39	1039	0	12.4	0	2	0	24.3	---	0.5	3.5 to 10	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
03/15/2006

Date: March 15, 2006 Technician: Nicholas Weinberger Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Time	Methane (%)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (%)	Carbon Monoxide (ppm)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet	Well Depth (feet bgs)
VW-40-01	1427	74.3	0.3	0	23.1	0	22.8	---	2	2.5 to 7.5	8
VW-40-02	1434	71	0.1	2	24.1	0	19.6	---	2	2.5 to 7.5	8
VW-40-03	1228	72.5	0	0	22.7	0	14.9	---	2	3.5 to 10	10.0
VW-40-04	1328	0	11.1	0	0.8	0	9.9	---	2	3.5 to 10	10.0
VW-40-05	1320	0	12.5	0	2.3	0	12.1	---	2	3.5 to 10	10.0
VW-40-06	1207	90.7	0.1	7	8.6	0	33.7	---	2	3.5 to 10	10.0
IW-1	1045	46	3.5	0	13.4	0	0	---	0.5	3.5 to 10	10.0
IW-2	1419	78.6	0.2	15	13.3	0	7.6	---	0.5	3.5 to 10	10.0
IW-3	1357	87.6	0.1	19	10	0	12.4	---	0.5	3.5 to 10	10.0
IW-4	1464	85.5	0.1	21	5.2	0	9.9	---	0.5	3.5 to 10	10.0
IW-5	There is no probe in this well, which is the former Pilot Test well MW-40-27										
IW-6	1235	63.9	0.1	1	29.6	0	26.5	---	0.5	3.5 to 10	10.0
IW-7	1242	83.8	0.1	6	13.4	0	37.4	---	0.5	3.5 to 10	10.0
IW-8	1310	72.9	0.3	12	22	0	18.6	---	0.5	3.5 to 10	10.0
IW-9	1350	87.4	0.1	4	1.3	0	14.6	---	0.5	3.5 to 10	10.0
IW-10	1336	74.7	0	4	11.1	0	17.2	---	0.5	3.5 to 10	10.0
IW-11	1052	81.8	0.1	5	16.4	0	0	---	0.5	3.5 to 10	10.0
IW-12	1059	78.1	0.1	10	18.9	0	1.1	---	0.5	3.5 to 10	10.0
IW-13	1221	15.1	13.9	1	3	0	37.5	---	0.5	3.5 to 10	10.0
IW-14	1214	80.4	0	3	15.8	0	21.7	---	0.5	3.5 to 10	10.0
IW-15	1159	78.9	0.1	12	18	0	26.1	---	0.5	3.5 to 10	10.0
IW-16	1124	88.9	0.5	4	7	0	11.8	---	0.5	3.5 to 10	10.0
IW-17	1133	96.4	0.1	2	2	0	0	---	0.5	3.5 to 10	10.0
MW-40-30	NA	NA	NA	NA	NA	NA	NA		0.5	3.5 to 10	10.0
MW-40-31	NA	NA	NA	NA	NA	NA	NA		0.5	3.5 to 10	10.0
MW-40-32	1343	88.8	0.0	0	9.6	0	16.7	---	0.5	3.5 to 10	10.0
MW-40-33	1107	0	16.4	0	0.1	0	5.7	---	0.5	3.5 to 10	10.0
MW-40-34	1116	90.7	0.1	0	8.7	0	0	---	0.5	3.5 to 10	10.0
MW-40-35	1250	71.1	0.1	0	23.1	0	312	---	0.5	3.5 to 10	10.0
MW-40-36	1258	79.1	0.0	1	14.6	0	26.6	---	0.5	3.5 to 10	10.0
MW-40-37	1152	88	0.2	4	9	0	13.7	---	0.5	3.5 to 10	10.0
MW-40-38	1411	30.6	0.1	1	1.5	0	14.2	---	0.5	3.5 to 10	10.0
MW-40-39	1143	0.4	12.7	0	2	0	8.7	---	0.5	3.5 to 10	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
07/18/2006

Date: July 18, 2006 Technician: Nicholas Weinberger Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Time	Methane (%)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (%)	Carbon Monoxide (ppm)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet	Well Depth (feet bgs)
VW-40-01	0944	73.1	0.3	1	24.2	14	0	---	2	2.5 to 7.5	8
VW-40-02	0946	74.1	1	37	24.6	17	0	---	2	2.5 to 7.5	8
VW-40-03	0951	72	0	1	23.8	0	0	---	2	3.5 to 10	10.0
VW-40-04	1102	0	19.2	0	0.2	0	4.2	---	2	3.5 to 10	10.0
VW-40-05	1107	0	17.8	0	0.2	0	1.1	---	2	3.5 to 10	10.0
VW-40-06	1017	82.9	0	10	12	3	0	---	2	3.5 to 10	10.0
IW-1	0940	71.9	0.5	26	21.1	18	0	---	0.5	3.5 to 10	10.0
IW-2	1042	71.1	0	16	16.2	0	0	---	0.5	3.5 to 10	10.0
IW-3	1022	78.4	0	37	16.1	21	0	---	0.5	3.5 to 10	10.0
IW-4	1047	85.7	0	55	7.4	7	0	---	0.5	3.5 to 10	10.0
IW-5	There is no probe in this well, which is the former Pilot Test well MW-40-27										
IW-6	1040	65	0	1	27.3	39	0	---	0.5	3.5 to 10	10.0
IW-7	1154	76.8	0.3	4	20.7	15	0	---	0.5	3.5 to 10	10.0
IW-8	1020	75.4	0	26	19	26	0	---	0.5	3.5 to 10	10.0
IW-9	1053	81.3	0	34	17.4	15	0	---	0.5	3.5 to 10	10.0
IW-10	1058	83.7	0	22	16	24	0	---	0.5	3.5 to 10	10.0
IW-11	1149	82.4	0.1	12	17.6	0	17.2	---	0.5	3.5 to 10	10.0
IW-12	1145	76.2	0	29	21.4	0	31	---	0.5	3.5 to 10	10.0
IW-13	1002	12.7	16.9	1	3.1	4	0	---	0.5	3.5 to 10	10.0
IW-14	1005	71.5	0	0	21.5	1	0	---	0.5	3.5 to 10	10.0
IW-15	1008	75.3	0	14	17.1	15	0	---	0.5	3.5 to 10	10.0
IW-16	1132	81.1	0	11	9.2	0	7	---	0.5	3.5 to 10	10.0
IW-17	1125	94.8	0.3	4	3	0	0	---	0.5	3.5 to 10	10.0
MW-40-30	1049	WATER PULLED IN TUBING							0.5	3.5 to 10	10.0
MW-40-31	1050	WATER PULLED IN TUBING							0.5	3.5 to 10	10.0
MW-40-32	1056	82.6	0.0	41	17	7	0	---	0.5	3.5 to 10	10.0
MW-40-33	1138	0.8	16.2.	0	10.3	2	27.2	---	0.5	3.5 to 10	10.0
MW-40-34	1128	91.6	0.0	0	8	0	4.1	---	0.5	3.5 to 10	10.0
MW-40-35	0958	71.5	0.0	1	22.6	2	0	---	0.5	3.5 to 10	10.0
MW-40-36	1113	69.6	0.0	2	22.1	8	0	---	0.5	3.5 to 10	10.0
MW-40-37	1010	70.8	1.4	1	12.3	8	0	---	0.5	3.5 to 10	10.0
MW-40-38	1045	66.3	0.0	1	2.6	0	0	---	0.5	3.5 to 10	10.0
MW-40-39	1120	0	0.0	1	3.1	0	0	---	0.5	3.5 to 10	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
09/14/2006

Date: September 14, 2006 Technician: Nicholas Weinberger Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Time	Methane (%)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (%)	Carbon Monoxide (ppm)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet	Well Depth (feet bgs)
VW-40-01	0954	73.1	0.5	1	23	13	0	---	2	2.5 to 7.5	8
VW-40-02	0946	75.2	1	36	24	16	0	---	2	2.5 to 7.5	8
VW-40-03	0951	72.3	0	1	22.9	0	0	---	2	3.5 to 10	10.0
VW-40-04	1102	0	18.2	0	0.2	0	4.7	---	2	3.5 to 10	10.0
VW-40-05	1107	0	16.6	0	0.1	0	1.3	---	2	3.5 to 10	10.0
VW-40-06	1017	80.9	0	9	13	4	0	---	2	3.5 to 10	10.0
IW-1	0940	70.9	0.5	27	22.1	17	0	---	0.5	3.5 to 10	10.0
IW-2	1042	71	0	14	16.2	0	0	---	0.5	3.5 to 10	10.0
IW-3	1022	77.4	0	32	16.6	21	0	---	0.5	3.5 to 10	10.0
IW-4	1047	84.7	0	45	8.1	8	0	---	0.5	3.5 to 10	10.0
IW-5	There is no probe in this well, which is the former Pilot Test well MW-40-27										
IW-6	1040	64.4	0	1	26.3	32	0	---	0.5	3.5 to 10	10.0
IW-7	1154	77.9	0.4	5	19.7	16	0	---	0.5	3.5 to 10	10.0
IW-8	1020	75.2	0	29	18	27	0	---	0.5	3.5 to 10	10.0
IW-9	1053	80.9	0	32	18.4	16	0	---	0.5	3.5 to 10	10.0
IW-10	1058	82.5	0	19	17.3	25	0	---	0.5	3.5 to 10	10.0
IW-11	1149	82	0.5	11	17.4	0	17.5	---	0.5	3.5 to 10	10.0
IW-12	1145	77.4	0	23	20.3	0	26	---	0.5	3.5 to 10	10.0
IW-13	1002	10.6	17.2	1	2.1	3	0	---	0.5	3.5 to 10	10.0
IW-14	1005	74.2	0	0	20.6	1	0	---	0.5	3.5 to 10	10.0
IW-15	1008	75.3	0	16	17.6	13	0	---	0.5	3.5 to 10	10.0
IW-16	1132	81.8	0	15	10.3	0	4	---	0.5	3.5 to 10	10.0
IW-17	1125	93.8	0.5	3	2	0	0	---	0.5	3.5 to 10	10.0
MW-40-30	1049	WATER IN PROBE							0.5	3.5 to 10	10.0
MW-40-31	1050	WATER IN PROBE							0.5	3.5 to 10	10.0
MW-40-32	1056	81.6	0.0	44	18	9	0	---	0.5	3.5 to 10	10.0
MW-40-33	1138	1.6	13.5	0	9.8	2	26.3	---	0.5	3.5 to 10	10.0
MW-40-34	1128	90.5	0.0	0	8.9	0	3.9	---	0.5	3.5 to 10	10.0
MW-40-35	0958	73.2	0.0	2	23	2	0	---	0.5	3.5 to 10	10.0
MW-40-36	1113	70.5	0.0	4	21.6	9	0	---	0.5	3.5 to 10	10.0
MW-40-37	1010	69.8	13.6	1	12.8	9	0	---	0.5	3.5 to 10	10.0
MW-40-38	1045	66.5	0.0	2	3	0	0	---	0.5	3.5 to 10	10.0
MW-40-39	1120	0	0.0	1	3.9	0	0	---	0.5	3.5 to 10	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
01/12/2007

Date: January 12, 2007 Technician: Nicholas Weinberger Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Time	Methane (%)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (%)	Carbon Monoxide (PPM)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet bgs)	Well Depth (feet bgs)
VW-40-01	735	72.6	1.1	0.0	20.8	0.0	0.0		2	2.5 to 7.5	8
VW-40-02	740	71.6	0.3	0.0	20.9	0.0	0.0		2	2.5 to 7.5	8
VW-40-03	745	69.4	0.2	0.0	22.9	0.0	0.0		2	3.5 to 10	10.0
VW-40-04	937	66.3	3.6	0.0	12.1	0.0	0.0		2	3.5 to 10	10.0
VW-40-05	941	59.7	4.2	0.0	11.0	0.0	0.0		2	3.5 to 10	10.0
VW-40-06	931	67.2	0.6	0.0	12.7	0.0	0.0		2	3.5 to 10	10.0
IW-1	728	69.7	1.4	0.0	17.3	0.0	0.0		0.5	3.5 to 10	10.0
IW-2	0921	66.1	1.5	0.0	13.7	0.0	0.0		0.5	3.5 to 10	10.0
IW-3	0858	71.7	0.2	4.0	19.6	0.0	0.0	Flooded	0.5	3.5 to 10	10.0
IW-4	0903	70.2	0.6	0.0	18.4	0.0	0.0		0.5	3.5 to 10	10.0
IW-5		No probe							0.5	3.5 to 10	10.0
IW-6	0750	65.3	1.3	0.0	25.8	0.0	0.0		0.5	3.5 to 10	10.0
IW-7	0754	74.8	0.5	3.0	16.6	0.0	0.0		0.5	3.5 to 10	10.0
IW-8	0858	69.7	0.3	2.0	15.2	0.0	0.0	Flooded	0.5	3.5 to 10	10.0
IW-9	0907	72.6	0.4	8.0	21.2	27.0	0.0		0.5	3.5 to 10	10.0
IW-10	0917	73.4	0.2	7.0	19.0	13.0	0.0		0.5	3.5 to 10	10.0
IW-11	0808	71.0	0.3	0.0	21.3	0.0	0.0		0.5	3.5 to 10	10.0
IW-12	0812	73.8	0.5	0.0	18.5	0.0	0.0		0.5	3.5 to 10	10.0
IW-13	0803	74.6	0.4	9.0	17.7	12.0	0.0		0.5	3.5 to 10	10.0
IW-14	0835	79.1	0.0	3.0	16.2	6.0	0.0	Flooded	0.5	3.5 to 10	10.0
IW-15	0841	82.2	0.0	2.0	17.1	9.0	0.0		0.5	3.5 to 10	10.0
IW-16	0821	60.3	0.7	0.0	11.1	0.0	0.0		0.5	3.5 to 10	10.0
IW-17	0829	71.1	0.2	0.0	16.3	0.0	0.0		0.5	3.5 to 10	10.0
MW-40-30		WATER IN PROBE							0.5	3.5 to 10	10.0
MW-40-31		WATER IN PROBE							0.5	3.5 to 10	10.0
MW-40-32	0912	71.8	0.3	4.0	22.3	14.0	0.0		0.5	3.5 to 10	10.0
MW-40-33	0817	0.0	2.1	0.0	4.1	0.0	0.0		0.5	3.5 to 10	10.0
MW-40-34	0825	74.8	0.6	0.0	16.5	0.0	0.0		0.5	3.5 to 10	10.0
MW-40-35	0759	68.0	1.5	12.0	25.0	10.0	0.0		0.5	3.5 to 10	10.0
MW-40-36	0845	69.1	1.2	6.0	19.6	6.0	0.0		0.5	3.5 to 10	10.0
MW-40-37	0853	66.3	2.4	0.0	10.7	0.0	0.0		0.5	3.5 to 10	10.0
MW-40-38	0925	64.2	3.7	0.0	12.6	0.0	0.0		0.5	3.5 to 10	10.0
MW-40-39	0947	0.0	14.1	0.0	2.1	0.0	0.0		0.5	3.5 to 10	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
04/05/2007

Date: April 05, 2007 Technician: Nicholas Weinberger Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Time	Methane (%)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (%)	Carbon Monoxide (ppm)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet	Well Depth (feet bgs)
VW-40-01	0805	78.2	0	0	20.8	0	43.6	---	2	2.5 to 7.5	8
VW-40-02	0823	74.1	0.9	0	19.6	0	0	---	2	2.5 to 7.5	8
VW-40-03	0845	76.5	0	0	22.1	0	0	---	2	3.5 to 10	10.0
VW-40-04	1020	69.9	0.6	0	20.9	0	0	---	2	3.5 to 10	10.0
VW-40-05	1027	65.6	0.4	0	24.1	0	0	---	2	3.5 to 10	10.0
VW-40-06	0938	28.8	7.5	0	9.3	0	16.8	---	2	3.5 to 10	10.0
IW-1	0742	71.6	0	0	19.8	0	19	---	0.5	3.5 to 10	10.0
IW-2	1057	63.1	1	0	20	0	0	---	0.5	3.5 to 10	10.0
IW-3	0956	84.8	0	0	15.2	0	0	---	0.5	3.5 to 10	10.0
IW-4	1052	74.6	0.3	0	19.6	0	0	---	0.5	3.5 to 10	10.0
IW-5	There is no probe in this well, which is the former Pilot Test well MW-40-27										
IW-6	1202	69.9	0.4	0	17.4	0	0	---	0.5	3.5 to 10	10.0
IW-7	0902	84.9	0	10	16	120	2.4	---	0.5	3.5 to 10	10.0
IW-8	1047	76.4	0.2	0	21.4	0	0	---	0.5	3.5 to 10	10.0
IW-9	1032	82.1	0	0	16	0	0	---	0.5	3.5 to 10	10.0
IW-10	1042	80.7	0	0	17.6	0	0	---	0.5	3.5 to 10	10.0
IW-11	1150	74.2	0.3	0	18.2	0	0	---	0.5	3.5 to 10	10.0
IW-12	1145	75.1	0.7	0	14.6	0	0	---	0.5	3.5 to 10	10.0
IW-13	1137	27.6	8.4	0	7.1	0	14.8	---	0.5	3.5 to 10	10.0
IW-14	1121	81.3	0	0	12.3	0	0	---	0.5	3.5 to 10	10.0
IW-15	1125	84.2	0	0	14.1	0	0	---	0.5	3.5 to 10	10.0
IW-16	1130	76.3	0	0	17.3	0	0	---	0.5	3.5 to 10	10.0
IW-17	1133	70.4	0.1	0	16.5	0	0	---	0.5	3.5 to 10	10.0
MW-40-30		WATER IN PROBE							0.5	3.5 to 10	10.0
MW-40-31		WATER IN PROBE							0.5	3.5 to 10	10.0
MW-40-32	1037	81.4	0.0	0	13.6	0	0	---	0.5	3.5 to 10	10.0
MW-40-33	1156	12.2	18.7	0	4.1	0	0	---	0.5	3.5 to 10	10.0
MW-40-34	0920	82.7	0.0	0	17.5	0	0	---	0.5	3.5 to 10	10.0
MW-40-35	1118	89.1	0.0	11	9.2	0	17.2	---	0.5	3.5 to 10	10.0
MW-40-36	1114	80.6	0.4	2	14.9	0	0	---	0.5	3.5 to 10	10.0
MW-40-37	1103	75.4	0.3	0	19.2	0	0	---	0.5	3.5 to 10	10.0
MW-40-38	1059	63.9	0.7	0	21.1	0	0	---	0.5	3.5 to 10	10.0
MW-40-39	1109	60.8	0.5	0	15.3	0	0	---	0.5	3.5 to 10	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
07/12/2007

Date: July 12, 2007 Technician: Nicholas Weinberger Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Time	Methane (%)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (%)	Carbon Monoxide (ppm)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet	Well Depth (feet bgs)
VW-40-01	0745	56.7	1.7	0	22	10	0	---	2	2.5 to 7.5	8
VW-40-02	0752	68.5	0	12	25.1	0	0	---	2	2.5 to 7.5	8
VW-40-03	0759	68.6	0	0	25.5	0	0	---	2	3.5 to 10	10.0
VW-40-04	1244	67	0	0	29.3	0	0	---	2	3.5 to 10	10.0
VW-40-05	1259	17.4	12.7	0	8.1	0	0	---	2	3.5 to 10	10.0
VW-40-06	1641	71.7	0	4	21	0	0	---	2	3.5 to 10	10.0
IW-1	0736	64.5	0	3	22	3	0	---	0.5	3.5 to 10	10.0
IW-2	1314	70.4	0	11	13.9	0	0	---	0.5	3.5 to 10	10.0
IW-3	1129	74.1	0	5	17	0	0	---	0.5	3.5 to 10	10.0
IW-4	1144	78.3	0	3	12.1	0	0	---	0.5	3.5 to 10	10.0
IW-5	There is no probe in this well, which is the former Pilot Test well MW-40-27										
IW-6	0808	69.4	1.2	0	23.7	0	0	---	0.5	3.5 to 10	10.0
IW-7	0818	76	0	7	18.5	3	0	---	0.5	3.5 to 10	10.0
IW-8	1114	58.9	0	7	33.7	1	0	---	0.5	3.5 to 10	10.0
IW-9	1159	71	0	1	16.8	0	0	---	0.5	3.5 to 10	10.0
IW-10	1229	71.1	0	4	27.2	0	0	---	0.5	3.5 to 10	10.0
IW-11	0851	71.4	0	1	21.9	0	0	---	0.5	3.5 to 10	10.0
IW-12	0100	73.7	0	0	19	0	0	---	0.5	3.5 to 10	10.0
IW-13	0840	87.4	0	0	15.6	0	0	---	0.5	3.5 to 10	10.0
IW-14	954	70.1	0	0	20.9	0	0	---	0.5	3.5 to 10	10.0
IW-15	1009	58.7	0	18	31.5	7	0	---	0.5	3.5 to 10	10.0
IW-16	0923	47.5	1	4	14.8	0	0	---	0.5	3.5 to 10	10.0
IW-17	0939	79.1	0	0	13.5	0	0	---	0.5	3.5 to 10	10.0
MW-40-30		WATER IN PROBE							0.5	3.5 to 10	10.0
MW-40-31		WATER IN PROBE							0.5	3.5 to 10	10.0
MW-40-32	1213	66.4	0.6	0	16.1	0	0	---	0.5	3.5 to 10	10.0
MW-40-33	0911	0.2	18.5	0	0.3	0	0	---	0.5	3.5 to 10	10.0
MW-40-34	0926	70.1	0.0	0	21.9	0	0	---	0.5	3.5 to 10	10.0
MW-40-35	0829	70.8	0.0	0	22.3	0	0	---	0.5	3.5 to 10	10.0
MW-40-36	1057	65.6	0.0	48	24.9	8	0	---	0.5	3.5 to 10	10.0
MW-40-37	1025	36.6	2.5	0	14.9	0	0	---	0.5	3.5 to 10	10.0
MW-40-38	1330	67.2	0.0	0	4.8	3	0	---	0.5	3.5 to 10	10.0
MW-40-39	1346	4.7	16.2	0	1.4	0	0	---	0.5	3.5 to 10	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
10/17/2007

Date: October 17, 2007 Technician: Nicholas Weinberger Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Time	Methane (%)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (%)	Carbon Monoxide (ppm)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet	Well Depth (feet bgs)
VW-40-01	0840	57.1	1.7	0	21.8	2	0	N/A	2	7.5	8
VW-40-02	0842	68.3	0	9	26.3	2	0	N/A	2	7.5	8
VW-40-03	0857	69.5	0	0	27.1	2		N/A	2	10.0	10.0
VW-40-04	1328	67.1	0	0	30.4	2	0	N/A	2	10.0	10.0
VW-40-05	1347	15.6	13.3	0	7.2	2	0	N/A	2	10.0	10.0
VW-40-06	1316	74.2	0	2	18.8	2	0	N/A	2	10.0	10.0
IW-1	0826	66.1	0	1	21.4	0.5	0	N/A	0.5	10.0	10.0
IW-2	1407	73.1	0	8	14.2	0.5	0	N/A	0.5	10.0	10.0
IW-3	1212	72.8	0	2	16.7	0.5	0	N/A	0.5	10.0	10.0
IW-4	1222	80.4	0	4	11.3	0.5	0	N/A	0.5	10.0	10.0
IW-5	1420- There is no probe in this well, which is the former Pilot Test well MW-40-27										
IW-6	1433	68.7	0.8	0	24	0	0	N/A	0.5	10.0	10.0
IW-7	1045	73.1	0	6	17.9	1	0	N/A	0.5	10.0	10.0
IW-8	1200	55.2	0	3	35.2	1	0	N/A	0.5	10.0	10.0
IW-9	1233	69	0	0	15.9	0	0	N/A	0.5	10.0	10.0
IW-10	1301	72.2	0	2	23.6	0	0	N/A	0.5	10.0	10.0
IW-11	0911	73.6	0	0	22.2	0	0	N/A	0.5	10.0	10.0
IW-12	0923	78.1	0	0	18.7	0	0	N/A	0.5	10.0	10.0
IW-13	1030	70.4	0	0	16.1	0	0	N/A	0.5	10.0	10.0
IW-14	1133	71.3	0	0	21.4	1	0	N/A	0.5	10.0	10.0
IW-15	1146	55.2	0	21	33	4	0	N/A	0.5	10.0	10.0
IW-16	1002	50.1	0.4	6	15.6	1	0	N/A	0.5	10.0	10.0
IW-17	1016	80.3	0	0	12.8	0	0	N/A	0.5	10.0	10.0
MW-40-30		WATER IN PROBE							0.5	10.0	10.0
MW-40-31		WATER IN PROBE							0.5	10.0	10.0
MW-40-32	1249	64.2	0.0	0	17.5	0	0	N/A	0.5	10.0	10.0
MW-40-33	0935	0.8	18.5	0	0.1	0	0	N/A	0.5	10.0	10.0
MW-40-34	0950	71.1	0.0	0	22.3	0	0	N/A	0.5	10.0	10.0
MW-40-35	1058	71.1	0.0	0	23.4	1	0	N/A	0.5	10.0	10.0
MW-40-36	1112	64.8	0.0	35	20.6	6	0	N/A	0.5	10.0	10.0
MW-40-37	1128	37.2	1.4	0	15.6	0	0	N/A	0.5	10.0	10.0
MW-40-38	1354	68.9	0.0	0	5.7	2	0	N/A	0.5	10.0	10.0
MW-40-39		3.8	17.4	0	1.6	0	0	N/A	0.5	10.0	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
01/18/2008

Date: January 18, 2008 Technician: Diane Suzuki/Wendy Bryant Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Time	Methane (%)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (%)	Carbon Monoxide (ppm)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet	Well Depth (feet bgs)
VW-40-01	0757	75.8	0.0	0	24.2	0	0.0	N/A	2	7.5	8
VW-40-02	0808	76.0	0.0	0	24.0	0	0.0	N/A	2	7.5	8
VW-40-03	0837	73.7	0.0	0	26.3	0	0.0	N/A	2	10.0	10.0
VW-40-04	1237	68.4	0.8	0	19.7	0	0.0	N/A	2	10.0	10.0
VW-40-05	Probe under vaccuum							N/A	2	10.0	10.0
VW-40-06	1125	70.2	0.0	0	27.8	0	0.0	N/A	2	10.0	10.0
IW-1	0823	74.7	0.0	0	23.1	0	0.0	N/A	0.5	10.0	10.0
IW-2	1325	70.4	1.4	2	20.1	0	0.0	N/A	0.5	10.0	10.0
IW-3	1138	79.7	0.0	3	16.3	0	0.0	N/A	0.5	10.0	10.0
IW-4	1149	75.8	0.0	1	21.1	0	0.0	N/A	0.5	10.0	10.0
IW-5	There is no probe in this well, which is the former Pilot Test well MW-40-27										
IW-6	0839	68.0	0.0	4	27.3	0	0.0	N/A	0.5	10.0	10.0
IW-7	0851	75.7	0.4	2	20.3	0	0.0	N/A	0.5	10.0	10.0
IW-8	1128	70.8	0.0	15	26.8	0	0.0	N/A	0.5	10.0	10.0
IW-9	1200	85.7	0.0	14	3.3	0	2.6	N/A	0.5	10.0	10.0
IW-10	1222	70.6	0.0	8	27.6	0	3.1	N/A	0.5	10.0	10.0
IW-11	0949	78.8	0.0	0	21.1	0	0.0	N/A	0.5	10.0	10.0
IW-12	0936	77.2	0.0	0	23.0	0	0.0	N/A	0.5	10.0	10.0
IW-13	0919	76.7	0.0	0	23.1	0	0.0	N/A	0.5	10.0	10.0
IW-14	1045	73.2	0.0	0	23.6	0	0.4	N/A	0.5	10.0	10.0
IW-15	1054	68.6	0.0	7	27.3	0	0.3	N/A	0.5	10.0	10.0
IW-16	1012	74.2	0.0	0	16.7	0	0.0	N/A	0.5	10.0	10.0
IW-17	1033	86.8	0.0	0	9.2	0	0.1	N/A	0.5	10.0	10.0
MW-40-30		WATER IN PROBE							0.5	10.0	10.0
MW-40-31		WATER IN PROBE							0.5	10.0	10.0
MW-40-32	1212	70.2	0.1	4	27.0	0	3.1	N/A	0.5	10.0	10.0
MW-40-33	1001	19.3	0.9	0	1.8	0	0.0	N/A	0.5	10.0	10.0
MW-40-34	1021	76.8	0.0	0	19.9	0	0.0	N/A	0.5	10.0	10.0
MW-40-35	0904	79.5	0.0	15	20.0	0	0.0	N/A	0.5	10.0	10.0
MW-40-36	1114	67.8	0.0	0	30.4	0	0.0	N/A	0.5	10.0	10.0
MW-40-37	1106	73.5	0.6	0	23.2	0	0.0	N/A	0.5	10.0	10.0
MW-40-38	1250	60.9	1.4	0	20.3	0	0.0	N/A	0.5	10.0	10.0
MW-40-39	1308	27.8	10.1	0	11.8	0	0.0	N/A	0.5	10.0	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
04/11/2008

Date: April 11, 2008 Technician: Wendy Bryant Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Time	Methane (%)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (%)	Carbon Monoxide (ppm)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet	Well Depth (feet bgs)
VW-40-01	0806	76.1	0.0	0	23.1	0	0.0	N/A	2	7.5	8
VW-40-02	0811	75.8	0.0	0	24.4	0	0.0	N/A	2	7.5	8
VW-40-03	0822	71.2	0.0	0	27.2	0	0.0	N/A	2	10.0	10.0
VW-40-04	1213	66.9	0.8	0	18.9	0	0.0	N/A	2	10.0	10.0
VW-40-05	Vaccuum, no useable readings.							N/A	2	10.0	10.0
VW-40-06	1101	69.9	0.0	0	28.1	0	0.0	N/A	2	10.0	10.0
IW-1	0800	75.1	0.0	0	23.4	0	0.0	N/A	0.5	10.0	10.0
IW-2	1259	69.3	2.0	4	27.4	0	0.0	N/A	0.5	10.0	10.0
IW-3	1225	79.2	0.0	5	14.2	0	0.0	N/A	0.5	10.0	10.0
IW-4	1236	74.3	0.0	1	20.0	0	0.0	N/A	0.5	10.0	10.0
IW-5	There is no probe in this well, which is the former Pilot Test well MW-40-27										
IW-6	0834	67.1	0.0	6	24.2	0	0.0	N/A	0.5	10.0	10.0
IW-7	0845	73.0	0.1	3	21.0	0	0.0	N/A	0.5	10.0	10.0
IW-8	1111	69.2	0.0	21	30.0	2	0.0	N/A	0.5	10.0	10.0
IW-9	1141	86.2	0.0	13	2.1	0	0.0	N/A	0.5	10.0	10.0
IW-10	1202	69.4	0.0	7	26.4	0	1.1	N/A	0.5	10.0	10.0
IW-11	0904	80.1	0.0	0	17.8	0	0.0	N/A	0.5	10.0	10.0
IW-12	0916	75.1	0.0	0	23.0	0	0.1	N/A	0.5	10.0	10.0
IW-13	0958	74.0	0.0	0	20.1	0	0.2	N/A	0.5	10.0	10.0
IW-14	1031	71.1	0.0	0	26.0	0	0.1	N/A	0.5	10.0	10.0
IW-15	1041	67.3	0.0	4	28.6	0	0.0	N/A	0.5	10.0	10.0
IW-16	0938	75.0	0.0	0	15.4	0	0.2	N/A	0.5	10.0	10.0
IW-17	1009	88.1	0.0	0	7.4	0	0.4	N/A	0.5	10.0	10.0
MW-40-30	1120	WATER IN PROBE							0.5	10.0	10.0
MW-40-31	1130	WATER IN PROBE							0.5	10.0	10.0
MW-40-32	1152	71.1	0.0	3	26.9	0	0.6	N/A	0.5	10.0	10.0
MW-40-33	0928	14.2	1.2	0	1.5	0	0.0	N/A	0.5	10.0	10.0
MW-40-34	0948	75.7	0.0	0	17.4	0	0.0	N/A	0.5	10.0	10.0
MW-40-35	0855	80.2	0.0	10	18.2	0	0.0	N/A	0.5	10.0	10.0
MW-40-36	1020	66.4	0.0	0	32.0	0	0.0	N/A	0.5	10.0	10.0
MW-40-37	1051	71.0	0.4	0	25.2	0	0.0	N/A	0.5	10.0	10.0
MW-40-38	1247	61.9	2.0	0	28.2	0	0.0	N/A	0.5	10.0	10.0
MW-40-39	1312	24.3	12.5	0	10.2	0	0.0	N/A	0.5	10.0	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
07/18/2008

Date: July 18, 2008 Technician: Wendy Bryant Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Time	Methane (%)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (%)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet bgs)	Well Depth (feet bgs)
VW-40-01	1222	77.2	0.0	0	22.0	0	-	2	7.5	8
VW-40-02	1229	76.4	0.0	0	23.3	0	-	2	7.5	8
VW-40-03	1524	70.8	0.0	0	27.4	0	-	2	10.0	10.0
VW-40-04	1531	67.3	1.2	0	25.8	0	-	2	10.0	10.0
VW-40-05	Vaccuum, no useable readings.						-	2	10.0	10.0
VW-40-06	1538	70.1	0.0	0	26.2	0	-	2	10.0	10.0
IW-1	1215	74.7	0.0	0	20.4	0	-	0.5	10.0	10.0
IW-2	1517	70.0	2.7	5	25.4	0	-	0.5	10.0	10.0
IW-3	1503	81.2	0.0	4	15.6	2	-	0.5	10.0	10.0
IW-4	1456	73.1	0.0	0	24.4	1	-	0.5	10.0	10.0
IW-5	There is no probe in this well, which is the former Pilot Test well MW-40-27									
IW-6	1236	68.2	0.0	3	28.9	0	-	0.5	10.0	10.0
IW-7	1243	73.4	0.7	4	24.3	0	-	0.5	10.0	10.0
IW-8	1414	68.7	0.0	17	28.6	4	-	0.5	10.0	10.0
IW-9	1435	86.0	0.0	15	12.2	0	-	0.5	10.0	10.0
IW-10	1449	68.4	0.0	6	30.0	0	-	0.5	10.0	10.0
IW-11	1304	81.3	0.0	0	14.8	0	-	0.5	10.0	10.0
IW-12	1311	74.0	0.0	0	23.1	0	-	0.5	10.0	10.0
IW-13	1257	75.6	0.0	0	20.2	0	-	0.5	10.0	10.0
IW-14	1407	70.3	0.0	0	26.4	0	-	0.5	10.0	10.0
IW-15	1400	65.2	0.0	5	33.8	0	-	0.5	10.0	10.0
IW-16	1353	73.7	0.0	0	25.3	0	-	0.5	10.0	10.0
IW-17	1346	82.3	0.0	0	17.0	0	-	0.5	10.0	10.0
MW-40-30	1421	WATER IN PROBE						0.5	10.0	10.0
MW-40-31	1428	WATER IN PROBE						0.5	10.0	10.0
MW-40-32	1442	70.2	0.0	2	28.8	0	-	0.5	10.0	10.0
MW-40-33	1318	12.1	1.5	0	1.7	0	-	0.5	10.0	10.0
MW-40-34	1325	74.5	0.3	0	23.8	0	-	0.5	10.0	10.0
MW-40-35	1250	81.9	0.0	7	17.6	0	-	0.5	10.0	10.0
MW-40-36	1332	65.3	0.0	0	32.3	0	-	0.5	10.0	10.0
MW-40-37	1339	71.1	0.7	0	26.1	0	-	0.5	10.0	10.0
MW-40-38	1510	63.5	2.1	0	30.4	0	-	0.5	10.0	10.0
MW-40-39	1545	22.0	11.6	0	10.2	0	-	0.5	10.0	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
10/03/2008

Date: October 03, 2008 Technician: Diane Suzuki Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Time	Methane (%)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (%)	Carbon Monoxide (ppm)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet	Well Depth (feet bgs)
VW-40-01	0801	73.4	0.1	0	20.7	0	0.0	N/A	2	7.5	8
VW-40-02	0816	71.2	0.1	0	24.6	0	0.0	N/A	2	7.5	8
VW-40-03	0831	68.7	0.0	0	20.8	0	0.0	N/A	2	10.0	10.0
VW-40-04	1324	65.3	1.1	0	25.9	0	0.0	N/A	2	10.0	10.0
VW-40-05	Vaccuum, no useable readings.							N/A	2	10.0	10.0
VW-40-06	1100	70.2	0.0	0	24.6	0	0.0	N/A	2	10.0	10.0
IW-1	0745	74.8	0.0	0	24.7	0	0.0	N/A	0.5	10.0	10.0
IW-2	1428	60.9	1.7	3	15.6	0	0.0	N/A	0.5	10.0	10.0
IW-3	1356	77.4	0.0	3	21.2	0	0.0	N/A	0.5	10.0	10.0
IW-4	1411	75.1	0.0	0	20.8	0	0.0	N/A	0.5	10.0	10.0
IW-5	There is no probe in this well, which is the former Pilot Test well MW-40-27										
IW-6	0846	69.2	0.0	4	16.4	0	0.0	N/A	0.5	10.0	10.0
IW-7	0901	71.4	0.1	2	22.7	0	0.0	N/A	0.5	10.0	10.0
IW-8	1341	67.4	0.1	14	20.6	0	0.0	N/A	0.5	10.0	10.0
IW-9	1307	85.2	0.0	6	14.0	0	0.0	N/A	0.5	10.0	10.0
IW-10	1237	71.3	0.0	3	26.7	0	0.8	N/A	0.5	10.0	10.0
IW-11	1015	83.2	0.0	0	12.3	0	0.0	N/A	0.5	10.0	10.0
IW-12	1000	74.6	0.2	0	25.0	0	0.4	N/A	0.5	10.0	10.0
IW-13	0932	70.4	0.0	0	24.7	0	0.6	N/A	0.5	10.0	10.0
IW-14	1128	69.2	0.0	0	27.2	0	0.3	N/A	0.5	10.0	10.0
IW-15	1133	78.4	0.0	2	18.9	0	0.0	N/A	0.5	10.0	10.0
IW-16	1148	70.2	0.1	0	23.3	0	0.5	N/A	0.5	10.0	10.0
IW-17	1203	84.3	0.0	0	12.7	0	0.2	N/A	0.5	10.0	10.0
MW-40-30		WATER IN PROBE							0.5	10.0	10.0
MW-40-31		WATER IN PROBE							0.5	10.0	10.0
MW-40-32	1252	70.0	0.0	1	27.7	0	0.7	N/A	0.5	10.0	10.0
MW-40-33	1031	15.7	1.9	0	1.1	0	0.0	N/A	0.5	10.0	10.0
MW-40-34	0946	76.2	0.0	0	17.6	0	0.0	N/A	0.5	10.0	10.0
MW-40-35	0917	81.4	0.0	12	15.8	0	0.0	N/A	0.5	10.0	10.0
MW-40-36	1045	65.3	0.0	0	24.2	0	0.0	N/A	0.5	10.0	10.0
MW-40-37	1114	70.7	0.5	0	23.6	0	0.0	N/A	0.5	10.0	10.0
MW-40-38	1444	63.4	3.2	0	26.4	0	0.0	N/A	0.5	10.0	10.0
MW-40-39	1220	19.8	13.3	0	10.1	0	0.0	N/A	0.5	10.0	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
06/03/2009

Date: June 3, 2009 Technician: Diane Suzuki Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Time	Methane (%)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (%)	Carbon Monoxide (PPM)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet bgs)	Well Depth (feet bgs)
VW-40-01	11:40	78.4	0.0	0	20.1	18.0	0.0		2	2.5 to 7.5	8
VW-40-02	11:44	76.0	0.0	8	22.6	8.0	0.0		2	2.5 to 7.5	8
VW-40-03	9:48	76.3	0.3	0	19.2	12.0	0.0		2	3.5 to 10	10.0
VW-40-04	14:35	PVC, no vacuum to get useable reading							2	3.5 to 10	10.0
VW-40-05	14:23	PVC, no vacuum to get useable reading							2	3.5 to 10	10.0
VW-40-06	14:00	74.9	0.0	0	21.5	12.0	0.0		2	3.5 to 10	10.0
IW-1	09:18	73.9	0.0	1	24.8	18.0	0.0		0.5	3.5 to 10	10.0
IW-2	09:05	54.3	0.0	3	22.2	22.0	0.0		0.5	3.5 to 10	10.0
IW-3	09:40	81.0	0.0	2	18.2	19.0	0.0		0.5	3.5 to 10	10.0
IW-4	09:55	82.0	0.6	0	17.3	23.0	0.0	water in well	0.5	3.5 to 10	10.0
IW-5	00	No probe							0.5	3.5 to 10	10.0
IW-6	10:28	68.8	0.0	4	26.4	20.0	0.0		0.5	3.5 to 10	10.0
IW-7	10:14	77.5	0.0	2	19.0	0.0	0.0		0.5	3.5 to 10	10.0
IW-8	15:17	66.3	0.0	12	25.2	16.0	0.0		0.5	3.5 to 10	10.0
IW-9	11:54	84.0	0.0	0	15.6	0.0	0.0		0.5	3.5 to 10	10.0
IW-10	14:45	72.9	0.0	0	26.5	0.0	0.5	Red rust soil & water	0.5	3.5 to 10	10.0
IW-11	11:54	84.0	0.0	0	12.3	0.0	0.0		0.5	3.5 to 10	10.0
IW-12	12:10	75.6	0.0	0	24.2	0.0	0.3	Green Bio, bailed and measured	0.5	3.5 to 10	10.0
IW-13	12:50	75.0	19.0	0	2.6	0.0	0.5	Rusty Bio, bailed & measured	0.5	3.5 to 10	10.0
IW-14	15:37	70.4	0.0	0	26.9	0.0	0.3		0.5	3.5 to 10	10.0
IW-15	15:50	78.0	0.0	2	19.0	0.0	0.0		0.5	3.5 to 10	10.0
IW-16	12:27	40.7	0.0	13	19.2	26.0	0.5		0.5	3.5 to 10	10.0
IW-17	12:36	85.7	0.0	1	12.4	0.0	0.0		0.5	3.5 to 10	10.0
MW-40-30	0	Water in probe							0.5	3.5 to 10	10.0
MW-40-31	0	Water in probe							0.5	3.5 to 10	10.0
MW-40-32	15:05	73.5	0.0	0	26.4	0.0	0.0		0.5	3.5 to 10	10.0
MW-40-33	12:18	16.1	13.4	0	5.2	0.0	0.6		0.5	3.5 to 10	10.0
MW-40-34	12:44	75.6	0.0	0	19.6	19.0	0.0	spider	0.5	3.5 to 10	10.0
MW-40-35	13:22	77.6	0.0	1	16.9	17.0	0.7		0.5	3.5 to 10	10.0
MW-40-36	15:26	65.2	0.0	0	24.2	18.0	0.0	Water in well	0.5	3.5 to 10	10.0
MW-40-37	16:03	73.6	0.3	0	23.0	0.0	0.0	Water in well	0.5	3.5 to 10	10.0
MW-40-38	14:53	70.6	0.0	0	19.9	12.0	0.0		0.5	3.5 to 10	10.0
MW-40-39	13:35	0.1	14.3	0	2.5	1.0	0.5		0.5	3.5 to 10	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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Soil Vapor/Gas Monitoring
05/04/2010

Date: May 4, 2010 Technician: Wendy Bryant Equipment Used: GEM2000+; PID Mini Rae2000

Well ID	Time	Methane (%)	Oxygen (%)	Hydrogen Sulfide (PPM)	Carbon Dioxide (%)	Carbon Monoxide (PPM)	VOCs (ppmv)	Comments and Remarks	Casing Diameter (inches)	Screen Interval (bottom) (feet bgs)	Well Depth (feet bgs)
VW-40-01	1250	87.5	0.0	1.0	23.4	0.0	0.0		2	2.5 to 7.5	8
VW-40-02	1245	91.9	0.0	0.0	23.6	0.0	0.0		2	2.5 to 7.5	8
VW-40-03	1134	81.4	0.0	0.0	31.7	0.0	0.0		2	3.5 to 10	10.0
VW-40-04	1128	18.6	16.5	0.0	6.4	0.0	0.0		2	3.5 to 10	10.0
VW-40-05	1134	20.1	19.1	0.0	8.9	0.0	0.0		2	3.5 to 10	10.0
VW-40-06	1308	81.9	0.0	19.0	33.8	12.0	0.0		2	3.5 to 10	10.0
IW-1	1255	76.8	0.0	14.0	23.3	0.0	0.0		0.5	3.5 to 10	10.0
IW-2	0858	57.4	0.0	0.0	18.8	0.0	0.0		0.5	3.5 to 10	10.0
IW-3	0905	89.5	0.0	14.0	24.5	0.0	0.0	Flooded	0.5	3.5 to 10	10.0
IW-4	0910	74.4	2.0	4.0	20.3	0.0	0.0		0.5	3.5 to 10	10.0
IW-5		No probe							0.5	3.5 to 10	10.0
IW-6	1128	82.6	0.0	0.0	33.8	14.0	0.0		0.5	3.5 to 10	10.0
IW-7	1124	88.7	0.0	11.0	26.7	16.0	0.0		0.5	3.5 to 10	10.0
IW-8	0918	78.3	1.8	0.0	19.9	0.0	0.0	Flooded	0.5	3.5 to 10	10.0
IW-9	1257	57.6	0.0	2.0	6.3	0.0	0.0		0.5	3.5 to 10	10.0
IW-10	1307	89.3	0.0	0.0	25.8	0.0	0.0		0.5	3.5 to 10	10.0
IW-11	0950	56.7	8.5	0.0	7.2	4.0	0.0		0.5	3.5 to 10	10.0
IW-12	1000	48.6	9.2	0.0	13.4	18.0	0.0		0.5	3.5 to 10	10.0
IW-13	1056	84.3	0.0	1.0	31.9	12.0	0.0		0.5	3.5 to 10	10.0
IW-14	1107	79.7	0.0	0.0	34.2	0.0	0.0	Flooded	0.5	3.5 to 10	10.0
IW-15	1113	77.5	0.0	1.0	29.3	0.0	0.0		0.5	3.5 to 10	10.0
IW-16	1023	0.1	20.9	0.0	0.1	0.1	0.0		0.5	3.5 to 10	10.0
IW-17	1040	0.2	10.7	1.0	25.3	20.0	0.0		0.5	3.5 to 10	10.0
MW-40-30		WATER IN PROBE							0.5	3.5 to 10	10.0
MW-40-31		WATER IN PROBE							0.5	3.5 to 10	10.0
MW-40-32	1302	87.0	0.0	0.0	28.9	0.0	0.0		0.5	3.5 to 10	10.0
MW-40-33	1015	5.9	10.7	0.0	1.6	0.0	0.0		0.5	3.5 to 10	10.0
MW-40-34	1033	27.8	16.6	0.0	8.7	0.0	0.0		0.5	3.5 to 10	10.0
MW-40-35	0942	47.3	6.3	0.0	21.0	12.0	0.0		0.5	3.5 to 10	10.0
MW-40-36	0935	76.5	1.2	0.0	26.5	13.0	0.0		0.5	3.5 to 10	10.0
MW-40-37	1121	82.9	0.0	2.5	30.7	0.0	0.0		0.5	3.5 to 10	10.0
MW-40-38	1311	56.5	0.0	0.0	17.4	25.0	0.0		0.5	3.5 to 10	10.0
MW-40-39	1330	0.1	20.0	0.0	1.9	0.0	0.0		0.5	3.5 to 10	10.0

22.1 Exceeding lower explosive limit (LEL) for methane which is 5% in air.

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APPENDIX F

METHANE EMISSION RESULTS

(ON CD ONLY)

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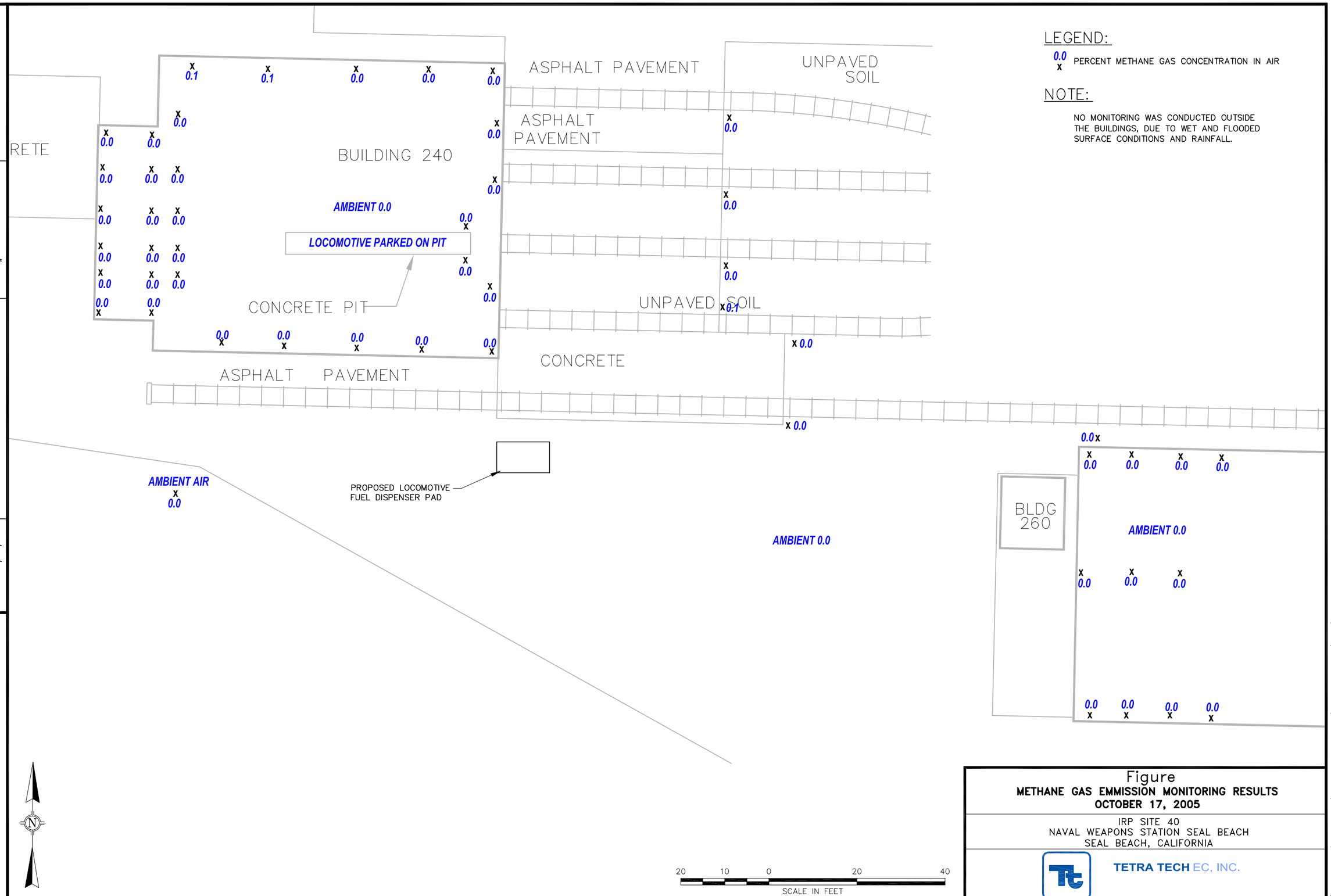

Figure
METHANE GAS EMMISSION MONITORING RESULTS
OCTOBER 17, 2005

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 1.DWG
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: ML
REV: REVISION 0
DRAWN BY: MD
DATE: 02/11/05

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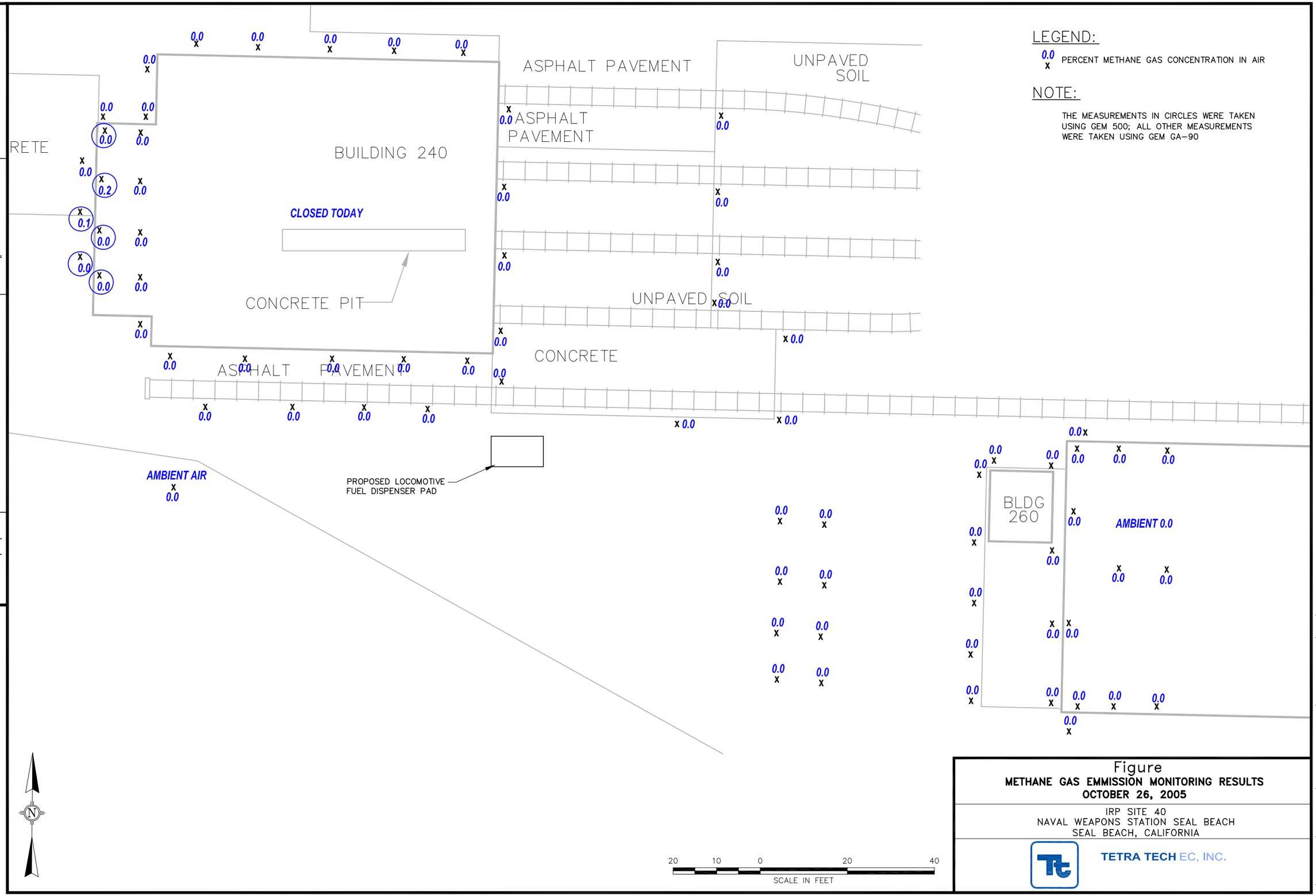

Figure
METHANE GAS EMMISSION MONITORING RESULTS
OCTOBER 26, 2005

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 1.DWG
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: ML
REV: REVISION 0
DRAWN BY: MD
DATE: 02/11/05

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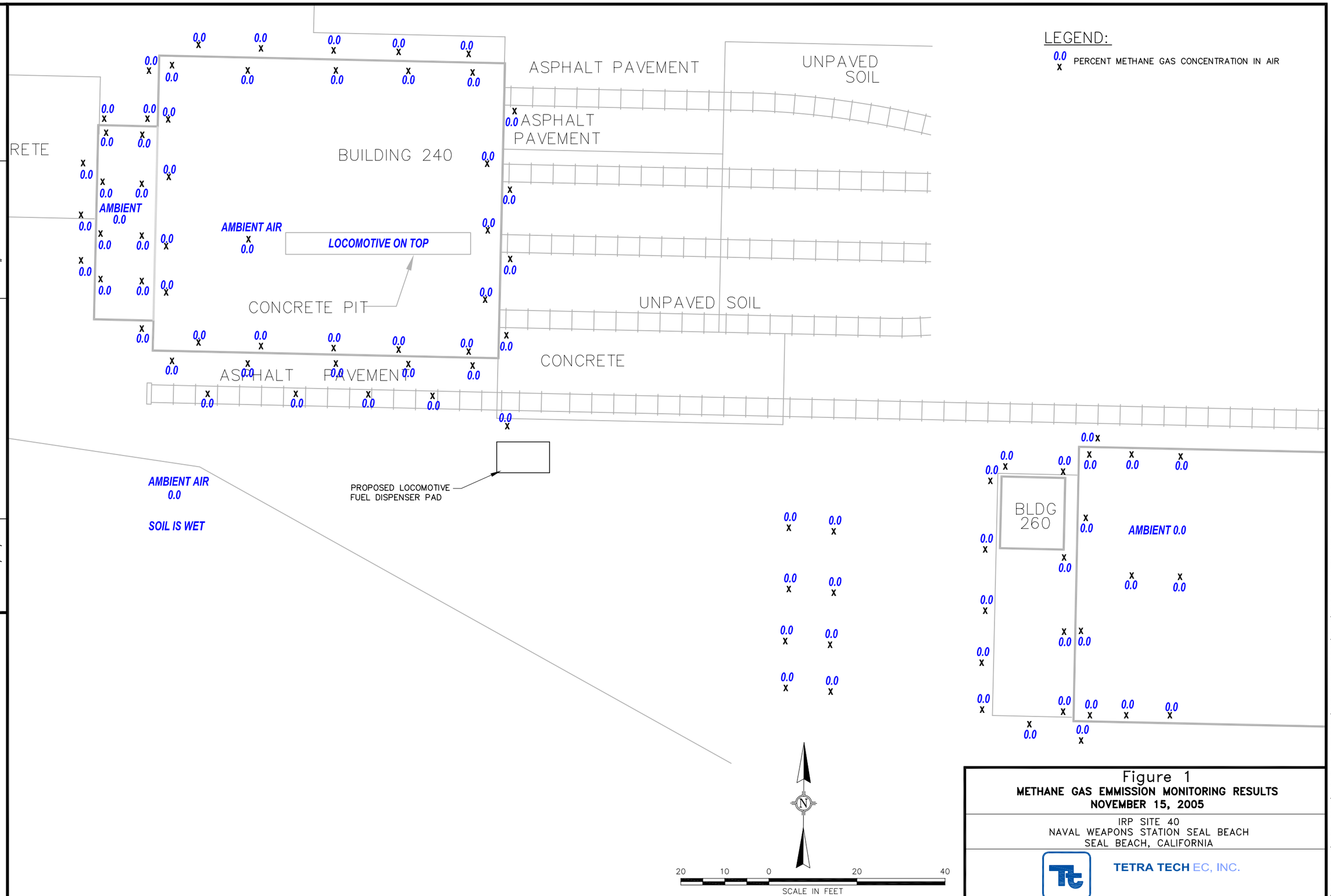

Figure 1
METHANE GAS EMMISSION MONITORING RESULTS
NOVEMBER 15, 2005

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 1
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: HH
REV: REVISION 0
DRAWN BY: MD
DATE: 11/15/05

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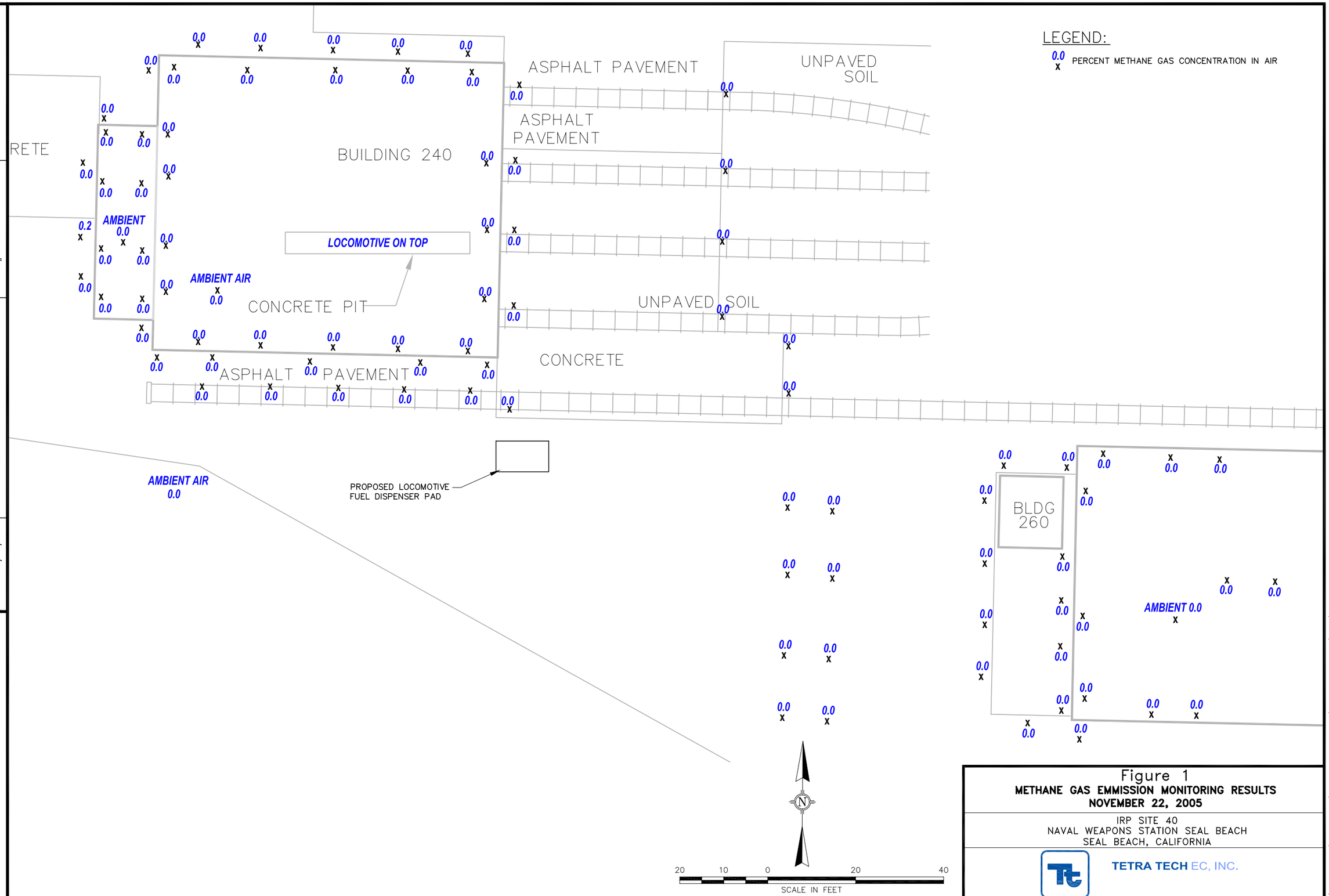

Figure 1
METHANE GAS EMMISSION MONITORING RESULTS
NOVEMBER 22, 2005

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 1
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: HH
REV: REVISION 0
DRAWN BY: MD
DATE: 11/15/05

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PLOT/UPDATE: NOV 29 2005 17:06:20

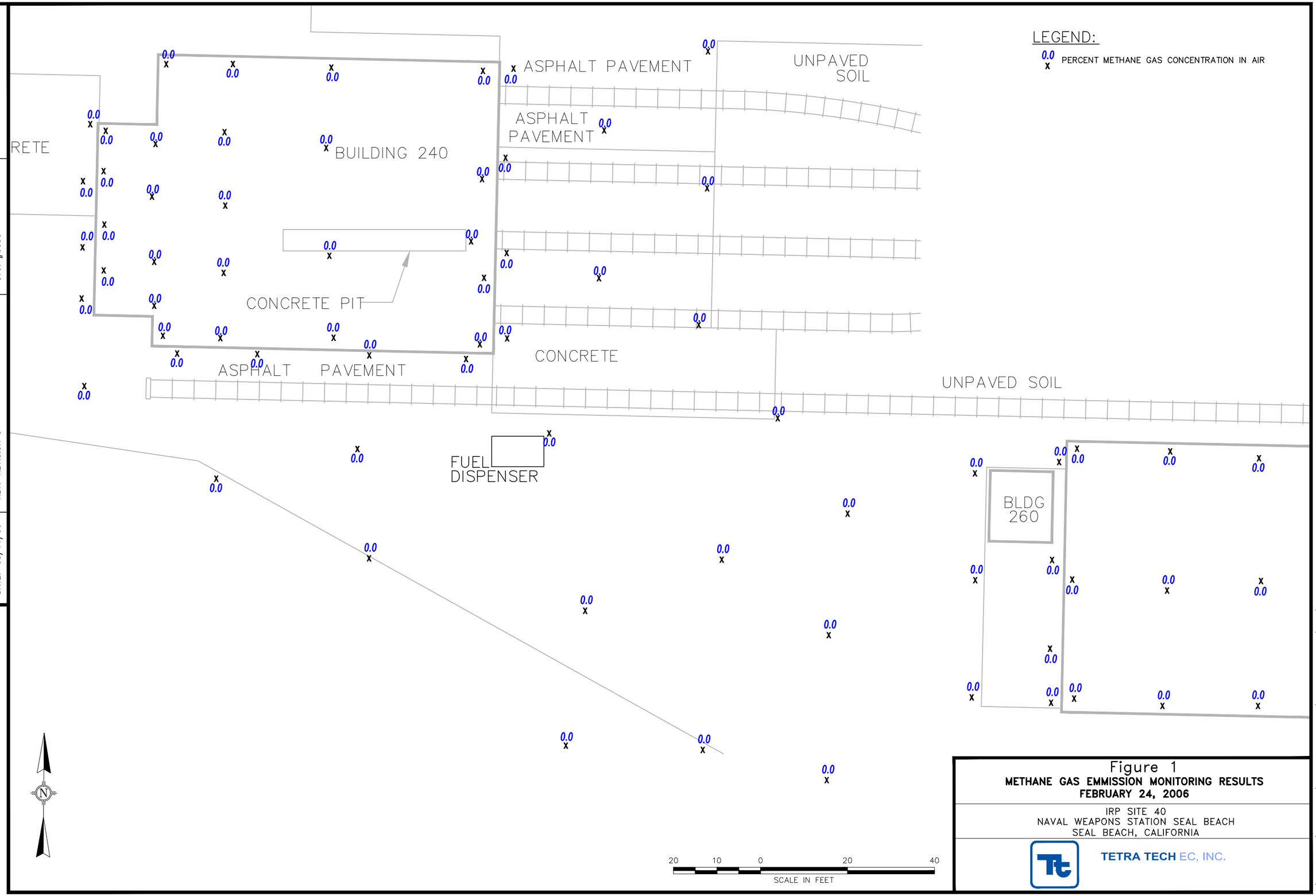

Figure 1
METHANE GAS EMMISSION MONITORING RESULTS
FEBRUARY 24, 2006

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 1
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: HH
REV: REVISION 0
DRAWN BY: MD
DATE: 08/11/06

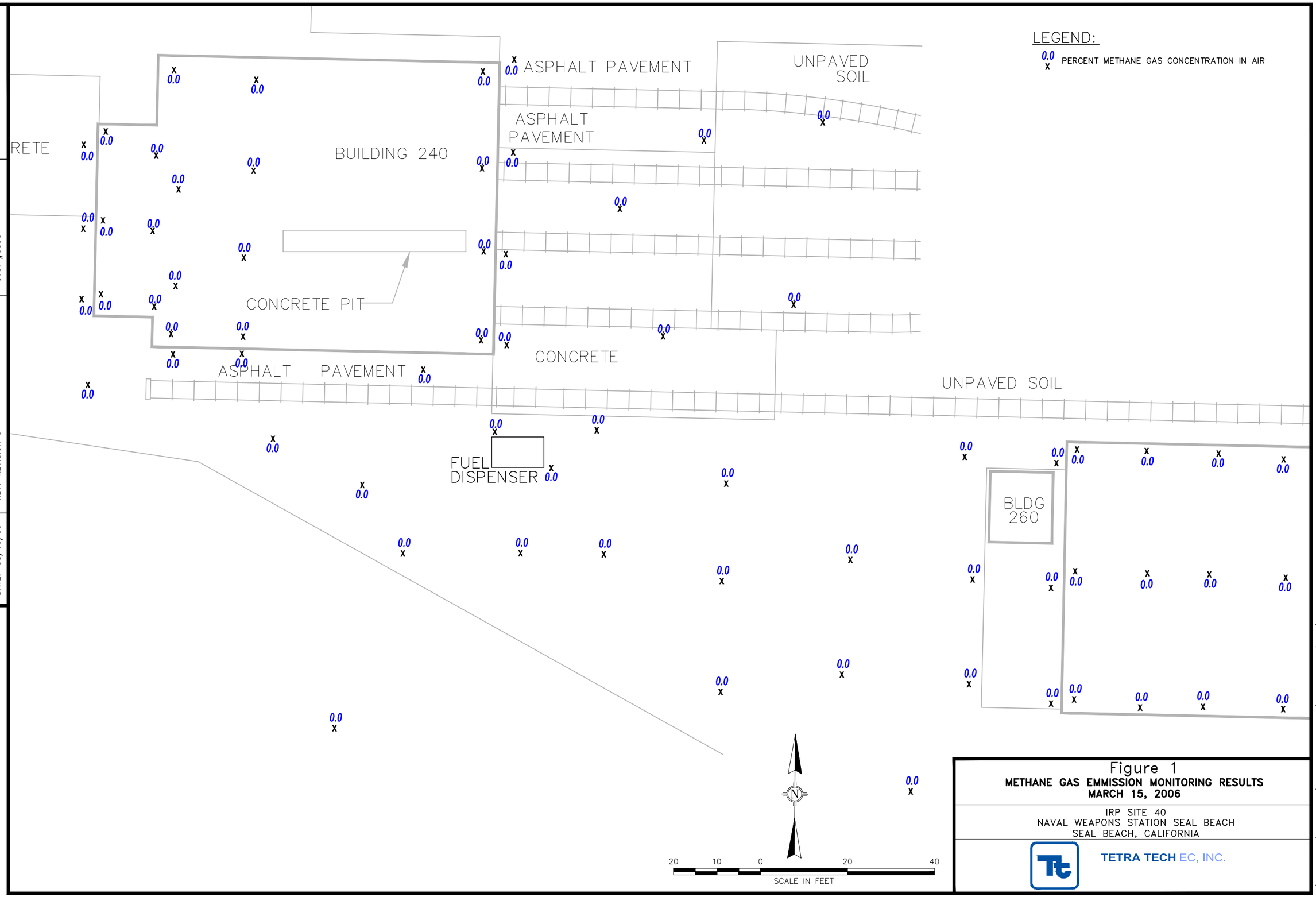

Figure 1
METHANE GAS EMMISSION MONITORING RESULTS
MARCH 15, 2006

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 1
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: HH
REV: REVISION 0
DRAWN BY: MD
DATE: 08/10/06

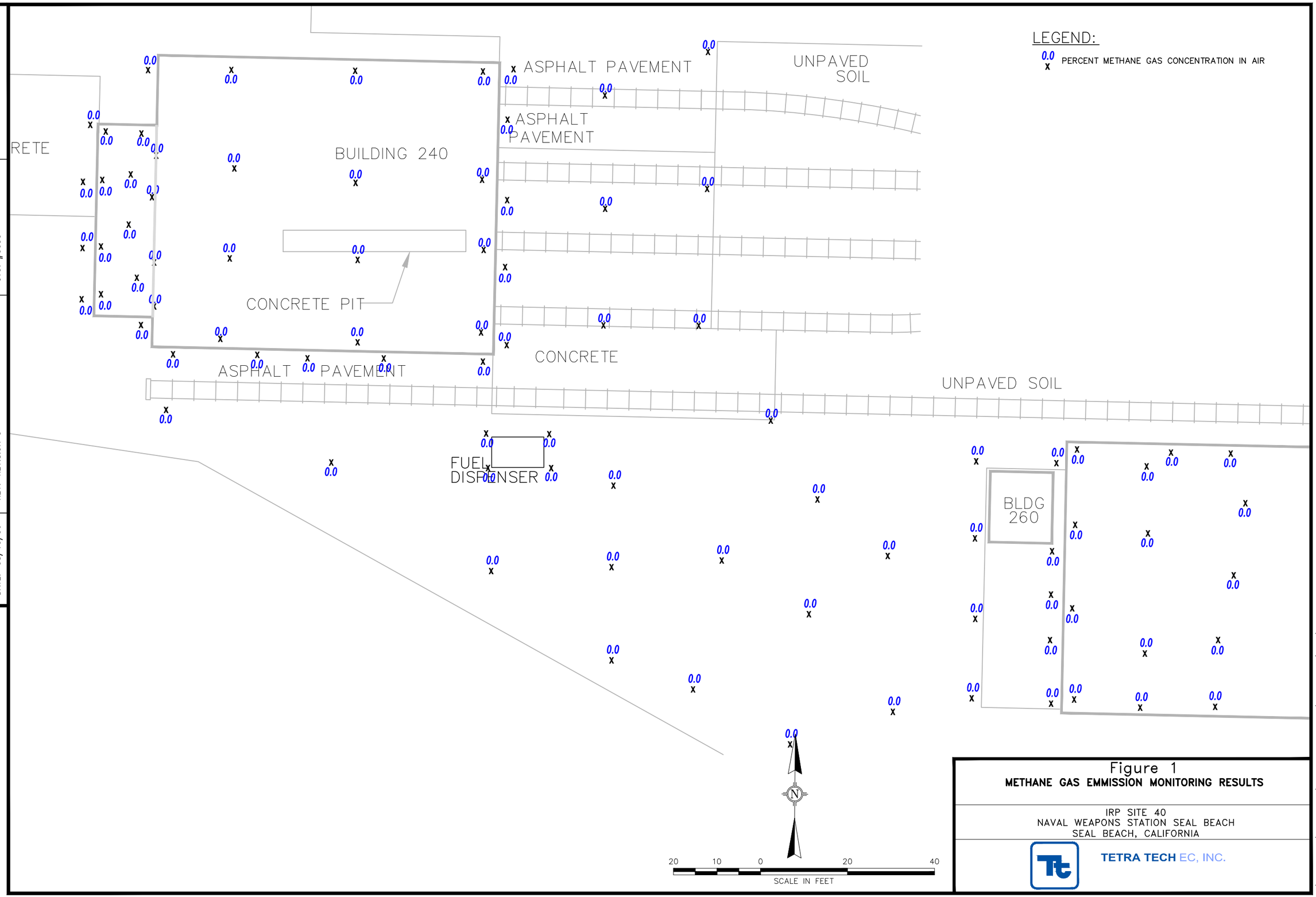

Figure 1
METHANE GAS EMMISSION MONITORING RESULTS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 1
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: HH
REV: REVISION 0
DRAWN BY: MD
DATE: 08/10/06

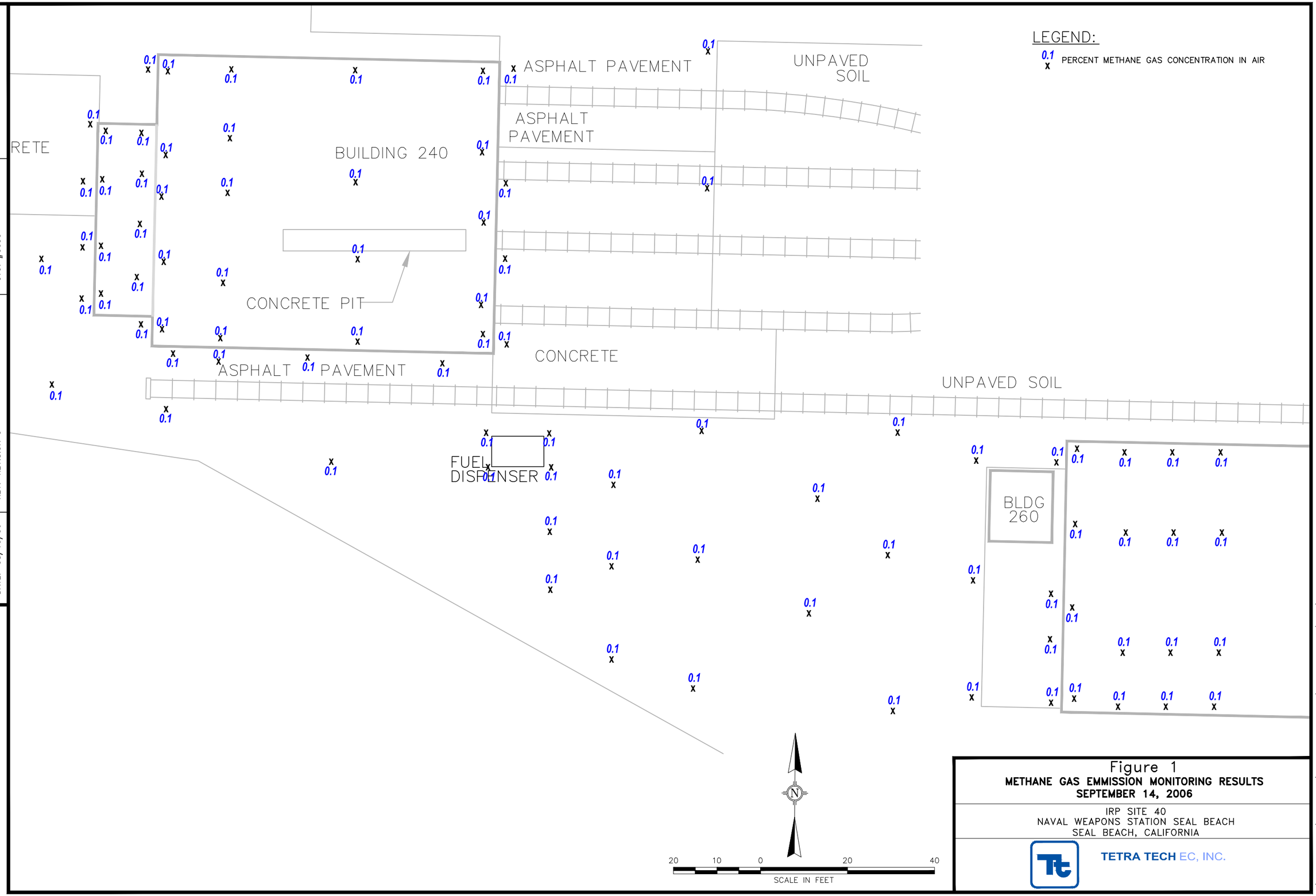

Figure 1
METHANE GAS EMMISSION MONITORING RESULTS
SEPTEMBER 14, 2006

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 1
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: HH
REV: REVISION 0
DRAWN BY: MD
DATE: 08/10/06

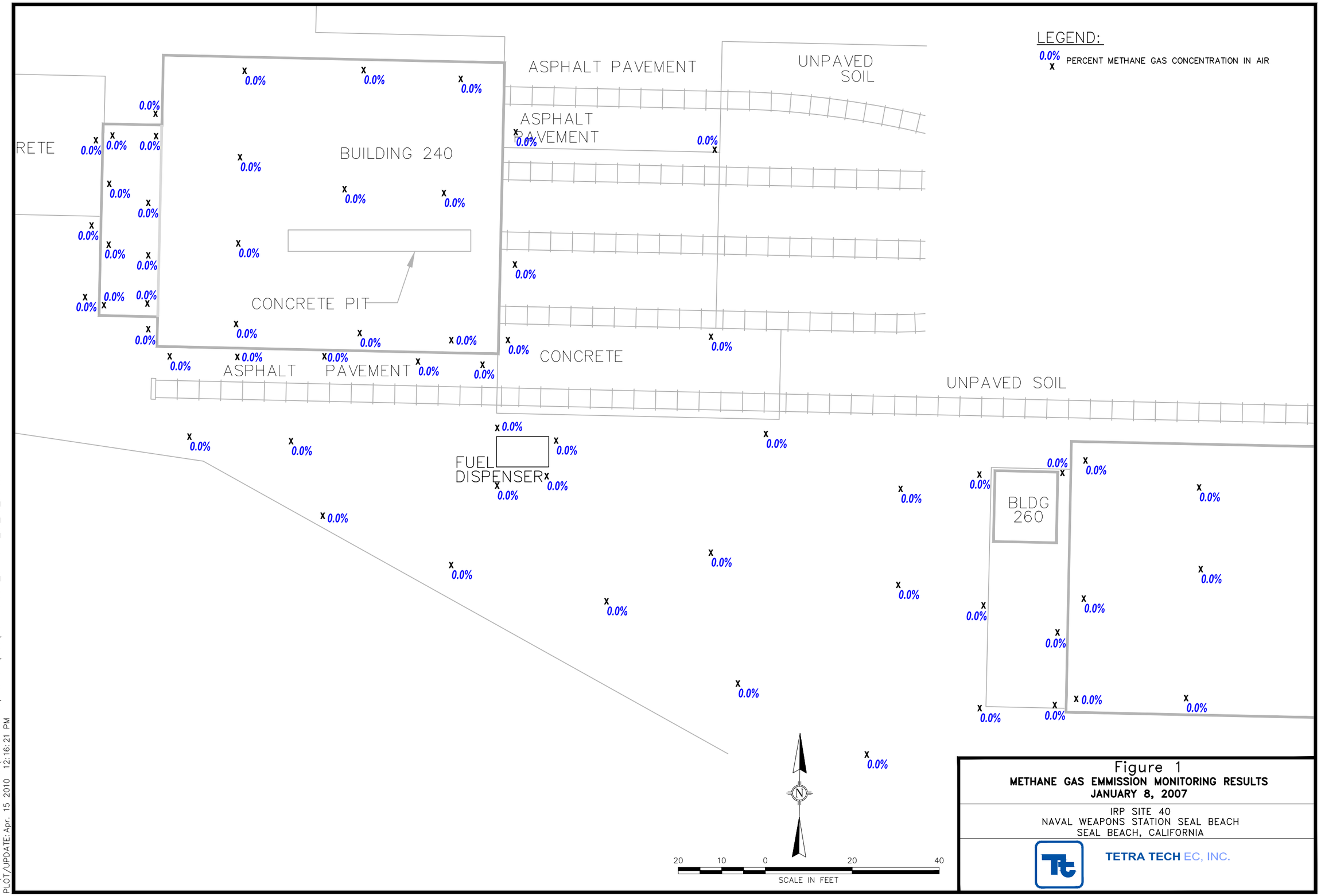

Figure 1
METHANE GAS EMMISSION MONITORING RESULTS
JANUARY 8, 2007

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

C:\DOCUMENTS AND SETTINGS\RYAN.HOOPES\DESKTOP\CAD\2007 BLDG 1_METHANE_01_08_07.DWG
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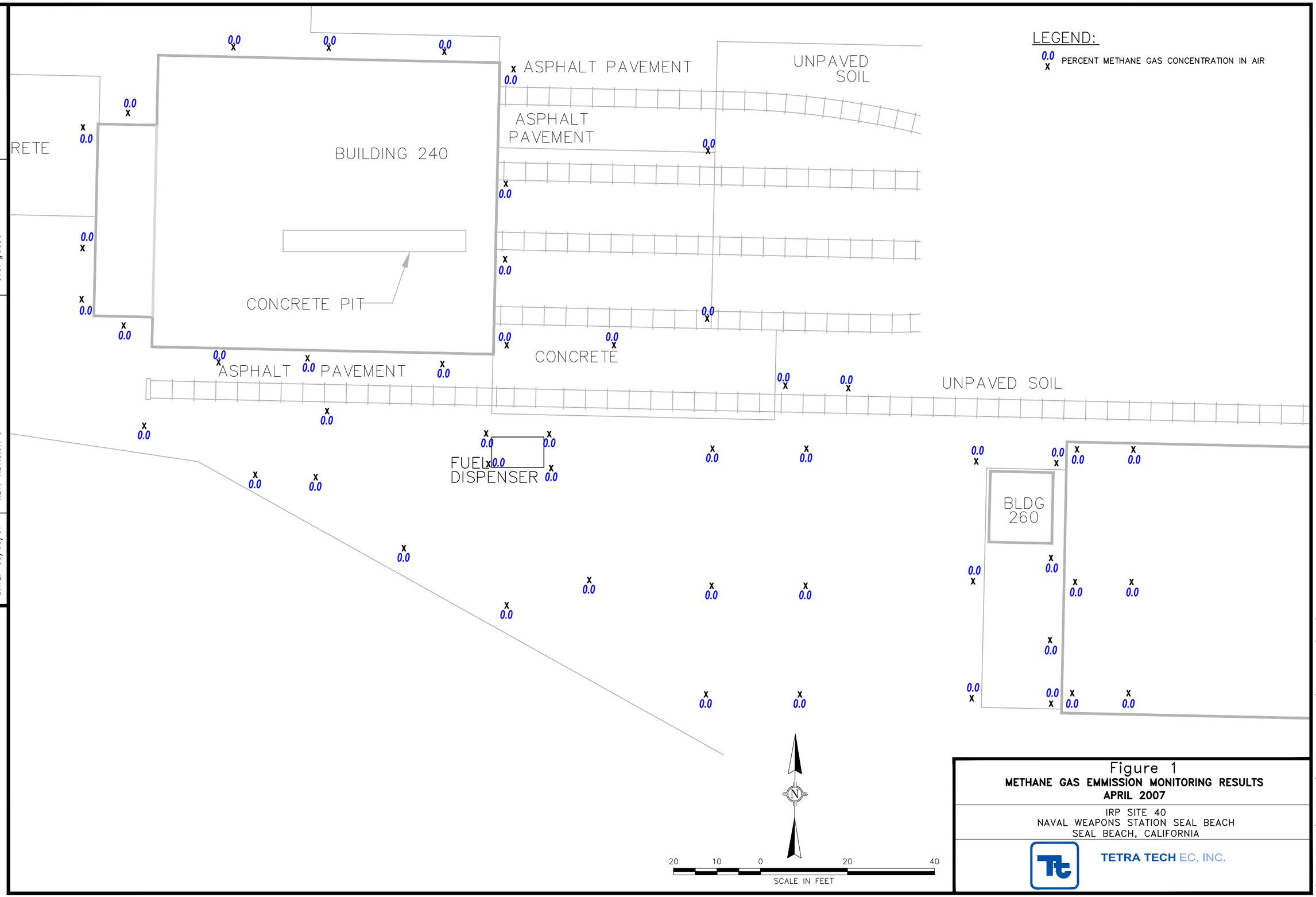

Figure 1
METHANE GAS EMMISSION MONITORING RESULTS
APRIL 2007

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 1
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: HH
REV: REVISION 0
DRAWN BY: MD
DATE: 05/09/07

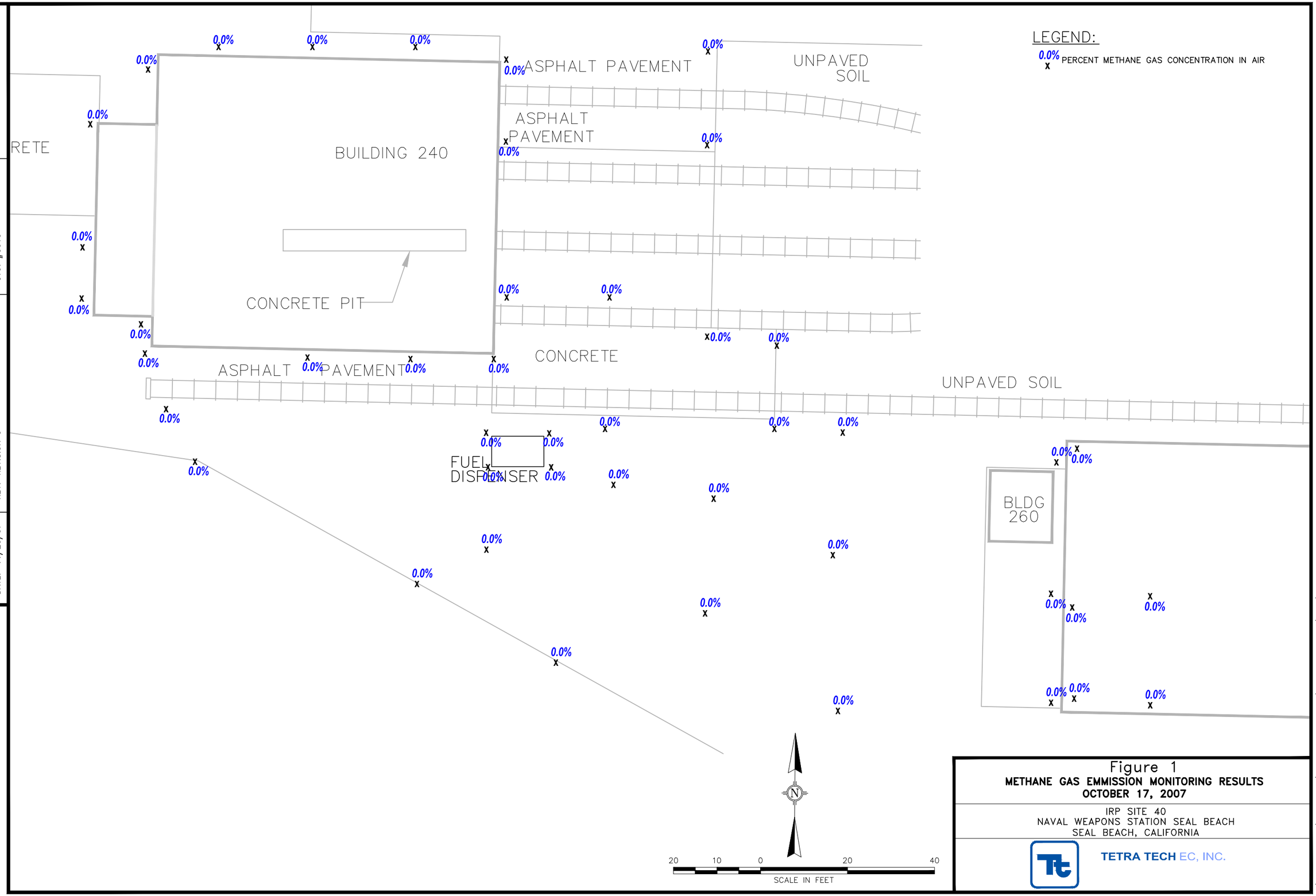

Figure 1
METHANE GAS EMMISSION MONITORING RESULTS
OCTOBER 17, 2007

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 1
DCN: ECSD-2201
CTO: #0010
APPROVED BY: HH
CHECKED BY: HH
REV: REVISION 0
DRAWN BY: MD
DATE: 11/20/07

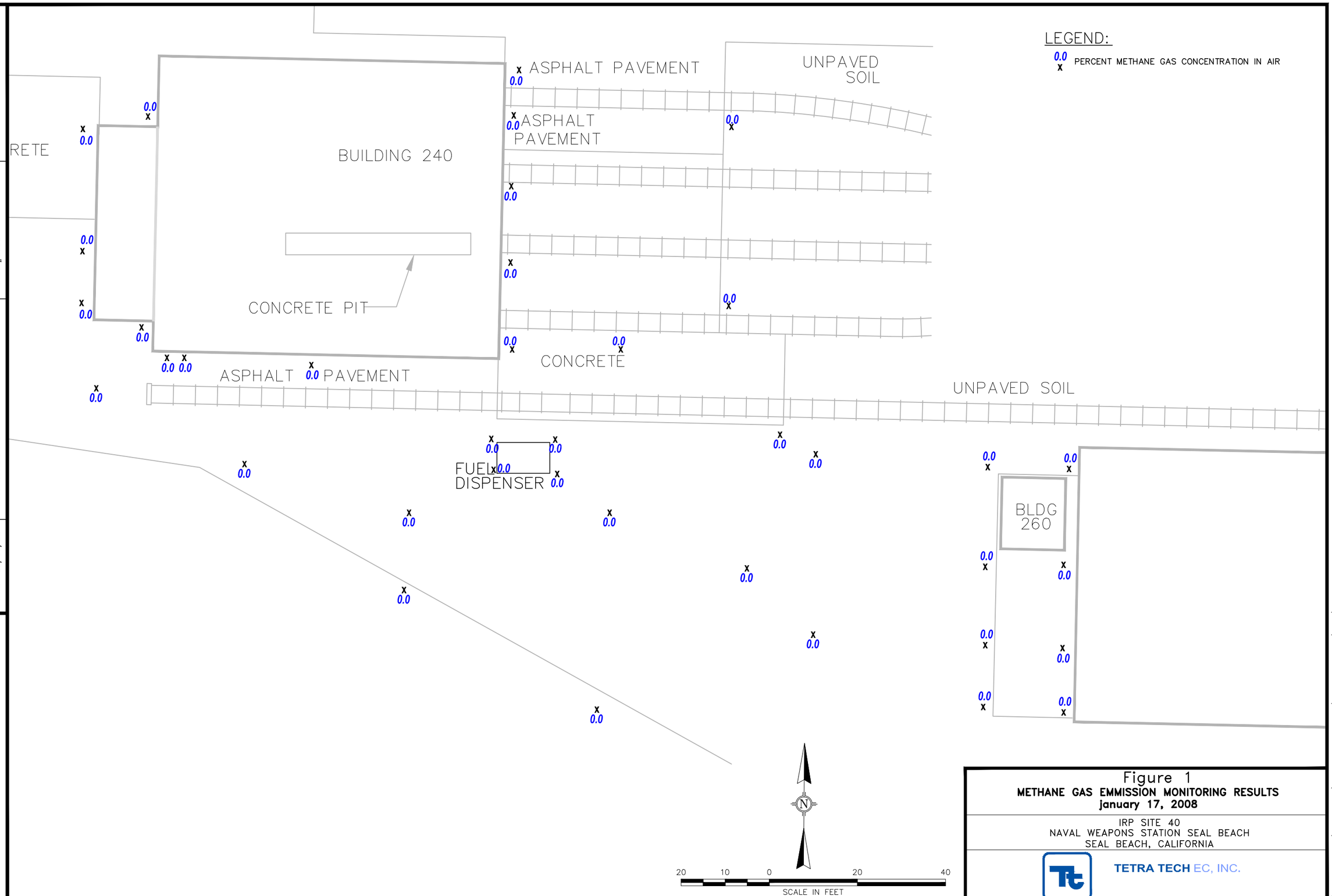

Figure 1
METHANE GAS EMMISSION MONITORING RESULTS
january 17, 2008

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: -
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: HH
REV: REVISION 0
DRAWN BY: MD
DATE: 03/07/08

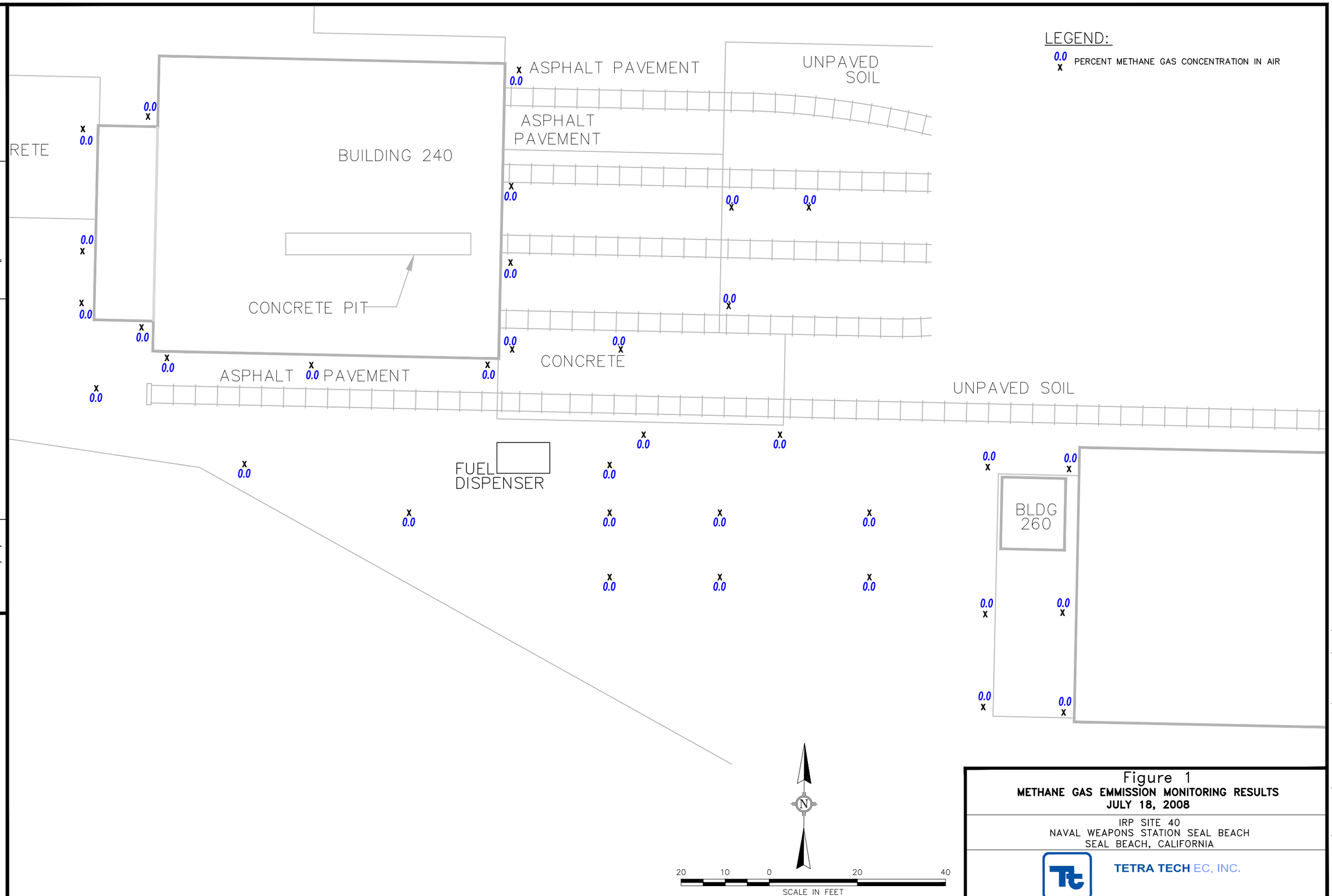

Figure 1
METHANE GAS EMMISSION MONITORING RESULTS
JULY 18, 2008

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 1
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: HH
REV: REVISION 0
DRAWN BY: MD
DATE: 03/07/08

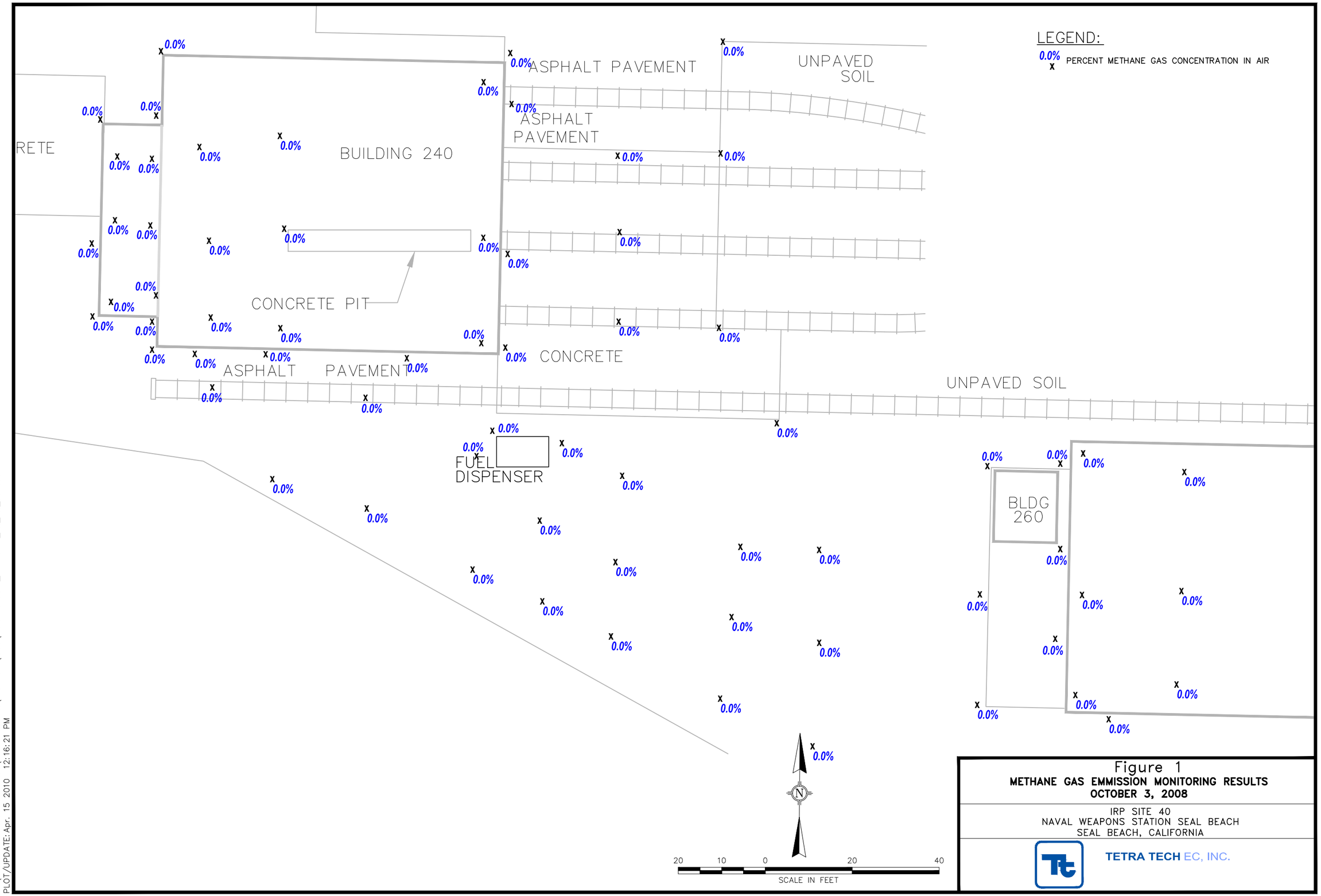

Figure 1
METHANE GAS EMMISSION MONITORING RESULTS
OCTOBER 3, 2008

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

C:\DOCUMENTS AND SETTINGS\RYAN.HOOPES\DESKTOP\CAD\2008 BLDG 1_METHANE_10_03_08.DWG
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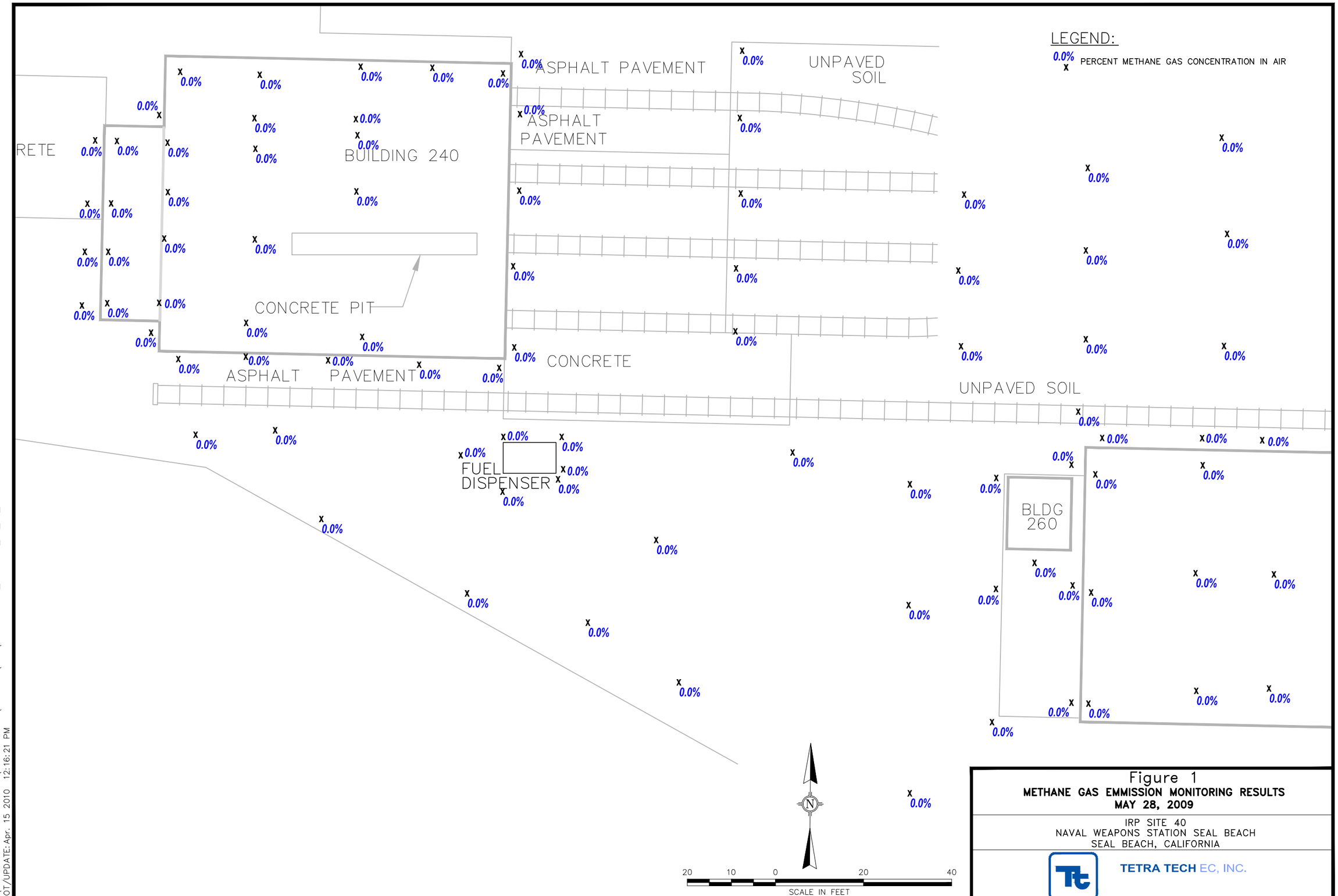

Figure 1
METHANE GAS EMMISSION MONITORING RESULTS
MAY 28, 2009

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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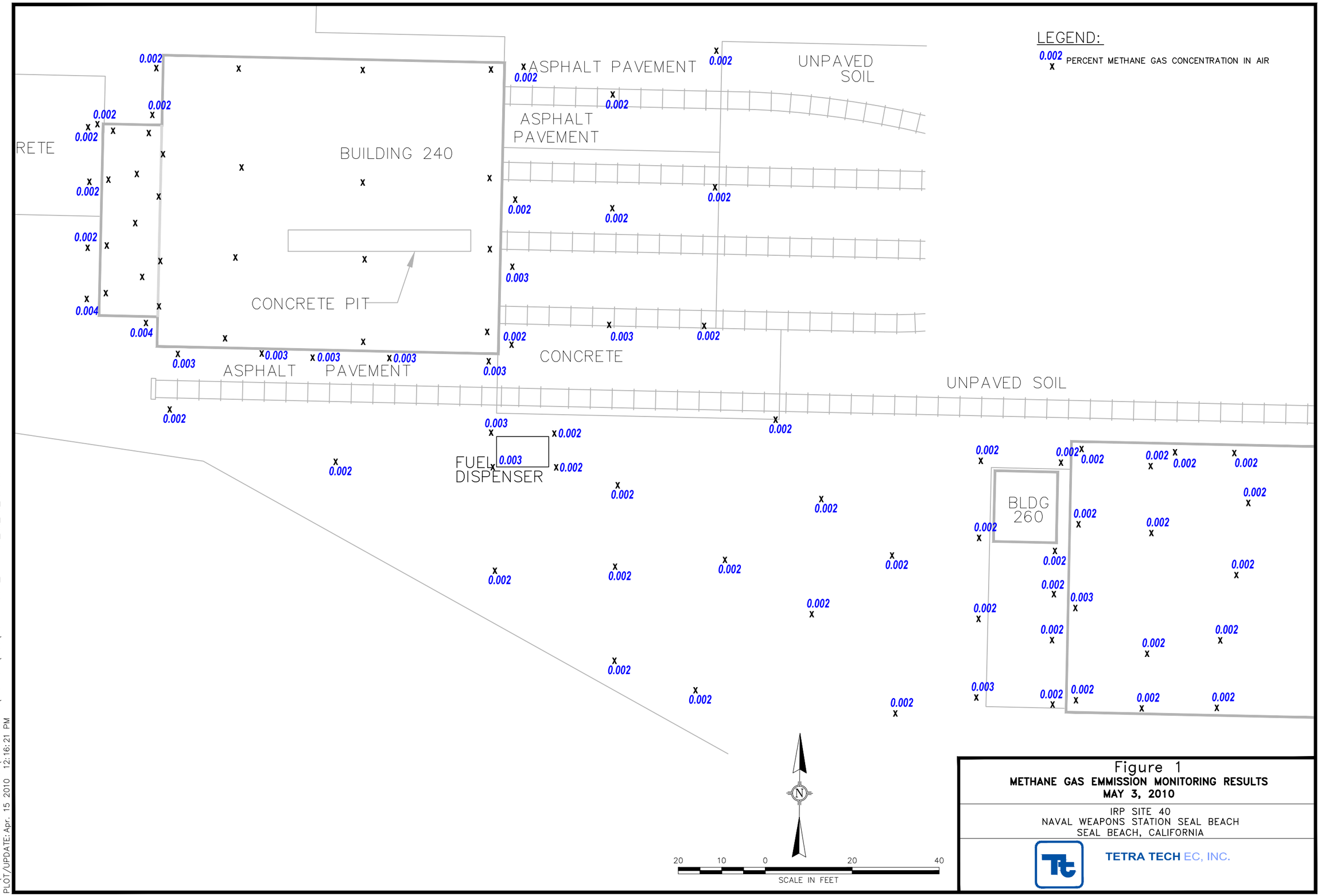

Figure 1
METHANE GAS EMMISSION MONITORING RESULTS
MAY 3, 2010

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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PLOT/UPDATE: Apr. 15 2010 12:16:21 PM

APPENDIX G

AGENCY COMMENTS ON THE DRAFT DOCUMENT, RESPONSE TO AGENCY COMMENTS, AND WATER BOARD'S CONCURRENCE WITH THE RTCs

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Department of Toxic Substances Control

Linda S. Adams
Acting Secretary for
Environmental Protection

Maziar Movassaghi
Acting Director
5796 Corporate Avenue
Cypress, California 90630

Edmund G. Brown Jr.
Governor

January 20, 2011

Ms. Pei-Fen Tamashiro
Installation Restoration Coordinator
Naval Weapons Station Seal Beach
800 Seal Beach Blvd
Seal Beach, CA 90740-5000

DRAFT COMPREHENSIVE PERFORMANCE MONITORING REPORT, IRP SITE 40, NAVAL WEAPONS STATION SEAL BEACH, (NWSSB)

Dear Ms. Tamashiro:

The Department of Toxic Substances Control (DTSC) received the above referenced document on December 6, 2010. The report summarizes site history including investigation and enhanced in-situ bioremediation conducted from October 2005 through May 2010 for dissolved chlorinated solvents in groundwater. The report also presents current site conditions including groundwater flow direction and extent of solvent plumes.

The report states that groundwater levels are measured on a quarterly basis and found that water flow direction remains unchanged. We recommend that the report show all four seasons' groundwater level contours so that questions on possible changes in groundwater migration direction may be resolved. DTSC also recommends that the report include a figure showing groundwater plumes in 2005 and in 2010 to demonstrate the effectiveness of site remediation.

If you have any questions regarding this letter, please contact me at (714) 484-5458.

Sincerely,

Stephen Niou

Stephen Niou, P.E.
Brownfields and Environmental Restoration Program

Printed on Recycled Paper

California Regional Water Quality Control Board
Santa Ana Region

Linda S. Adams
Secretary for Environmental Protection

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Phone (951) 782-4130 • FAX (951) 781-6288 • TDD (951) 782-3221
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Arnold Schwarzenegger
Governor

December 29, 2010

Ms. Pei-Fen Tamashiro
Installation Restoration Coordinator
pei-fen.tamashiro@navy.mil
Naval Weapons Station, Seal Beach
800 Seal Beach Blvd.
Seal Beach, CA 90740-5000

COMMENTS ON DRAFT COMPREHENSIVE PERFORMANCE MONITORING REPORT (OCTOBER 2005 THROUGH MAY 2010), FULL-SCALE ENHANCED *IN SITU* BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS, INSTALLATION RESTORATION PROGRAM SITE 40, U.S. NAVAL WEAPONS STATION SEAL BEACH
GeoTracker No. DOD100354200

Dear Ms Tamashiro:

We have completed our review of the above-referenced document, dated December 3, 2010, which we received December 6, 2010. This report summarizes the operational status and the results of the remedial action for chlorinated ethenes in groundwater at the Site 40 concrete, pit, and gravel area release site associated with the Building 240 locomotive shop.

We have the following comments on this report:

- **6.0 RECOMMENDATIONS**, 1) first sentence, Page 6-1: Recommends annual groundwater monitoring to assess natural attenuation for a selected set of groundwater monitoring wells. We normally require semiannual monitoring of an appropriate monitoring network for an initial demonstration period for a natural attenuation demonstration and verification monitoring following remedial actions.

For any questions, please call me at (951) 782-4494, or send e-mail to jbroderick@waterboards.ca.gov.

Sincerely,

John Broderick
Land Disposal and DoD Section

cc via electronic copy:
Brenda Reese, Navy - Brenda.reese@navy.mil
Stephen Niou, DTSC - sniou@dtsc.ca.gov
Kirk Gilligan, SB NWR - kirk.gilligan@navy.mil

RESPONSE TO AGENCIES' COMMENTS ON DRAFT COMPREHENSIVE PERFORMANCE MONITORING REPORT (OCTOBER 2005 THROUGH MAY 2010)

December 3, 2010

FULL-SCALE ENHANCED IN SITU BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS INSTALLATION RESTORATION PROGRAM SITE 40 NAVAL WEAPONS STATION SEAL BEACH SEAL BEACH, CALIFORNIA

DCN: ECSD-2201-0010-0006

Mr. John Broderick Water Resources Control Engineer California Regional Water Quality Control Board Santa Ana Region 3737 Main Street, Suite 500 Riverside, California 92501 Comments: December 29, 2010	Response by: Ms. Pei-Fen Tamashiro Installation Restoration Coordinator Naval Weapons Station, Seal Beach 800 Seal Beach Blvd. Seal Beach, CA 90740-5000 Response: February 14, 2011
GENERAL COMMENTS	
Comment 1. Section 6.0 Recommendations, 1) first sentence, Page 6-1: Recommends annual groundwater monitoring to assess natural attenuation for a selected set of groundwater monitoring wells. We normally require semiannual monitoring of an appropriate monitoring network for an initial demonstration period for a natural attenuation demonstration and verification monitoring following remedial actions.	**Response 1.** Following the initial phase of the bioremediation activities, the Navy conducted monthly sampling from March 2005 through December 2005, after which the monitoring frequency was reduced to quarterly. Quarterly summary updates were prepared and provided to the Water Board and the DTSC for information on a regular basis. Copies of the reports are provided in Attachment 1 of the draft Comprehensive Performance Monitoring Report (TtEC 2010). Following the January 2008 monitoring event, and after assessing the historical data and trends, it was recommended that the monitoring frequency of several of the wells be reduced to annually. No COC concentrations above the detection limits have been reported in these wells either since the start of the project or for at least four quarters. Several of the wells that had one or more COCs with concentrations that exceeded their MCLs, but were less than 10 times the MCL and showed a reducing trend, were proposed for semiannual monitoring. The remaining wells that did not meet the above criteria were proposed for quarterly monitoring. Following the second round of HRC injection in October and November 2008, an assessment of the recommended monitoring frequency for all the wells was made, and the monitoring frequency was

	reduced to annually for all wells that had reported COC concentrations exceeding their respective MCLs. After discussing with the Water Board and DTSC on December 4, 2008, the next round of monitoring at IRP Site 40 was conducted 1 year after the May 2009 event. The May 2010 monitoring included the same wells and analytes that were monitored in May 2009. Based on the analytical and water level data collected since 2005, reversing the frequency back to semiannual would not provide beneficial information for monitoring for natural attenuation. Therefore, no change is recommended for Section 6.0.

RESPONSE TO AGENCIES' COMMENTS ON
DRAFT COMPREHENSIVE PERFORMANCE MONITORING REPORT
(OCTOBER 2005 THROUGH MAY 2010)

December 3, 2010

FULL-SCALE ENHANCED IN SITU BIOREMEDIATION OF
CHLORINATED VOLATILE ORGANIC COMPOUNDS
INSTALLATION RESTORATION PROGRAM SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

DCN: ECSD-2201-0010-0006

Mr. Stephan Niou California Environmental Protection Agency Department of Toxic Substances Control 5796 Corporate Avenue Cypress, CA 90630 Comments: January 20, 2011	Response by: Ms. Pei-Fen Tamashiro, PG Naval Weapons Station Seal Beach N45W, Building 230 800 Seal Beach Blvd Seal Beach, CA 90740-5000 Response: February 14, 2011
GENERAL COMMENTS	
Comment 1. The report states that groundwater levels are measured on a quarterly basis and found that water flow direction remains unchanged We recommend that the report show all four seasons' groundwater level contours so that questions on possible changes in groundwater migration direction may be resolved. DTSC also recommends that the report include a figure showing groundwater plumes in 2005 and in 2010 to demonstrate the effectiveness of site remediation.	**Response 1.** Upon further review, the following statement more accurately reflects the frequency of groundwater level measurements between 2005 and 2010: "Initially, from November 2005 through March 2006, groundwater level measurements were collected monthly from all wells. After that, through October 2008, groundwater levels were measured quarterly. Subsequently, in May 2009 and May 2010 groundwater level measurements were collected." Appendix A of the final report will include groundwater contour maps (Figures A-1 through A-4) for the four quarters (January, April, July, and October) in 2008 (the last year that monitoring was conducted quarterly) using data from wells screened at similar intervals. The 2008 data show minor seasonal variations in groundwater levels. Based on the contour maps, the groundwater flow direction is generally towards the southeast. The calculated flow gradients for the four quarters (January, April, July, and October) in 2008 were 0.0037, 0.0064, 0.0035, and 0.0027 foot/foot, respectively. Figure 4-1 shows measured groundwater levels in several key groundwater monitoring wells at the site. Groundwater level measurement data collected from November 2005 through May 2010 for key monitoring wells are presented in Table 4-1 and shown on Figure 4-1.

	The May 2010 groundwater contour map (Figure 4-2) has been revised to use the same wells used to construct the groundwater contour maps in Figures A-1 through A-4. The groundwater flow direction in May 2010 was very similar to the flow direction depicted on Figures A-1 to A-4 for 2008 monitoring results. Figure 1-3 presents the pre-remediation PCE plume concentration contour map, and Figure 4-5 presents the most current plume boundaries for the COCs based on the May 2010 data. A new Figure 3-1 will be added to the report to show the composite plume delineations for PCE, TCE, 1,2-DCE, and VC, based on the September 2005 data. The following will be added to the end of Section 3.2: "A composite of the COC concentration contours based on September 2005 data is shown on Figure 3-1. Figure 3-1 will be used for comparison with the data collected in May 2010 and presented on Figure 4-5 to demonstrate the effectiveness of site remediation." Current Figures 3-1 and 3-2 will be renumbered as Figures 3-2 and 3-3, respectively.

California Regional Water Quality Control Board
Santa Ana Region

Linda S. Adams
Acting Secretary for Environmental Protection

3737 Main Street, Suite 500, Riverside, California 92501-3348
Phone (951) 782-4130 • FAX (951) 781-6288
www.waterboards.ca.gov/santaana

Edmund G. Brown, Jr.
Governor

February 23, 2011

Ms. Pei-Fen Tamashiro
Installation Restoration Coordinator
pei-fen.tamashiro@navy.mil
Naval Weapons Station, Seal Beach
800 Seal Beach Blvd.
Seal Beach, CA 90740-5000

REPLY TO RESPONSE TO AGENCY COMMENTS ON DRAFT COMPREHENSIVE PERFORMANCE MONITORING REPORT, DECEMBER 3, 2010, FULL-SCALE ENHANCED IN SITU BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS, INSTALLATION RESTORATION PROGRAM SITE 40, U.S. NAVAL WEAPONS STATION, SEAL BEACH
GeoTracker No. DOD100354200

Dear Ms. Tamashiro:

We have completed our review of the above-referenced document, dated February 14, 2011, which we received electronically on February 16, 2010. This document contains responses to our and the Department of Toxic Substances Control comments.

We have no counter comments on Response 1 to our comment, and hereby concur with the continuance of the annual groundwater sample frequency at Site 40.

For any questions, please call me at (951) 782-4494, or send e-mail to jbroderick@waterboards.ca.gov .

Sincerely,

John Broderick
Land Disposal and DoD Section

cc via electronic copy:
Brenda Reese, Navy - Brenda.reese@navy.mil
Stephen Niou, DTSC - sniou@dtsc.ca.gov
Kirk Gilligan, SB NWR - kirk.gilligan@navy.mil

ATTACHMENT 1

SUMMARIES OF FIELD ACTIVITIES AND DATA REPORTS

(ON CD ONLY)

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TETRA TECH EC, INC.

OCTOBER 2005, MONTHLY SUMMARY OF FIELD ACTIVITIES AND DATA ENHANCED *IN SITU* BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS VIA LACTATE INJECTION

INSTALLATION RESTORATION PROGRAM SITE 40
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CA

Date: November 10, 2005

Prepared by: Hamlet Hamparsumian and Mark Losi, Tetra Tech EC, Inc. (TtEC)

Distribution:	**Navy**	**TtEC**	**Agencies**
	Si Le	Hamlet Hamparsumian	Patricia Hannon (WB)
	Pei-Fen Tamashiro	Mark E. Losi	Katherine Leibel (DTSC)
	Chris Leadon		

INTRODUCTION

This is the seventh monthly report documenting activities conducted in association with groundwater remediation activities at Installation Restoration Program (IRP) Site 40. This monthly report provides a brief review of site activities conducted during the last week of September through mid-October 2005 and briefly summarizes the status of the bioremediation project. Monitoring and other field activities conducted during the period are summarized in Table 1, and the locations of substrate injection wells and groundwater monitoring wells are shown on Figure 1.

SUMMARY OF FIELD ACTIVITIES

The field activities included ongoing monitoring activities, continued lactate injection, and assessment of relevant data collected to date. Results of the monitoring activities are briefly discussed in the following section.

MONITORING EVALUATION

Lactate injection data, groundwater and soil vapor monitoring well data, and groundwater levels are briefly discussed below. Groundwater monitoring well data for chemicals of concern (COCs) are included on Figure 1. In addition, concentration trends (molar basis) and are presented graphically in Figure 2.

Lactate Injection. Following bioaugmentation (September 19 and 21) lactate injections were conducted on October 4, 5, 6, and 11. The 3 percent sodium lactate solution was injected into the following wells: IW-3, -4, -5, -6, -7, -8, -9, -10, -11, -12, -13, -14, -15, -16, -18, -19. A total of approximately 37,000 gallons of sodium lactate solution was injected during the October 4, 5, 6, and 11 injections.

Groundwater Data. The general trends are discussed in the following subsections.

COCs – The following key observations are noted:

1) As can be seen in Figures 1 and 2, trends regarding tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE) are still inconclusive and suggest that some desorption and redistribution of contaminants may still be occurring. Overall, however, PCE and TCE generally

appear to be degrading to DCE to varying degrees, and effectiveness is expected to occur over the next several months. This is because much of the site appears to be appropriately reduced, continuing lactate injection will expand the reduced area, and the KB-1 inoculum can be expected to follow the expanding reduced "envelope" surrounding the injection wells during subsequent lactate injections.

2) COC concentrations in MW-40-07 increased slightly [from 63 micrograms per liter (μg/L) to 110 μg/L]. This represents an increase; however it is anticipated that the new injection wells (IW-18 and -19) will help in addressing contamination in this area.

3) PCE was detected at a concentration of 16 μg/L in MW-40-17 during the September monitoring event. The detection of PCE in MW-40-17 is unexpected and it could be a one-time coincidental detection. Therefore, this cannot be interpreted as an indication of plume expansion in the easterly direction at this time, based solely on one detection. Further sampling and data analysis will be performed over several additional months to confirm whether or not PCE is impacting groundwater at this location.

Lactate Distribution and Geochemical and Microbiological Parameters – Substrate and geochemical data generally indicate that much of the site is reduced and is responding to the lactate injections. A summary of the evidence of increasing biological activity and conditions supportive of reductive dechlorination is provided in Table 2.

Soil Vapor Data. No significant concentrations of methane gas within Buildings 239 and 240 and surrounding areas were detected during the methane gas emissions monitoring performed on September 27 and October 17, 2005. Of the 31 probes that were tested in the field for methane gas concentrations, 25 had methane concentrations ranging from as low as 4.4 percent up to 92.8 percent of in air. The highest methane concentration was detected in the nested probe in injection well IW-14. The average concentration in all soil vapor/gas monitoring wells and nested probes (in the groundwater and injection wells) was 57.5 percent methane in air. TtEC is conducting more frequent surface emissions monitoring on weekly basis to assess the methane concentrations in the vadose zone. Hydrogen sulfide was detected in 11 out of 31 probes that were tested, ranging from 4 parts per million by volume (ppmv) to 175 ppmv.

Groundwater Levels. No significant changes in groundwater elevation data were observed. Groundwater elevations within the site, measured in September 2005, ranged from 1.51 feet above mean sea level (msl) (in MW-40-38) to 2.37 feet above msl (in IW-16).

SUMMARY AND FOLLOW-UP ACTIVITIES

Although the contaminants still appear to be undergoing some degree of desorption and redistribution, reductive dechlorination appears to be occurring to various degrees over the most crucial areas of the site. This is expected to improve over the next several months, as conditions are generally favorable for reductive dechlorination, bioaugmentation has been carried out, and lactate injections have been resumed.

COC levels in MW-40-07 increased from 63 μg/L to 110 μg/L, and PCE was detected for the first time in MW-40-17.

The following activities will be conducted over the month of November:

- Resume lactate injections, however, at a reduced rate. This will continue to provide electron donor required to maintain appropriate conditions for the recently injected inoculum and will aid in transport of the bioaugmented organisms radially from the injection points. The frequency of sodium lactate injection in the bioaugmented injection wells will be reduced to half of the initial frequency (at once a week) in order to minimize the potential for

contaminant migration and may be adjusted based on field and laboratory data, including COCs, chemical oxygen demand, oxidation/reduction potential, geochemical, and microbiological measurements.

- Continue to address downgradient COC detection in the vicinity of MW-40-07 through monitoring (and injection of lactate into newly installed injection wells IW-18 and –19). In addition, continue to assess PCE detected in well MW-40-17 through monitoring. We propose collecting groundwater samples from MW-40-17 every other month for COC analyses.
- As stated in the Work Plan, the list of analytical parameters are subject to refinement based on review of the results to incorporate only analyses that yield useful data in monitoring the enhanced *in situ* bioremediation process. In addition, it is stipulated that the sampling frequency would be on monthly basis for the first 3 months and quarterly for the remainder of the first year. We have continued to collect laboratory data on a monthly basis, and field data (using field analytical kits) were initially collected biweekly, but were reduced to monthly during October because they were not providing useful information toward performance assessment or for making operational adjustments. We recommend that sampling for laboratory analysis be conducted on a monthly basis rather than quarterly, during the months of November 2005 through January 2006, due to the fact that the system is at a critical juncture. Afterward, the sampling frequency may be reduced to quarterly. However, we propose to eliminate the field kit analyses, as the monthly laboratory data are comprehensive and adequate for performance assessment. The monthly sampling events will continue to include field analysis of DO, pH, ORP, temperature, and conductivity, using the flow-through cell field analyzer.

TABLES

Table 1 Summary of Monitoring Activities Conducted During October

Table 2 Summary of Biological Activity and Reductive Dechlorination in Select Monitoring Wells

FIGURES

Figure 1 Chemicals of Concern Results (March through September 2004)

Figure 2 Chemicals of Concern Trends Over Time by Location, Molar Basis

TABLES

TABLE 1

SUMMARY OF MONITORING ACTIVITIES CONDUCTED DURING OCTOBER

Date	Event	Wells Sampled[1]	Analytes[2]/Parameters	Notes
From: 9/26/05 To: 9/30/05	Scheduled monthly laboratory and field parameter sampling and analysis	Groundwater: MW-40-01, -02, -06, -07, -08, -10, -11, -13, -14 -15, -17, -19, -20, -22, and -30 through –39.	VOCs, cations, microbial parameters, soil vapor, water levels, COD, SO_4^{2-}, Fe^{2+}, CO_2, alkalinity, and NO_3^- additional geochemical parameters IW-18: VOCs, field parameters; wells 7 and 39, VOCs, selected geochemical parameters, and field parameters	
10/11/05	Monthly soil vapor testing	Soil Vapor: VW-1 through VW-6, IW-1, IW-3, IW-7, MW-40-31, and MW-40-34	soil vapor parameters	
From: 10/13/05 To: 10/18/05	Field parameter sampling and analytical field kit	Groundwater: MW-40-02, -07, -14, -22, and -30 through –39	COD, SO_4^{2-}, Fe^{2+}, CO_2, alkalinity, and NO_3^-, additional geochemical parameters	
10/19/05	Waste and selected well testing	Solid waste, wastewater, HP-1 through -3.	Waste: VOCs and metals. HP-1 through -3, VOCs	
10/24 – 10-26	Scheduled monthly laboratory and field parameter sampling and analysis	Groundwater: MW-40-02, -07, -14, -22, and -30 through –39, IW-6, -9, -13, -14.	VOCs, cations, DNA, soil vapor, water levels, COD, SO_4^{2-}, Fe^{2+}, CO_2, alkalinity, and NO_3^- additional geochemical parameters, IW-6: VOCs only IW-9, -13, -14: VOCs and DNA.	Note that field test kits (COD, SO_4^{2-}, Fe, CO_2, alkalinity, NO_3^-) were not conducted
10/31	Soil vapor sampling	VW-40-01 through -06, MW-40-34, IW-1, -3, -7	VOCs and fixed gasses.	

Notes:

[1]Refer to Figure 1 for well locations
[2]Refer to SAP for complete list of analytes

CO_2 – carbon dioxide
COD – chemical oxygen demand
Fe^{2+} - ferrous iron
NO_3^- - nitrate
SAP – Sampling and Analysis Plan
SO_4^{2-} - sulfate
VOC – volatile organic compound

TABLE 2

SUMMARY OF BIOLOGICAL ACTIVITY AND REDUCTIVE DECHLORINATION IN SELECT MONITORING WELLS

		Evidence of Increasing Biological Activity and Conditions Supportive of Reductive Dechlorination[1,2]												
Well	**General Location**	**PCE/TCE Decrease**	**DCE Accumulation**	**VC Generation**	**COD Increase**	**VFA Increase**	**Sulfate Reduction**	**CO_2 Production**	**CH_4 Production**	**H_2S Production**	**Reducing ORP**	**Increasing Alkalinity**	**Increasing DHC/PLFA Biomass**	**Comments and General Assessment**
MW-40-2	Upgradient edge				○				○		○			Located upgradient of all injection wells; COC levels very low; slight decrease in PCE concentration and general upward trend in COD may indicate that this well is beginning to respond to lactate injection.
MW-40-14	Plume center	●	●	○	●	●	●	●	○	○	●	●	○	Located in key area of plume; contained COCs at relatively high levels; appears to be responding reasonably well to treatment.
MW-40-22	Pilot study area				○				○	○	●			COC levels very low, PCE/TCE below MCLs, low and decreasing levels of DCE, VC, and ethene suggest reductive dechlorination in the past, process near completion.
MW-40-30	Off plume center toward cross-gradient edge	●	●		○		○	●	●	○	○	○	○	Key plume well; appears to be generally responding to treatment; expected to respond favorably to bioaugmentation.
MW-40-31	Off plume center toward cross-gradient edge	●	●	○	●	●	●	●	●	●	●	●	○	Key plume well; appears to be responding to treatment; expected to respond favorably to bioaugmentation.
MW-40-32	Off plume center toward cross-gradient edge	●	●	○	●	●	●	●	●		●	●	○	Key plume well; appears to be responding to treatment; expected to respond favorably to bioaugmentation.
MW-40-33	Cross-gradient edge				○		○	●			●		○	COCs have not been detected in this well; nevertheless, appears to be responding to lactate to some degree; not deemed crucial in performance assessment at this time.
MW-40-34	Off plume center toward cross-gradient edge	●	●		●		●	●	●	●	●	●	●	Appears to be behaving as expected in many respects; however, inconsistencies in several key parameters (COCs, COD, sulfate) suggest COC redistribution may be significant and/or substrate transport is not optimal in this area; COC rebound may be transitory.
MW-40-35	Plume center	●	●		●	●	●	●	●	●	●	●		Key plume well; appears to be responding to treatment; expected to respond favorably to bioaugmentation.
MW-40-36	Plume center		●		●		●	●	●		●			Key plume well; limited response to treatment is evident at this time; however, most recent sampling event indicates that substrate is now present; may respond respond favorably to bioaugmentation; may require recirculation to better facilitate transport of substrate and/or inoculum.
MW-40-37	Plume center	●	●		●			●	●	●	●		●	Key plume well; appears to be behaving as expected in some respects; however, inconsistencies in several key parameters (COCs, COD) suggest redistribution may be significant and/or substrate transport is not optimal in this area; COC rebound may be transitory.
MW-40-38	Crossgradient edge				○			○	○		○		○	COCs never measured at levels above MCLs in this well; COD impacts may now be evident; not deemed crucial in performance assessment at this time.
MW-40-39	Down-gradient edge				○		○	○						COCs never measured at levels above MCLs in this well; not deemed crucial in performanc assessment at this time.

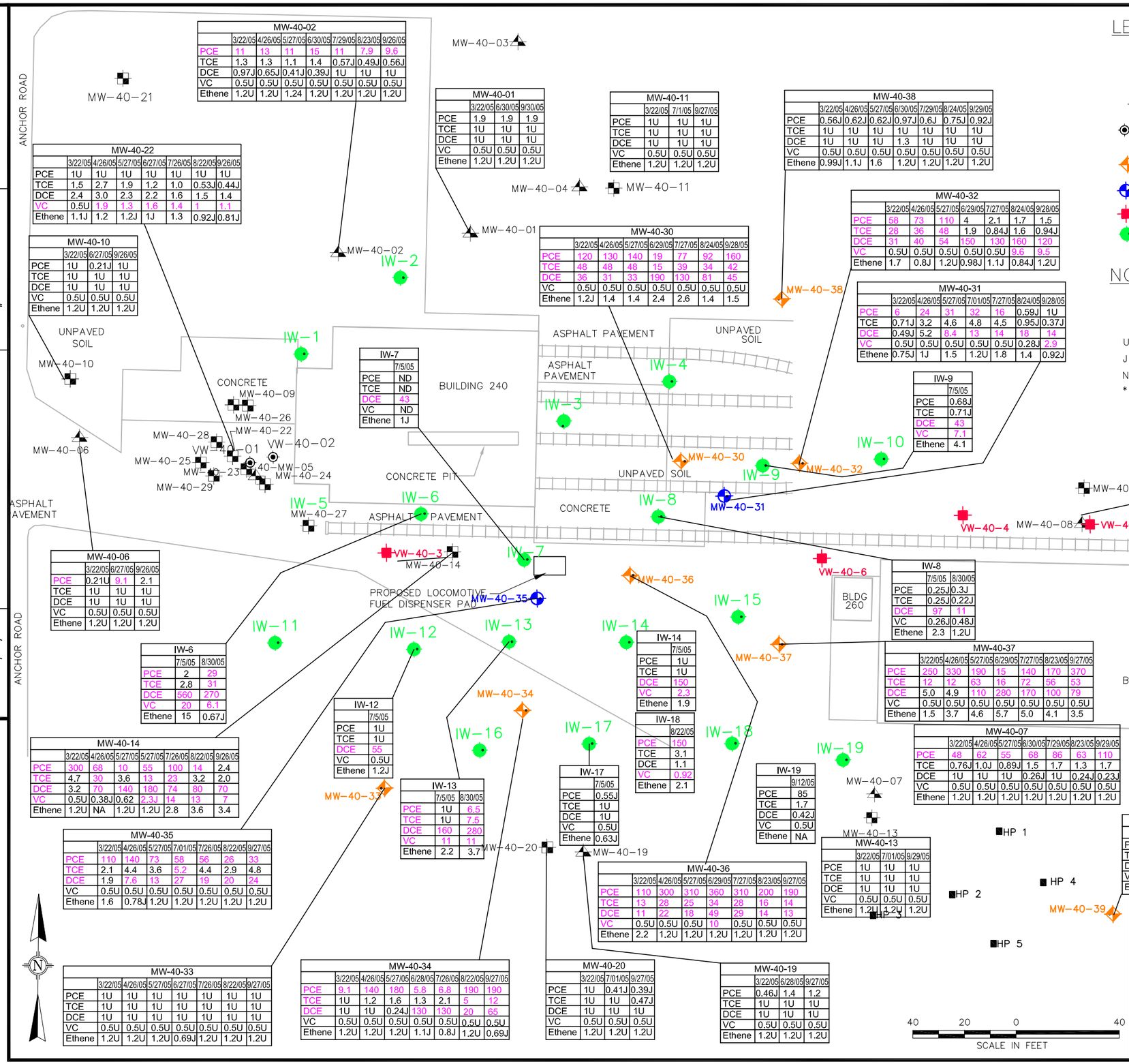
Notes:

1) Black-filled circles indicate strong evidence; gray filled circles indicate some, but less certain evidence; a blank field indicates little or no evidence

2) DO and NO_3^- data are not included. These analytes were not detected or were detected at very low levels in all monitoring wells, which suggests that anoxic (but not strongly reducing) conditions are present site-wide.

CH_4 - methane
CO_2 - carbon dioxide
COC - chemical of concern
COD - chemical oxygen demand
DCE - dichloroethene
DHC - *Dehalococcoides ethenogenes* spp.
DO - dissolved oxygen
H_2S - hydrogen sulfide
MCL - Maximum Containment Level
NO_3^- - nitrate
ORP - oxidation/reduction potential
PCE - tetrachloroethene
PLFA - phospholipid fatty acid
TCE - trichloroethene
VC - vinyl chloride
VFA - volatile fatty acid

FIGURES



MW-40-02	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/26/05
PCE	11	13	11	15	11	7.9	9.6
TCE	1.3	1.3	1.1	1.4	0.57J	0.49J	0.56J
DCE	0.97J	0.65J	0.41J	0.39J	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.24	1.2U	1.2U	1.2U	1.2U

MW-40-01	3/22/05	6/30/05	9/30/05
PCE	1.9	1.9	1.9
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-11	3/22/05	7/1/05	9/27/05
PCE	1U	1U	1U
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-38	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/24/05	9/29/05
PCE	0.56J	0.62J	0.62J	0.97J	0.6J	0.75J	0.92J
TCE	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1.3	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.99J	1.1J	1.6	1.2U	1.2U	1.2U	1.2U

MW-40-22	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05
PCE	1U	1U	1U	1U	1U	1U	1U
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J

MW-40-10	3/22/05	6/27/05	9/26/05
PCE	1U	0.21J	1U
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-30	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05
PCE	120	130	140	19	77	92	160
TCE	48	48	48	15	39	34	42
DCE	36	31	33	190	130	81	45
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2J	1.4	1.4	2.4	2.6	1.4	1.5

MW-40-32	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05
PCE	58	73	110	4	2.1	1.7	1.5
TCE	28	36	48	1.9	0.84J	1.6	0.94J
DCE	31	40	54	150	130	160	120
VC	0.5U	0.5U	0.5U	0.5U	0.5U	9.6	9.5
Ethene	1.7	0.8J	1.2U	0.98J	1.1J	0.84J	1.2U

MW-40-31	3/22/05	4/26/05	5/27/05	7/01/05	7/27/05	8/24/05	9/28/05
PCE	6	24	31	32	16	0.59J	1U
TCE	0.71J	3.2	4.6	4.8	4.5	0.95J	0.37J
DCE	0.49J	5.2	8.4	13	14	18	14
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.28J	2.9
Ethene	0.75J	1J	1.5	1.2U	1.8	1.4	0.92J

IW-7	7/5/05
PCE	ND
TCE	ND
DCE	43
VC	ND
Ethene	1J

IW-9	7/5/05
PCE	0.68J
TCE	0.71J
DCE	43
VC	7.1
Ethene	4.1

MW-40-08	3/22/05	6/29/05	9/28/05
PCE	7.3	10	7.5
TCE	1.2	1.9	1.4
DCE	0.22J	0.34J	0.21J
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-17	3/22/05	6/29/05	9/28/05
PCE	0.51J	0.51J	16
TCE	1U	1U	0.21J
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-06	3/22/05	6/27/05	9/26/05
PCE	0.21U	9.1	2.1
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

IW-8	7/5/05	8/30/05
PCE	0.25J	0.3J
TCE	0.25J	0.22J
DCE	97	11
VC	0.26J	0.48J
Ethene	2.3	1.2U

MW-40-15	3/22/05	6/30/05	9/28/05
PCE	1U	1U	0.26J
TCE	1U	1U	0.26J
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.1J	1.2U	1.2U

IW-6	7/5/05	8/30/05
PCE	2	29
TCE	2.8	31
DCE	560	270
VC	20	6.1
Ethene	15	0.67J

IW-14	7/5/05
PCE	1U
TCE	1U
DCE	150
VC	2.3
Ethene	1.9

MW-40-37	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05
PCE	250	330	190	15	140	170	370
TCE	12	12	63	16	72	56	53
DCE	5.0	4.9	110	280	170	100	79
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.5	3.7	4.6	5.7	5.0	4.1	3.5

IW-12	7/5/05
PCE	1U
TCE	1U
DCE	55
VC	0.5U
Ethene	1.2J

IW-18	8/22/05
PCE	150
TCE	3.1
DCE	1.1
VC	0.92
Ethene	2.1

MW-40-07	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/29/05
PCE	48	62	55	68	86	63	110
TCE	0.76J	1.0J	0.89J	1.5	1.7	1.3	1.7
DCE	1U	1U	1U	0.26J	1U	0.24J	0.23J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-14	3/22/05	4/26/05	5/27/05	5/27/05	7/26/05	8/22/05	9/26/05
PCE	300	68	10	55	100	14	2.4
TCE	4.7	30	3.6	13	23	3.2	2.0
DCE	3.2	70	140	180	74	80	70
VC	0.5U	0.38J	0.62	2.3J	14	13	7
Ethene	1.2U	NA	1.2U	1.2U	2.8	3.6	3.4

IW-13	7/5/05	8/30/05
PCE	1U	6.5
TCE	1U	7.5
DCE	160	280
VC	11	11
Ethene	2.2	3.7

IW-17	7/5/05
PCE	0.55J
TCE	1U
DCE	1U
VC	0.5U
Ethene	0.63J

IW-19	9/12/05
PCE	85
TCE	1.7
DCE	0.42J
VC	0.5U
Ethene	NA

MW-40-39	3/22/05	4/26/05	4/26/05	6/30/05	7/29/05	8/23/05	9/29/05
PCE	1U	1U	1U	1U	0.34J	0.29J	0.35J
TCE	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	NA

MW-40-35	3/22/05	4/26/05	5/27/05	7/01/05	7/26/05	8/22/05	9/27/05
PCE	110	140	73	58	56	26	33
TCE	2.1	4.4	3.6	5.2	4.4	2.9	4.8
DCE	1.9	7.6	13	27	19	20	24
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.6	0.78J	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-36	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05
PCE	110	300	310	360	310	200	190
TCE	13	28	25	34	28	16	14
DCE	11	22	18	49	29	14	13
VC	0.5U	0.5U	0.5U	10	0.5U	0.5U	0.5U
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-13	3/22/05	7/01/05	9/29/05
PCE	1U	1U	1U
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-33	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/27/05
PCE	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	0.69J	1.2U	1.2U	1.2U

MW-40-34	3/22/05	4/26/05	5/27/05	6/28/05	7/26/05	8/22/05	9/27/05
PCE	9.1	140	180	5.8	6.8	190	190
TCE	1U	1.2	1.6	1.3	2.1	5	12
DCE	1U	1U	0.24J	130	130	20	65
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.1J	0.8J	1.2U	0.69J

MW-40-20	3/22/05	7/01/05	9/27/05
PCE	1U	0.41J	0.39J
TCE	1U	1U	0.47J
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-19	3/22/05	6/28/05	9/27/05
PCE	0.46J	1.4	1.2
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION INSTALLED BY BNI
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION INSTALLED BY BNI
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION INSTALLED BY BNI
- MW-40-30 — SHALLOW-INTERVAL LOCATION MONITORING WELL (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL LOCATION MONITORING WELL (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005

VALUES IN RED EXCEED REMEDIATION CRITERIA

U NOT DETECTED AT DETECTION LIMIT GIVEN

J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT

NA NOT ANALYZED

* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

IW-18 INSTALLED AUGUST 19, 2005

IW-19 INSTALLED SEPTEMBER 10, 2005

Figure 1
CHEMICALS OF CONCERN RESULTS (MARCH THROUGH SEPTEMBER 2005)

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 1.DWG
DCN: FWSD-RAC- CTO: #0090
APPROVED BY: HH
CHECKED BY: ML REV: REVISION 0
DRAWN BY: MD DATE: 08/23/05

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\OCTOBER 2005\DWG\FIG 1.DWG
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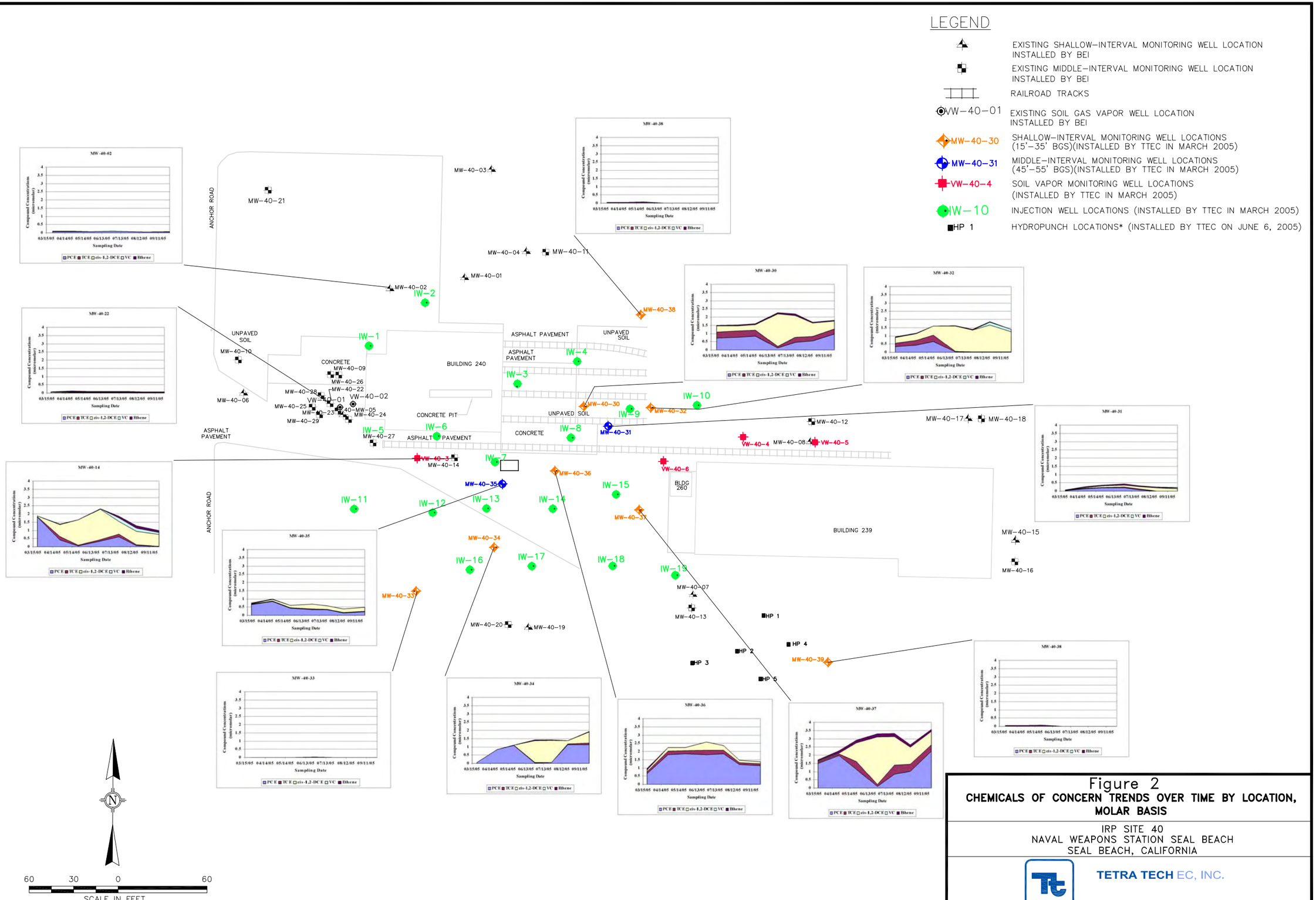

Figure 2

CHEMICALS OF CONCERN TRENDS OVER TIME BY LOCATION, MOLAR BASIS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 2.DWG
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: MT
REV: REVISION 0
DRAWN BY: MD
DATE: 08/23/05

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\OCTOBER 2005\DWG\FIG 2.DWG
PLOT/UPDATE: NOV 10 2005 13:20:13

TETRA TECH EC, INC.

NOVEMBER 2005, MONTHLY SUMMARY OF FIELD ACTIVITIES AND DATA ENHANCED *IN SITU* BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS VIA LACTATE INJECTION

INSTALLATION RESTORATION PROGRAM SITE 40
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CA

Date: November 21, 2005

Prepared by: Hamlet Hamparsumian and Mark E. Losi, Tetra Tech EC, Inc. (TtEC)

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	Chris Leadon		

INTRODUCTION

This is the eighth monthly report documenting activities conducted in association with groundwater remediation activities at Installation Restoration Program (IRP) Site 40. This monthly report provides a brief review of site activities conducted during the last week of October through mid-November 2005 and briefly summarizes the status of the bioremediation project. Monitoring and other field activities conducted during the period are summarized in Table 1, and the locations of substrate injection wells and groundwater monitoring wells are shown on Figure 1.

SUMMARY OF FIELD ACTIVITIES

The field activities included ongoing monitoring activities, continued lactate injection, and assessment of relevant data collected to date. Results of the monitoring activities are briefly discussed in the following section.

MONITORING EVALUATION

Lactate injection data, groundwater and soil vapor monitoring well data, and groundwater levels are briefly discussed below. Groundwater monitoring well data for chemicals of concern (COCs) are included on Figure 1 for the monitoring wells and Figure 2 for the injection wells. In addition, concentration trends (molar basis) are presented graphically in Figure 3.

Lactate Injection. As noted in the prior monthly report, lactate injections were conducted on October 4, 5, 6, and 11. A total of approximately 37,000 gallons of 3 percent sodium lactate solution were injected during those 4 days. Following that, lactate injections were continued from November 7 to November 16, 2005. Since November 7, lactate was injected into the following wells: IW-3, -4, -6, -7, -8, -9, -10, -11, -12, -13, -14, -15, -16, -18, -19. A 3 percent solution of sodium lactate was injected once a week in each well at a rate of 4 gallons per minute (gpm) for 8 hours per day. A total of approximately 52,440 gallons of sodium lactate solution was injected during the 2 weeks from November 7 through 16, 2005, at an estimated average of 1,750 gallons per well. Sodium lactate injection will be continued at the same rate and frequency for the next 4 weeks, from November 21 through December 23, 2005.

Groundwater Data. The general trends are discussed in the following subsections.

COCs – The following key observations are noted:

1) As can be seen in Figures 1, 2, and 3, some of the rebound and plume distribution that had been evident over the past few months may have been transient. Specifically, tetrachloroethene (PCE) levels in key plume wells MW-40-30, -34, -36, and -37 had been exhibiting increasing trends over the past few months, but now reflect a decrease (Figures 1 and 3). In addition, PCE levels are either decreasing or non-detect in all injection wells for which October data were collected, and vinyl chloride (VC) was generally present (Figure 2). It is noted that for newly installed wells, IW-18 and -19, only baseline data have been collected thus far, and lactate injections have recently been performed. These wells will be analyzed again during the November monthly sampling event to assess the effects of the lactate in these areas. Overall, the data are encouraging, and continue to suggest that PCE and trichloroethene (TCE) are degrading to dichloroethene (DCE), and in some cases to VC, to varying degrees.

2) COC concentrations in MW-40-07 decreased slightly [from 110 micrograms per liter (μg/L) to 81 μg/L]. This represents a slight decrease, but is not necessarily due to biological processes, as daughter products (TCE and DCE) were not detected.

Lactate Distribution and Geochemical and Microbiological Parameters – Substrate and geochemical data continue to indicate that much of the site is reduced and is responding to the lactate injections. A summary of the evidence of increasing biological activity and conditions supportive of reductive dechlorination is provided in Table 2.

Regarding Bioaugmentation and *Dehalococcoides* spp. (DHC) populations, transport to monitoring wells is not expected at this time, as bioaugmentation was only recently conducted. However, selected injection well samples were analyzed for DHC prior to bioaugmentation (September 19 and 21), and again following bioaugmentation (October 25 and 26) at SiREM Laboratory. Results (following table) indicate order of magnitude increases in two of the three wells.

Well	DHC - September 19 and 21 Samping (16s Gene Copies/Liter[1])	DHC - October 25 and 2621 Samping (16s Gene Copies/Liter[1])
IW-9	1.7×10^6	1.0×10^6
IW-13	4.0×10^5	3.0×10^6
IW-14	5.9×10^4	5.9×10^6

[1]Generally assumed to be one gene copy/organism, therefore, results represent cells/liter

Ongoing monitoring is expected to reflect survival, growth, transport, and effectiveness of the culture.

Soil Vapor Data. Methane gas was not detected within Buildings 239 and 240 and surrounding areas during the methane gas emissions monitoring performed on October 17 and 26 and November 15, 2005. The results of probe monitoring conducted on November 1, 2005, indicated that 24 out of the 30 probes that were tested in the field had methane gas concentrations ranging from as low as 11.8 percent up to 91.4 percent in air. The highest methane concentration was detected in the nested probe in injection well IW-14. The average concentration in all soil vapor/gas monitoring wells and nested probes (in the groundwater and injection wells) was 78.9 percent methane in air. TtEC is conducting more frequent surface emissions monitoring to assess the methane concentrations in the vadose zone. Hydrogen sulfide was detected in only one nested probe out of 31 probes that were tested, and at a concentration of 2 parts per million by volume (ppmv).

Groundwater Levels. Groundwater level measurements conducted on November 1, 2005, indicted no significant changes in groundwater elevation since the previous groundwater level measurements

conducted on September 26, 2005. Groundwater elevations within the site, measured on November 1, 2005, ranged from 1.52 feet above mean sea level (msl) (in MW-40-27) to 2.35 feet above msl (in MW-40-34).

SUMMARY AND FOLLOW-UP ACTIVITIES

While overall COC data to date have suggested some degree of desorption and redistribution of PCE, the October data indicate general decreases in several of the key plume wells, including MW-40-30, -34, -36, and -37. In addition, accumulation of DCE indicates that reductive dechlorination continues to occur to various degrees over most of the site. Finally, increases in VC in several injection wells following bioaugmentation suggest preliminarily that complete reductive dechlorination is occurring. This is expected to improve over the next several months, as conditions are generally favorable for reductive dechlorination, bioaugmentation has been carried out, and lactate injections have been resumed.

COC levels in MW-40-07 decreased from 110 μg/L to 81 μg/L.

The following activities will be conducted over the month of December:

- Continue lactate injections at the current rate. This will continue to provide electron donor required to maintain appropriate conditions for the recently injected inoculum and will aid in transport of the bioaugmented organisms radially from the injection points. The frequency of sodium lactate injection in the bioaugmented injection wells were reduced to half of the initial frequency (at once a week) in order to minimize the potential for contaminant migration and appears to be adequate based on field and laboratory data, including COCs, chemical oxygen demand, oxidation/reduction potential, geochemical, and microbiological measurements.
- Continue to address downgradient COC detection in the vicinity of MW-40-07 through monitoring (and injection of lactate into newly installed injection wells IW-18 and -19). In addition, continue to assess PCE detected in well MW-40-17 through monitoring. We propose collecting groundwater samples from MW-40-17 every other month for COC analyses, including during the next sampling event in late November.
- Continue sampling for laboratory analysis on a monthly basis rather than quarterly, during the months of December 2005 through January 2006, due to the fact that the system is at a critical juncture. Afterward, the sampling frequency may be reduced to quarterly. We are no longer conducting the field kit analyses, as the monthly laboratory data are comprehensive and adequate for performance assessment. The monthly sampling events will continue to include field analysis of dissolved oxygen, pH, oxidation/reduction potential, temperature, and conductivity, using the flow-through cell field analyzer.

TABLES

Table 1 Summary of Monitoring Activities Conducted During Late October/November

Table 2 Summary of Biological Activity and Reductive Dechlorination in Select Monitoring Wells

FIGURES

Figure 1 Chemicals of Concern Results (March through October 2005) Monitoring Wells

Figure 2 Chemicals of Concern Results (March through October 2005) Injection Wells

Figure 3 Chemicals of Concern Trends Over Time by Location, Molar Basis

TABLES

TABLE 1

SUMMARY OF MONITORING ACTIVITIES CONDUCTED DURING LATE OCTOBER/NOVEMBER

Date	Event	Wells Sampled[1]	Analytes[2]/Parameters	Notes
9/26	Groundwater level measurements	MW-40-06, -10, -14, -20, -22, -30 through -39, and IW-1 through IW-17	No analysis	Water level measurements only.
9/27	Soil vapor/gas monitoring	VW-40-01 through -06, IW-1 though -4 and IW-6 through -17, and MW-40-30 through -39	Field testing for methane, hydrogen sulfide, oxygen, CO_2, and VOCs	A Landtec GEM 200 was used for field testing.
10/17	Methane gas emissions monitoring	Surface emissions in and around Buildings 240, and 239	Field testing of methane gas concentrations	A Landtec GEM 200 was used for field testing.
10/26	Methane gas emissions monitoring	Surface emissions in and around Buildings 240, and 239	Field testing of methane gas concentrations	A Landtec GEM 200 was used for field testing.
10/24 – 10-26	Scheduled monthly laboratory and field parameter sampling and analysis	Groundwater: MW-40-02, -07, -14, -22, and -30 through –39, IW-6, -9, -13, -14.	VOCs, cations, DNA, soil vapor, water levels, COD, SO_4^{2-}, Fe^{2+}, CO_2, alkalinity, and NO_3^- additional geochemical parameters IW-6: VOCs only IW-9, -13, -14: VOCs and DHC	Field test kits (COD, SO_4^{2-}, Fe^{2+}, CO_2, alkalinity, NO_3^-) were not conducted. IWs with the highest COC levels were selected to assess trends; IW-18 and -19 were excluded, as these have only recently received lactate and will be assessed in the future.
10/31	Soil vapor sampling	VW-40-01 through -06, MW-40-34, IW-1, -3, -7	VOCs and fixed gasses	

Notes:

[1]Refer to Figure 1 for well locations
[2]Refer to SAP for complete list of analytes

CO_2 – carbon dioxide
COC – chemical of concern
COD – chemical oxygen demand
DHC – *Dehalococcoides* spp.
Fe^{2+} – ferrous iron
IW – injection well
NO_3^- - nitrate
SAP – Sampling and Analysis Plan
SO_4^{2-} – sulfate
VOC – volatile organic compound

TABLE 2

SUMMARY OF BIOLOGICAL ACTIVITY AND REDUCTIVE DECHLORINATION IN SELECT MONITORING WELLS

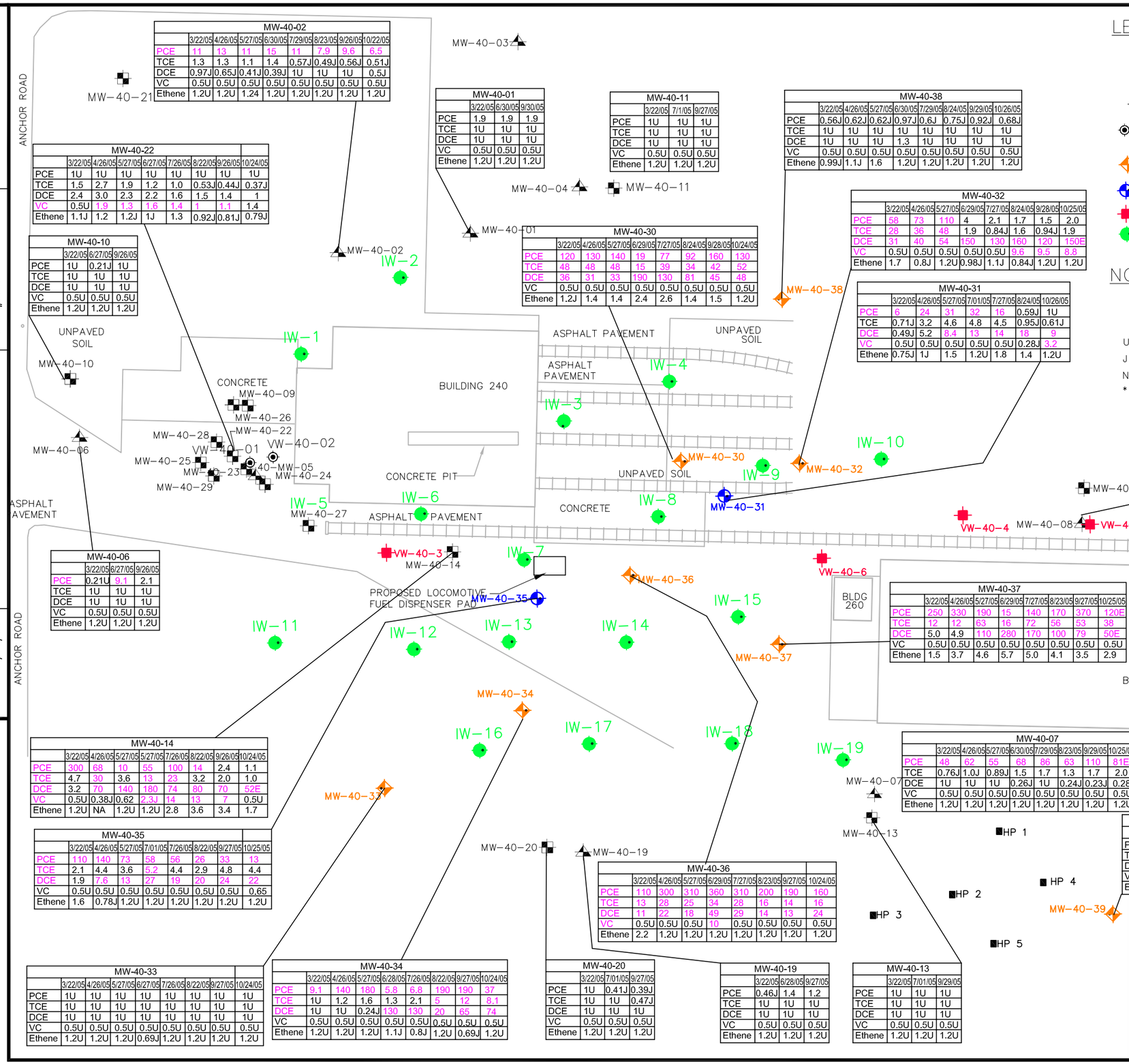
Evidence of Increasing Biological Activity and Conditions Supportive of Reductive Dechlorination[1,2]														
Well	**General Location**	**PCE/TCE Decrease**	**DCE Accumulation**	**VC Generation**	**COD Increase**	**VFA Increase**	**Sulfate Reduction**	**CO_2 Production**	**CH_4 Production**	**H_2S Production**	**Reducing ORP**	**Increasing Alkalinity**	**Increasing DHC/PLFA Biomass**	**Comments and General Assessment**
MW-40-2	Upgradient edge	○			●			○	○		○			Located upgradient of all injection wells; COC levels very low; slight decrease in PCE concentration and general upward trend in COD may indicate that this well is responding to lactate injection.
MW-40-14	Plume center	●	●	○	●	●	●	●	●	○	●	●	○	Located in key area of plume; contained COCs at relatively high levels; appears to be responding reasonably well to treatment.
MW-40-22	Pilot study area				○				●	○	●			COC levels very low, PCE/TCE below MCLs, low and decreasing levels of DCE, VC, and ethene suggest reductive dechlorination in the past, process near completion.
MW-40-30	Off plume center toward cross-gradient edge	○	●		○		○	●	●	○	○	○	●	Key plume well; appears to be generally responding to treatment.
MW-40-31	Off plume center toward cross-gradient edge	●	●	●	●	●	●	●	○	○	●	●	○	Key plume well; appears to be responding to treatment.
MW-40-32	Off plume center toward cross-gradient edge	●	●	●	●	●	●	●	●		○	●	○	Appears to be responding to treatment.
MW-40-33	Cross-gradient edge				●		○	●			○		●	COCs have not been detected in this well; nevertheless, appears to be responding to lactate to some degree; not deemed crucial in performance assessment at this time.
MW-40-34	Off plume center toward cross-gradient edge	●	●		●		○	●	●	●	●	●	●	Appears to be behaving as expected in many respects; some evidence of PCE reduction following apparent initial desorption/redistribution; COC trends still somewhat irregular, although appear more favorable at this time.
MW-40-35	Plume center	●	●		●	●	●	●	●	●	●	●		Key plume well; appears to be responding to treatment.
MW-40-36	Plume center	○	○		●		●	●	●		○	○	○	Key plume well; minor evidence of PCE reduction following apparent initial desorption; however, most recent sampling event indicates that substrate is now present.
MW-40-37	Plume center	●	●		○			●	●	○	●		○	Key plume well; appears to be behaving as expected in many respects; some evidence of PCE reduction following apparent initial desorption/redistribution; COC trends still somewhat irregular, although appear more favorable at this time.
MW-40-38	Cross-gradient edge				●			●	●		○		○	COCs never measured at levels above MCLs in this well; COD impacts may now be evident; not deemed crucial in performance assessment at this time.
MW-40-39	Downgradient edge				○		○	○						COCs never measured at levels above MCLs in this well; not deemed crucial in performance assessment at this time.

Notes:

1) Black-filled circles indicate strong evidence; gray filled circles indicate some, but less certain evidence; a blank field indicates little or no evidence
2) DO and NO_3^- data are not included. These analytes were not detected or were detected at very low levels in all monitoring wells, which suggests that anoxic (but not strongly reducing) conditions are present site-wide.
CH_4 - methane
CO_2 - carbon dioxide
COC - chemical of concern
COD - chemical oxygen demand
DCE - dichloroethene
DHC - *Dehalococcoides ethenogenes* spp.
DO - dissolved oxygen
H_2S - hydrogen sulfide
MCL - Maximum Containment Level
NO_3^- - nitrate
ORP - oxidation/reduction potential
PCE - tetrachloroethene
PLFA - phospholipid fatty acid
TCE - trichloroethene
VC - vinyl chloride
VFA - volatile fatty acid

FIGURES

DRAWING NO: FIG 1.DWG
DCN: FWSD-RAC- CTO: #0090
APPROVED BY: HH
CHECKED BY: ML REV: REVISION 0
DRAWN BY: MD DATE: 08/23/05



LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION INSTALLED BY BNI
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION INSTALLED BY BNI
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION INSTALLED BY BNI
- MW-40-30 — SHALLOW-INTERVAL LOCATION MONITORING WELL (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL LOCATION MONITORING WELL (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA
U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05
IW-18 INSTALLED AUGUST 19, 2005
IW-19 INSTALLED SEPTEMBER 10, 2005

MW-40-02

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/26/05	10/22/05
PCE	11	13	11	15	11	7.9	9.6	6.5
TCE	1.3	1.3	1.1	1.4	0.57J	0.49J	0.56J	0.51J
DCE	0.97J	0.65J	0.41J	0.39J	1U	1U	1U	0.5J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.24	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-01

	3/22/05	6/30/05	9/30/05
PCE	1.9	1.9	1.9
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-11

	3/22/05	7/1/05	9/27/05
PCE	1U	1U	1U
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-38

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/24/05	9/29/05	10/26/05
PCE	0.56J	0.62J	0.62J	0.97J	0.6J	0.75J	0.92J	0.68J
TCE	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1.3	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.99J	1.1J	1.6	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-22

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05	10/24/05
PCE	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J	0.37J
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4	1
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1	1.4
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J	0.79J

MW-40-30

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/24/05
PCE	120	130	140	19	77	92	160	130
TCE	48	48	48	15	39	34	42	52
DCE	36	31	33	190	130	81	45	48
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2J	1.4	1.4	2.4	2.6	1.4	1.5	1.2U

MW-40-32

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/25/05
PCE	58	73	110	4	2.1	1.7	1.5	2.0
TCE	28	36	48	1.9	0.84J	1.6	0.94J	1.9
DCE	31	40	54	150	130	160	120	150E
VC	0.5U	0.5U	0.5U	0.5U	0.5U	9.6	9.5	8.8
Ethene	1.7	0.8J	1.2U	0.98J	1.1J	0.84J	1.2U	1.2U

MW-40-10

	3/22/05	6/27/05	9/26/05
PCE	1U	0.21J	1U
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-31

	3/22/05	4/26/05	5/27/05	7/01/05	7/27/05	8/24/05	10/26/05
PCE	6	24	31	32	16	0.59J	1U
TCE	0.71J	3.2	4.6	4.8	4.5	0.95J	0.61J
DCE	0.49J	5.2	8.4	13	14	18	9
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.28J	3.2
Ethene	0.75J	1J	1.5	1.2U	1.8	1.4	1.2U

MW-40-08

	3/22/05	6/29/05	9/28/05
PCE	7.3	10	7.5
TCE	1.2	1.9	1.4
DCE	0.22J	0.34J	0.21J
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-17

	3/22/05	6/29/05	9/28/05
PCE	0.51J	0.51J	16
TCE	1U	1U	0.21J
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-06

	3/22/05	6/27/05	9/26/05
PCE	0.21U	9.1	2.1
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-37

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/25/05
PCE	250	330	190	15	140	170	370	120E
TCE	12	12	63	16	72	56	53	38
DCE	5.0	4.9	110	280	170	100	79	50E
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.5	3.7	4.6	5.7	5.0	4.1	3.5	2.9

MW-40-15

	3/22/05	6/30/05	9/28/05
PCE	1U	1U	0.26J
TCE	1U	1U	0.26J
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.1J	1.2U	1.2U

MW-40-14

	3/22/05	4/26/05	5/27/05	5/27/05	7/26/05	8/22/05	9/26/05	10/24/05
PCE	300	68	10	55	100	14	2.4	1.1
TCE	4.7	30	3.6	13	23	3.2	2.0	1.0
DCE	3.2	70	140	180	74	80	70	52E
VC	0.5U	0.38J	0.62	2.3J	14	13	7	0.5U
Ethene	1.2U	NA	1.2U	1.2U	2.8	3.6	3.4	1.7

MW-40-07

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05
PCE	48	62	55	68	86	63	110	81E
TCE	0.76J	1.0J	0.89J	1.5	1.7	1.3	1.7	2.0
DCE	1U	1U	1U	0.26J	1U	0.24J	0.23J	0.28J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-39

	3/22/05	4/26/05	4/26/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05
PCE	1U	1U	1U	1U	0.34J	0.29J	0.35J	0.42J
TCE	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U

MW-40-35

	3/22/05	4/26/05	5/27/05	7/01/05	7/26/05	8/22/05	9/27/05	10/25/05
PCE	110	140	73	58	56	26	33	13
TCE	2.1	4.4	3.6	5.2	4.4	2.9	4.8	4.4
DCE	1.9	7.6	13	27	19	20	24	22
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.65
Ethene	1.6	0.78J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-36

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/24/05
PCE	110	300	310	360	310	200	190	160
TCE	13	28	25	34	28	16	14	16
DCE	11	22	18	49	29	14	13	24
VC	0.5U	0.5U	0.5U	10	0.5U	0.5U	0.5U	0.5U
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-33

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/27/05	10/24/05
PCE	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U

MW-40-34

	3/22/05	4/26/05	5/27/05	6/28/05	7/26/05	8/22/05	9/27/05	10/24/05
PCE	9.1	140	180	5.8	6.8	190	190	37
TCE	1U	1.2	1.6	1.3	2.1	5	12	8.1
DCE	1U	1U	0.24J	130	130	20	65	74
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.1J	0.8J	1.2U	0.69J	1.2U

MW-40-20

	3/22/05	7/01/05	9/27/05
PCE	1U	0.41J	0.39J
TCE	1U	1U	0.47J
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-19

	3/22/05	6/28/05	9/27/05
PCE	0.46J	1.4	1.2
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-13

	3/22/05	7/01/05	9/29/05
PCE	1U	1U	1U
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

Figure 1

CHEMICALS OF CONCERN RESULTS (MARCH THROUGH OCTOBER 2005)
MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\NOVEMBER 2005\DWG\FIG 1_MONITORING_WELLS.DWG
PLOT/UPDATE: NOV 16 2005 11:12:04

DRAWING NO: FIG 2.DWG
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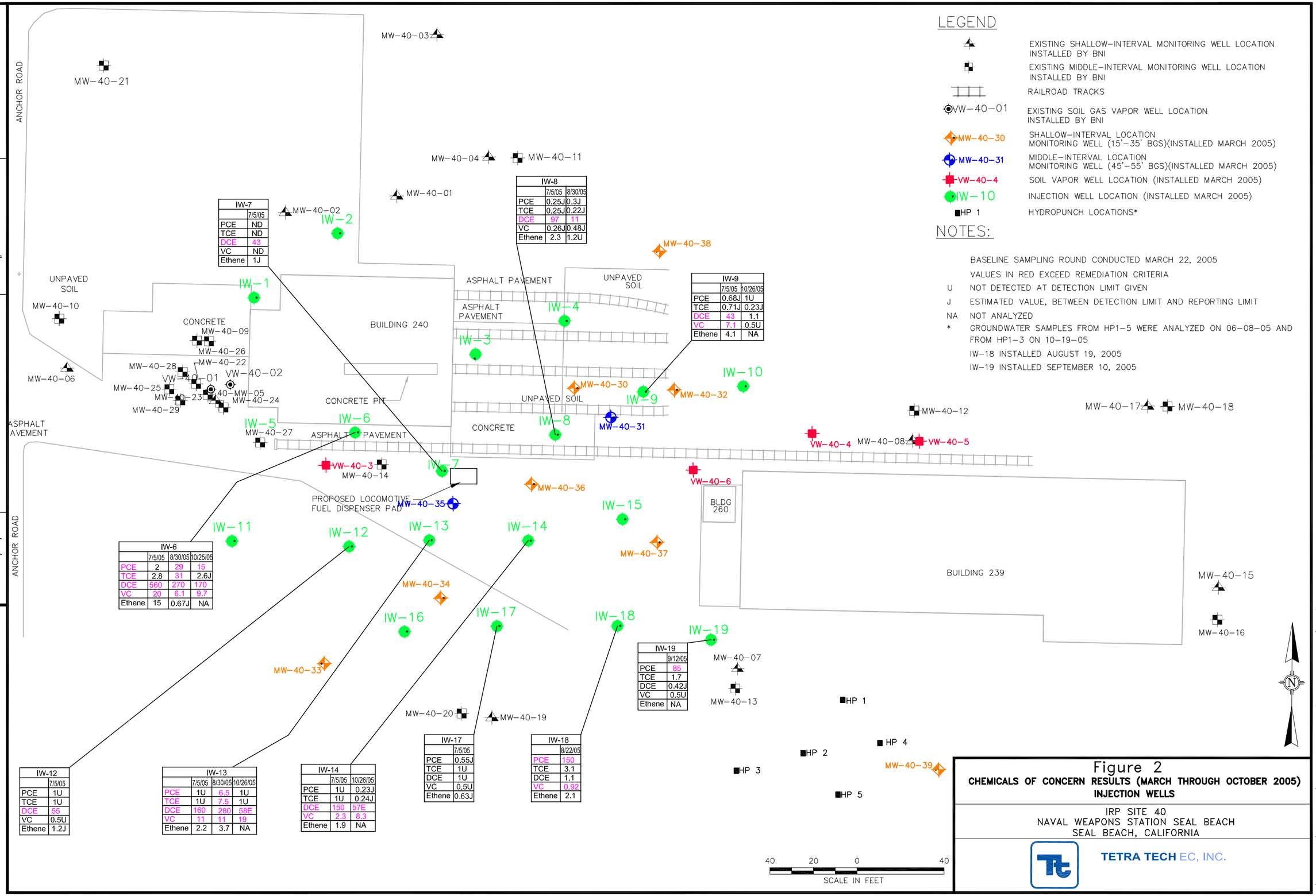
APPROVED BY: HH
CHECKED BY: ML REV: REVISION 0
DRAWN BY: MD DATE: 08/23/05



IW-7	7/5/05
PCE	ND
TCE	ND
DCE	43
VC	ND
Ethene	1J

IW-8	7/5/05	8/30/05
PCE	0.25J	0.3J
TCE	0.25J	0.22J
DCE	97	11
VC	0.26J	0.48J
Ethene	2.3	1.2U

IW-9	7/5/05	10/26/05
PCE	0.68J	1U
TCE	0.71J	0.23J
DCE	43	1.1
VC	7.1	0.5U
Ethene	4.1	NA

IW-6	7/5/05	8/30/05	10/25/05
PCE	2	29	15
TCE	2.8	31	2.6J
DCE	560	270	170
VC	20	6.1	9.7
Ethene	15	0.67J	NA

IW-19	9/12/05
PCE	85
TCE	1.7
DCE	0.42J
VC	0.5U
Ethene	NA

IW-12	7/5/05
PCE	1U
TCE	1U
DCE	55
VC	0.5U
Ethene	1.2J

IW-13	7/5/05	8/30/05	10/26/05
PCE	1U	6.5	1U
TCE	1U	7.5	1U
DCE	160	280	58E
VC	11	11	19
Ethene	2.2	3.7	NA

IW-14	7/5/05	10/26/05
PCE	1U	0.23J
TCE	1U	0.24J
DCE	150	57E
VC	2.3	8.3
Ethene	1.9	NA

IW-17	7/5/05
PCE	0.55J
TCE	1U
DCE	1U
VC	0.5U
Ethene	0.63J

IW-18	8/22/05
PCE	150
TCE	3.1
DCE	1.1
VC	0.92
Ethene	2.1

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION INSTALLED BY BNI
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION INSTALLED BY BNI
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION INSTALLED BY BNI
- MW-40-30 — SHALLOW-INTERVAL LOCATION MONITORING WELL (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL LOCATION MONITORING WELL (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA
U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05
IW-18 INSTALLED AUGUST 19, 2005
IW-19 INSTALLED SEPTEMBER 10, 2005

Figure 2

CHEMICALS OF CONCERN RESULTS (MARCH THROUGH OCTOBER 2005)
INJECTION WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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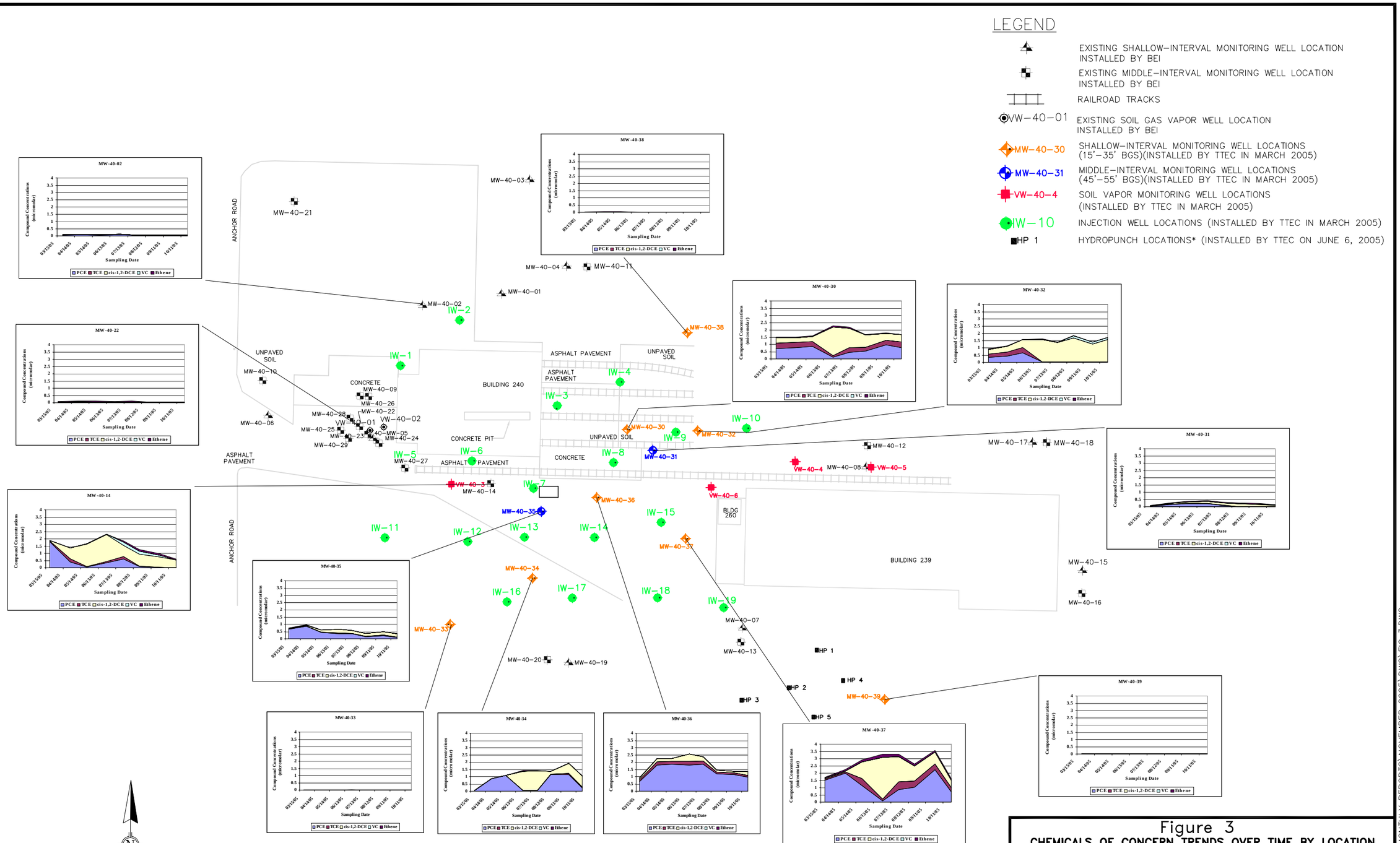

Figure 3

CHEMICALS OF CONCERN TRENDS OVER TIME BY LOCATION, MOLAR BASIS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\NOVEMBER 2005\DWG\FIG 3.DWG
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TETRA TECH EC, INC.

DECEMBER 2005, MONTHLY SUMMARY OF FIELD ACTIVITIES AND DATA ENHANCED *IN SITU* BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS VIA LACTATE INJECTION

INSTALLATION RESTORATION PROGRAM SITE 40
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CA

Date: December 21, 2005

Prepared by: Hamlet Hamparsumian and Mark E. Losi, Tetra Tech EC, Inc. (TtEC)

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INTRODUCTION

This is the ninth monthly report documenting activities conducted in association with groundwater remediation activities at Installation Restoration Program (IRP) Site 40. This monthly report provides a brief review of site activities conducted during November 2005 and briefly summarizes the status of the bioremediation project. Monitoring and other field activities conducted during the period are summarized in Table 1, and the locations of substrate injection wells and groundwater monitoring wells are shown on Figure 1.

SUMMARY OF FIELD ACTIVITIES

The field activities included ongoing monitoring activities, continued lactate injection, and assessment of relevant data collected to date. Results of the monitoring activities are briefly discussed in the following section.

MONITORING EVALUATION

Lactate injection data, groundwater and soil vapor monitoring well data, and groundwater levels are briefly discussed below. Groundwater monitoring well data for chemicals of concern (COCs) collected over this monitoring period are included on Figure 1 (injection wells were not sampled during this time period). In addition, concentration trends (molar basis) over the course of the project are presented graphically in Figure 2.

Lactate Injection. Since the prior monthly report, lactate injections were continued at half the initial frequency, to provide electron donor required to maintain appropriate conditions for the recently injected inoculum and aid in transport of the bioaugmented organisms while minimizing the potential for contaminant migration. In addition, the number of injection wells was reduced in order to avoid application of lactate into areas where the contaminants were no longer present.

Since November 16, lactate has been injected into the following wells: IW-3, -4, -6, -7, -8, -9, -10, -11, -12, -13, -14, -15, -16, -18, and -19. A 3 percent solution of sodium lactate was injected once a week in each well at a rate of 4 gallons per minute (gpm) for 8 hours per day. A total of approximately 107,700 gallons of sodium lactate solution were injected during the month of November 2005, at an estimated

average of 7,200 gallons per well. As explained below, we will likely attempt to test recirculation of groundwater in certain areas, in order to increase the horizontal distribution of lactate in where limited migration has occurred.

Groundwater Data. The general trends are discussed in the following subsections. Refer to Figure 1 for contaminant concentrations.

COCs – The following key observations are noted:

1) The data we have gathered so far, which include data for eight monthly sampling events conducted since treatment began, show favorable evidence of contaminant degradation in several of the monitoring wells, especially in the deeper wells. These wells include MW-40-14, -30, -35, -34, -31, and -32. A few of these wells, such as MW-40-14, -30, and -34, have exhibited fluctuations, but overall, the data suggests that degradation is occurring, and will likely continue as long as conditions are favorable. MW-40-35 and MW-40-31 (deeper wells), and MW-40-32 have shown a continuous reduction in PCE concentrations and increase in 1,2-dichloroethene (1,2-DCE) and vinyl chloride (VC). However, a slight rebound in PCE concentrations is detected in the November results for MW-40-32. Allowing for inherent variations in the full-scale system, these wells can be considered to be performing within reasonable expectations.
2) Results for MW-40-36, and -37, which are located in the central area of the plume, do not provide consistent evidence of contaminant degradation. In addition, results for MW-40-07 do not indicate contaminant degradation at this time, following more than two months of sodium lactate injection in wells IW-18 (injection in this well began on August 24, 2005) and IW-19 (injection in this well began on September 16, 2005).
3) PCE concentrations in MW-40-07 increased slightly [from 81 micrograms per liter (μg/L) to 90 μg/L]. Reductive dechlorination is not evident in this well, as daughter products (TCE and DCE) have not been detected. PCE was detected at a concentration of 0.28J μg/L in MW-40-17 in November compared with a concentration of 16 μg/L detected in September.

Lactate Distribution and Geochemical and Microbiological Parameters –

Review of the chemical oxygen demand (COD) data, which is an indicator of sodium lactate presence, suggests that sodium lactate is prevalent in the deeper wells such as MW-40-14, MW-40-31, and MW-40-35, MW-40-20, and MW-40-13. The most recent COD concentration for the above wells are 5,160 milligrams per liter (mg/L), 5,290 mg/L, 24,000 mg/L, 4,520 mg/L, and 120 mg/L, respectively. As a result of COD prevalence, more rapid degradation and reduction in PCE and trichloroethene (TCE) concentrations are seen in the monitoring wells MW-40-14, MW-40-31, and MW-40-35. COD concentrations are lower in the shallow wells where the PCE and TCE concentration are not decreasing at the same pace as being observed in the deeper wells. Nevertheless, much of the geochemical evidence suggests that biological activity is occurring, and that the subsurface conditions are supportive of reductive dechlorination at most locations. A summary of the evidence of increasing biological activity and conditions supportive of reductive dechlorination is provided in Table 2.

Regarding bioaugmentation and *Dehalococcoides* spp. (DHC) populations, DHC has been consistently detected and cell counts have generally exhibited increasing trends over the course of the project, although not in all cases. This is likely due to the presence of a native strain not detected during the pilot test, and/or DNA remaining from the prior bioaugmentation. Bioaugmentation with KB-1 was conducted in September. The migration of the KB-1 culture during the pilot test was estimated at 17 feet downgradient over 4 months. Because only 3 months have elapsed, and the majority of monitoring wells are located greater than 17 feet downgradient, detection of the bioaugmented organisms in monitoring wells is not yet expected.

Soil Vapor Data. Methane gas was not detected within Buildings 239 and 240 and surrounding areas during the methane gas emissions monitoring performed on November 15, and 22, 2005. The results of probe monitoring conducted on November 22, 2005, indicated that 24 out of the 30 probes that were tested in the field had methane gas concentrations ranging from as low as 10.9 percent up to 88.0 percent in air. The highest methane concentration was detected in the gas monitoring well VW-40-06. The average concentration in all soil vapor/gas monitoring wells and nested probes (in the groundwater and injection wells) was 70.7 percent methane in air. TtEC is conducting more frequent surface emissions monitoring to assess the methane concentrations in the vadose zone. Hydrogen sulfide was not detected in any of the soil vapor/gas monitoring wells or nested probe.

Groundwater Levels. Groundwater level measurements conducted on November 22, 2005, indicted no significant changes in groundwater elevation since the previous groundwater level measurements conducted on November 1, 2005. Groundwater elevations within the site, measured on November 22, 2005, ranged from 1.58 feet above mean sea level (msl) (in MW-40-20) to 2.41 feet above msl (in MW-40-30 and IW-16).

SUMMARY AND FOLLOW-UP ACTIVITIES

Overall COC data collected to date continue to fluctuate to some degree, but generally indicate that reductive dechlorination is occurring as expected over much of the site. While we still believe that this will continue to improve as KB-1 migrates within the subsurface and has time to become established, we have begun planning for system optimizations in areas where lactate migrating appears to be less favorable, including within the vicinity of MW-40-36, -37, and -07.

In November, PCE levels in MW-40-07 increased slightly from 81 μg/L to 90 μg/L, and the PCE concentration in MW-40-17 was 0.28J μg/L compared with 16 μg/L detected in September.

The following activities will be conducted over the month of January:

- Lactate injections were halted on December 16, 2005. We are preparing to perform a modeling effort to increase understanding of subsurface variability in the areas where lactate distribution appears to be inhibited. This will be used in conducting system optimizations.
- Implement recirculation initially in one localized area, which would help gain an understanding of how this might work, and then apply it to other similar areas, if required. We propose ultimately conducting recirculation in the areas near MW-40-07, MW-40-36, MW-40-37, and MW-40-30.
- Begin preliminary plans for collecting groundwater samples using geoprobe methodology in the area of MW-40-17, in order to increase our understanding of subsurface conditions and contaminant presence/transport in this area.
- Continue to address downgradient COC detection in the vicinities of MW-40-07 and -17 through monitoring on monthly basis.

TABLES

Table 1 Summary of Monitoring Activities Conducted During November

Table 2 Summary of Biological Activity and Reductive Dechlorination in Select Monitoring Wells

FIGURES

Figure 1 Chemicals of Concern Results (March through November 2005) Monitoring Wells

Figure 2 Chemicals of Concern Trends Over Time by Location, Molar Basis

TABLES

TABLE 1

SUMMARY OF MONITORING ACTIVITIES CONDUCTED DURING NOVEMBER

Date	Event	Wells Sampled[1]	Analytes[2]/Parameters	Notes
11/15	Surface emissions monitoring	Not applicable	Methane gas concentrations	Inside Building 240 and western portion of Building 239, and areas surrounding the above buildings.
11/22	Surface emissions monitoring	Not applicable	Methane gas concentrations	Inside Building 240 and western portion of Building 239, and areas surrounding the above buildings.
11/22	Soil vapor/gas monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, and IW-1 through IW-4 and IW-6 through IW-17.	Methane, hydrogen sulfide, oxygen, carbon dioxide, VOCs, and carbon monoxide.	
11/22	Groundwater level measurements	MW-40-06, -10, -14, -20, -22, -30 through 39, and IW-1 through IW-17	None,	Groundwater level measurements.
11/28 – 11/30	Scheduled monthly laboratory analysis	Groundwater: MW-40-07, -14, -17, -22, and -30 through –39.	VOCs, dissolved gasses, cations, DNA, water levels, COD, SO_4^{2-}, Fe^{2+}, CO_2, alkalinity, and NO_3^- additional geochemical parameters MW-40-07, -17, and -39: VOCs only	Field test kits (COD, SO_4^{2-}, Fe^{2+}, CO_2, alkalinity, NO_3^-) were not conducted. Well MW-40-17 was sampled instead of MW-40-02 to assess plume migration
11/29	Soil vapor sampling	VW-40-01 through -06, MW-40-34, IW-1, -3, -7	VOCs and fixed gasses	

Notes:

[1]Refer to Figure 1 for well locations
[2]Refer to SAP for complete list of analytes

CO_2 – carbon dioxide
COC – chemical of concern
COD – chemical oxygen demand
DHC – *Dehalococcoides* spp.
Fe^{2+} – ferrous iron
IW – injection well
NO_3^- - nitrate
SAP – Sampling and Analysis Plan
SO_4^{2-} – sulfate
VOC – volatile organic compound

TABLE 2

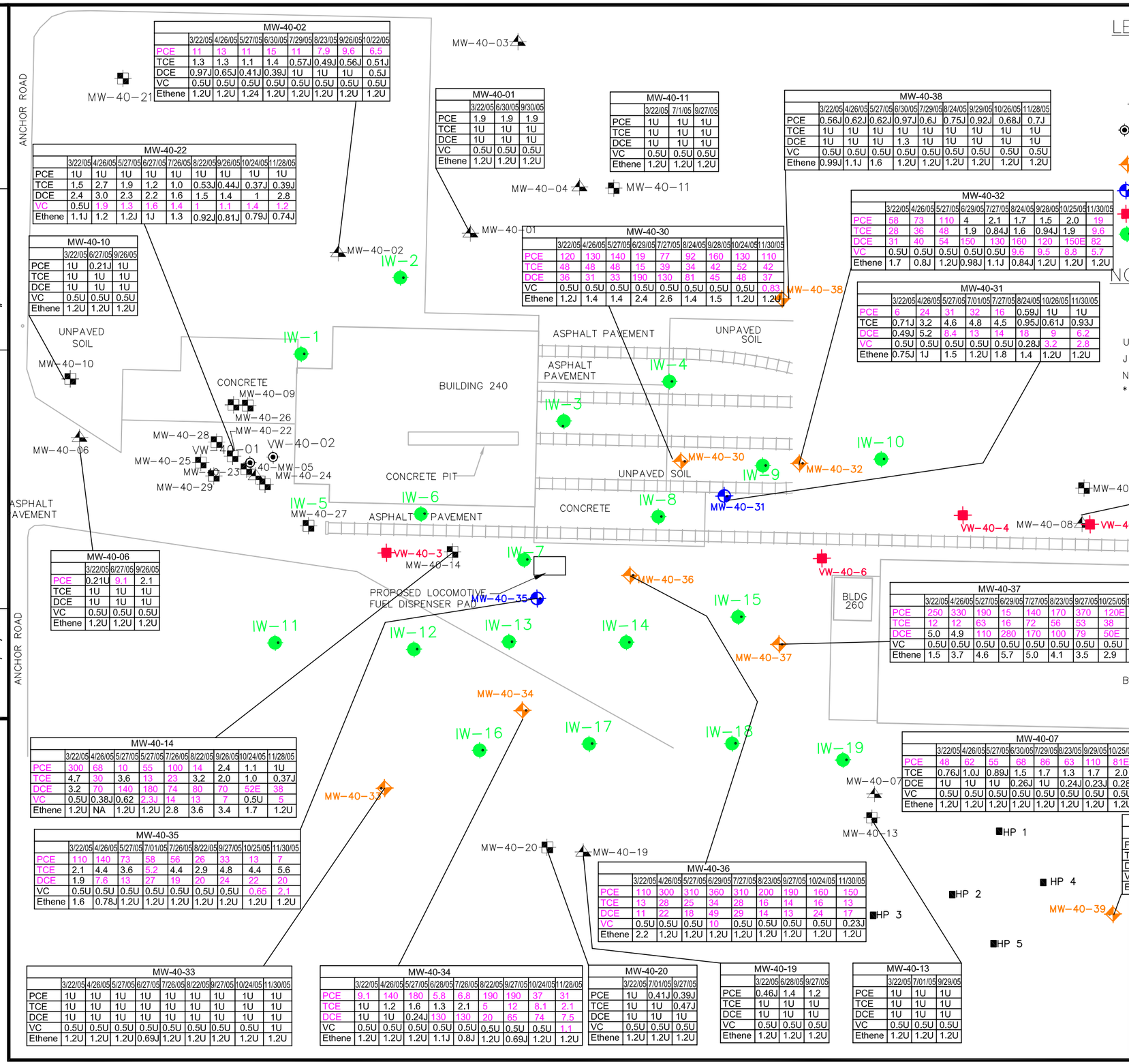
SUMMARY OF BIOLOGICAL ACTIVITY AND REDUCTIVE DECHLORINATION IN SELECT MONITORING WELLS

Evidence of Increasing Biological Activity and Conditions Supportive of Reductive Dechlorination[1,2]														
Well	**General Location**	**PCE/TCE Decrease**	**DCE Accumulation**	**VC Generation**	**COD Increase**	**VFA Increase**	**Sulfate Reduction**	**CO_2 Production**	**CH_4 Production**	**H_2S Production**	**Reducing ORP**	**Increasing Alkalinity**	**Increasing DHC/PLFA Biomass**	**Comments and General Assessment**
MW-40-2	Upgradient edge	○			●			○	○		○			Not analyzed this period. This well is located upgradient of all injection wells. Bases on past data, COC levels very low; slight decrease in PCE concentration and general upward trend in COD may indicate that this well is responding to lactate injection.
MW-40-14	Plume center	●	●	●	●	(3)	●	●	●	○	●	●	○	Located in key area of plume; contained COCs at relatively high levels; appears to be responding reasonably well to treatment.
MW-40-22	Pilot study area				○	(3)			●	●	●			COC levels very low, PCE/TCE below MCLs, low and decreasing levels of DCE, VC, and ethene suggest reductive dechlorination in the past, process near completion.
MW-40-30	Off plume center toward cross-gradient edge	○	●	○	○	(3)	○	●	●	○	○	○	●	Key plume well; appears to be generally responding to treatment.
MW-40-31	Off plume center toward cross-gradient edge	●	●	●	●	(3)	●	●	●	○	●	●	●	Key plume well; appears to be responding to treatment.
MW-40-32	Off plume center toward cross-gradient edge	●	●	●	●	(3)	●	●	●		●	●	●	Appears to be responding to treatment (minor PCE rebound noted for this period)..
MW-40-33	Cross-gradient edge				○	(3)	○	●	○		●	○	●	COCs have not been detected in this well; nevertheless, appears to be responding to lactate to some degree; not deemed crucial in performance assessment at this time.
MW-40-34	Off plume center toward cross-gradient edge	●	●	○	●	(3)	○	●	●	●	●	●	○	Appears to be behaving as expected in many respects; some evidence of PCE reduction following apparent initial desorption/redistribution; COC trends still somewhat irregular, although appear more favorable at this time.
MW-40-35	Plume center	●	●	○	●	(3)	●	●	●	●	●	●	●	Key plume well; appears to be responding to treatment.
MW-40-36	Plume center	○	○		●	(3)	●	●	●		○	○	○	Key plume well; minor evidence of PCE reduction following apparent initial desorption; however, recent sampling event indicates that substrate is now present, however, response is slow.
MW-40-37	Plume center	●	●		●	(3)		●	●	○	●		○	Key plume well; appears to be behaving as expected in many respects; some evidence of PCE reduction following apparent desorption/redistribution; COC trends still somewhat irregular.
MW-40-38	Cross-gradient edge				●	(3)		●	●		○	○	○	COCs never measured at levels above MCLs in this well; not deemed crucial in performance assessment at this time.
MW-40-39	Downgradient edge				○	(3)	○	○						COCs never measured at levels above MCLs in this well; not deemed crucial in performance assessment at this time.

Notes:

1) Black-filled circles indicate strong evidence; gray filled circles indicate some, but less certain evidence; a blank field indicates little or no evidence
2) DO and NO_3^- data are not included. These analytes were not detected or were detected at very low levels in all monitoring wells, which suggests that anoxic (but not strongly reducing) conditions are present site-wide.
3) Data not yet received
CH_4 - methane
CO_2 - carbon dioxide
COC - chemical of concern
COD - chemical oxygen demand
DCE - dichloroethene
DHC - *Dehalococcoides ethenogenes* spp.
DO - dissolved oxygen
H_2S - hydrogen sulfide
MCL - Maximum Containment Level
NO_3^- - nitrate
ORP - oxidation/reduction potential
PCE - tetrachloroethene
PLFA - phospholipid fatty acid
TCE - trichloroethene
VC - vinyl chloride
VFA - volatile fatty acid

FIGURES



LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION INSTALLED BY BNI
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION INSTALLED BY BNI
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION INSTALLED BY BNI
- MW-40-30 — SHALLOW-INTERVAL LOCATION MONITORING WELL (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL LOCATION MONITORING WELL (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005

VALUES IN RED EXCEED REMEDIATION CRITERIA

U NOT DETECTED AT DETECTION LIMIT GIVEN

J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT

NA NOT ANALYZED

* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

IW-18 INSTALLED AUGUST 19, 2005

IW-19 INSTALLED SEPTEMBER 10, 2005

MW-40-02

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/26/05	10/22/05
PCE	11	13	11	15	11	7.9	9.6	6.5
TCE	1.3	1.3	1.1	1.4	0.57J	0.49J	0.56J	0.51J
DCE	0.97J	0.65J	0.41J	0.39J	1U	1U	1U	0.5J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.24	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-01

	3/22/05	6/30/05	9/30/05
PCE	1.9	1.9	1.9
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-11

	3/22/05	7/1/05	9/27/05
PCE	1U	1U	1U
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-38

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/24/05	9/29/05	10/26/05	11/28/05
PCE	0.56J	0.62J	0.62J	0.97J	0.6J	0.75J	0.92J	0.68J	0.7J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1.3	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.99J	1.1J	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-22

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J	0.37J	0.39J
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4	1	2.8
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1	1.4	1.2
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J	0.79J	0.74J

MW-40-10

	3/22/05	6/27/05	9/26/05
PCE	1U	0.21J	1U
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-30

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/24/05	11/30/05
PCE	120	130	140	19	77	92	160	130	110
TCE	48	48	48	15	39	34	42	52	42
DCE	36	31	33	190	130	81	45	48	37
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.83
Ethene	1.2J	1.4	1.4	2.4	2.6	1.4	1.5	1.2U	1.2U

MW-40-32

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/25/05	11/30/05
PCE	58	73	110	4	2.1	1.7	1.5	2.0	19
TCE	28	36	48	1.9	0.84J	1.6	0.94J	1.9	9.6
DCE	31	40	54	150	130	160	120	150E	82
VC	0.5U	0.5U	0.5U	0.5U	0.5U	9.6	9.5	8.8	5.7
Ethene	1.7	0.8J	1.2U	0.98J	1.1J	0.84J	1.2U	1.2U	1.2U

MW-40-31

	3/22/05	4/26/05	5/27/05	7/01/05	7/27/05	8/24/05	10/26/05	11/30/05
PCE	6	24	31	32	16	0.59J	1U	1U
TCE	0.71J	3.2	4.6	4.8	4.5	0.95J	0.61J	0.93J
DCE	0.49J	5.2	8.4	13	14	18	9	6.2
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.28J	3.2	2.8
Ethene	0.75J	1J	1.5	1.2U	1.8	1.4	1.2U	1.2U

MW-40-08

	3/22/05	6/29/05	9/28/05
PCE	7.3	10	7.5
TCE	1.2	1.9	1.4
DCE	0.22J	0.34J	0.21J
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-17

	3/22/05	6/29/05	9/28/05	11/28/05
PCE	0.51J	0.51J	16	0.28J
TCE	1U	1U	0.21J	0.21J
DCE	1U	1U	1U	0.23J
VC	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA

MW-40-06

	3/22/05	6/27/05	9/26/05
PCE	0.21U	9.1	2.1
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-37

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/25/05	11/30/05
PCE	250	330	190	15	140	170	370	120E	390
TCE	12	12	63	16	72	56	53	38	29
DCE	5.0	4.9	110	280	170	100	79	50E	48
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.5	3.7	4.6	5.7	5.0	4.1	3.5	2.9	2.9

MW-40-15

	3/22/05	6/30/05	9/28/05
PCE	1U	1U	0.26J
TCE	1U	1U	0.26J
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.1J	1.2U	1.2U

MW-40-14

	3/22/05	4/26/05	5/27/05	5/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05
PCE	300	68	10	55	100	14	2.4	1.1	1U
TCE	4.7	30	3.6	13	23	3.2	2.0	1.0	0.37J
DCE	3.2	70	140	180	74	80	70	52E	38
VC	0.5U	0.38J	0.62	2.3J	14	13	7	0.5U	5
Ethene	1.2U	NA	1.2U	1.2U	2.8	3.6	3.4	1.7	1.2U

MW-40-07

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/28/05
PCE	48	62	55	68	86	63	110	81E	90
TCE	0.76J	1.0J	0.89J	1.5	1.7	1.3	1.7	2.0	2.4
DCE	1U	1U	1U	0.26J	1U	0.24J	0.23J	0.28J	0.34J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA

MW-40-39

	3/22/05	4/26/05	4/26/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/30/05
PCE	1U	1U	1U	1U	0.34J	0.29J	0.35J	0.42J	0.49J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	NA

MW-40-35

	3/22/05	4/26/05	5/27/05	7/01/05	7/26/05	8/22/05	9/27/05	10/25/05	11/30/05
PCE	110	140	73	58	56	26	33	13	7
TCE	2.1	4.4	3.6	5.2	4.4	2.9	4.8	4.4	5.6
DCE	1.9	7.6	13	27	19	20	24	22	20
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.65	2.1
Ethene	1.6	0.78J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-36

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/24/05	11/30/05
PCE	110	300	310	360	310	200	190	160	150
TCE	13	28	25	34	28	16	14	16	13
DCE	11	22	18	49	29	14	13	24	17
VC	0.5U	0.5U	0.5U	10	0.5U	0.5U	0.5U	0.5U	0.23J
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-33

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/27/05	10/24/05	11/30/05
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U
Ethene	1.2U	1.2U	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-34

	3/22/05	4/26/05	5/27/05	6/28/05	7/26/05	8/22/05	9/27/05	10/24/05	11/28/05
PCE	9.1	140	180	5.8	6.8	190	190	37	31
TCE	1U	1.2	1.6	1.3	2.1	5	12	8.1	2.1
DCE	1U	1U	0.24J	130	130	20	65	74	7.5
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.1
Ethene	1.2U	1.2U	1.2U	1.1J	0.8J	1.2U	0.69J	1.2U	1.2U

MW-40-20

	3/22/05	7/01/05	9/27/05
PCE	1U	0.41J	0.39J
TCE	1U	1U	0.47J
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-19

	3/22/05	6/28/05	9/27/05
PCE	0.46J	1.4	1.2
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-13

	3/22/05	7/01/05	9/29/05
PCE	1U	1U	1U
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

Figure 1

CHEMICALS OF CONCERN RESULTS (MARCH THROUGH NOVEMBER 2005)
MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 1.DWG
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: ML
REV: REVISION 0
DRAWN BY: MD
DATE: 08/23/05

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\DECEMBER 2005\DWG\FIG 1_MONITORING_WELLS.DWG
PLOT/UPDATE: DEC 20 2005 09:16:07

DRAWING NO: FIG 2.DWG

DCN: FWSD-RAC CTO: #0090

APPROVED BY: HH

CHECKED BY: MT REV: REVISION 0

DRAWN BY: MD DATE: 12/16/05

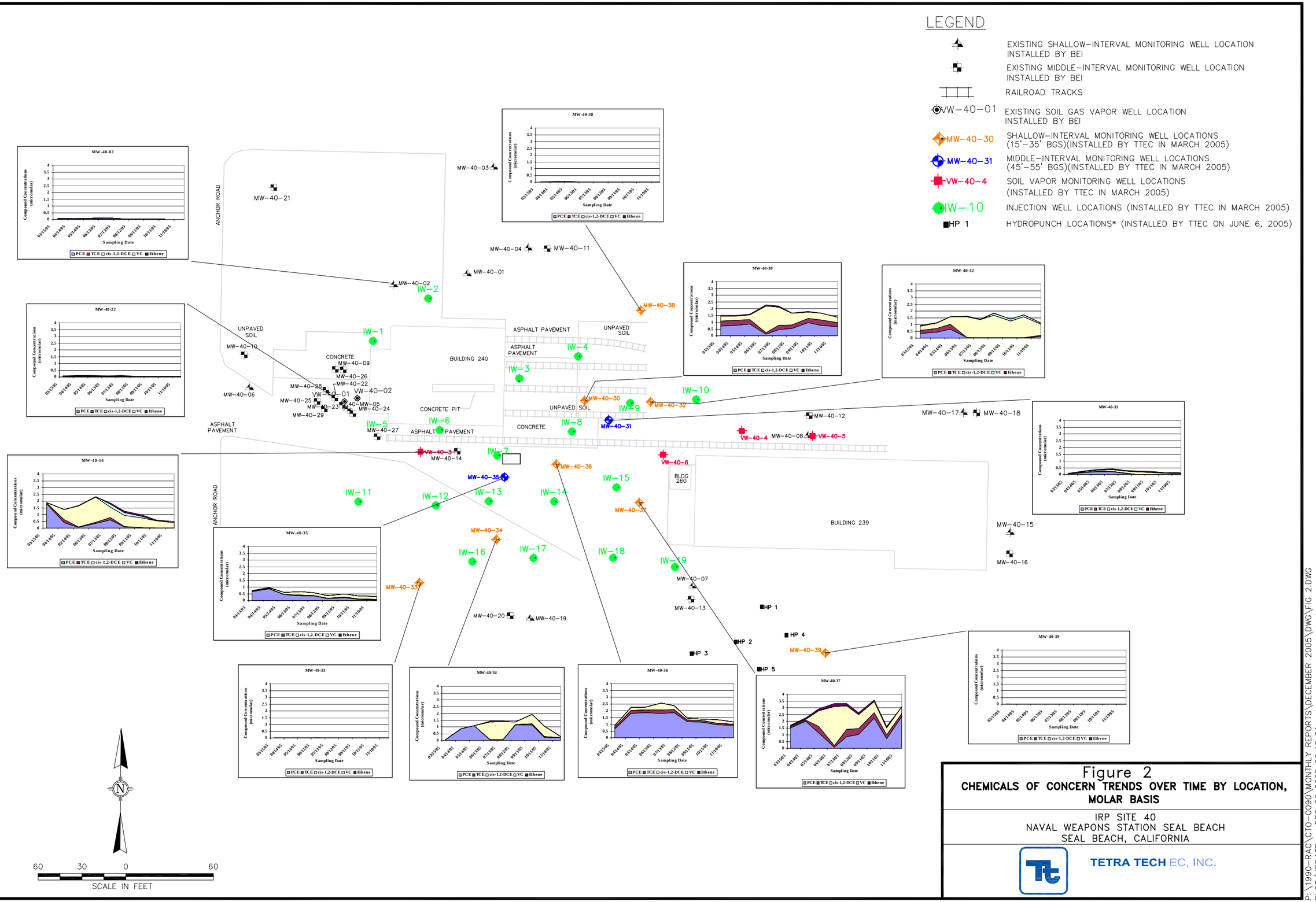


Figure 2

CHEMICALS OF CONCERN TRENDS OVER TIME BY LOCATION, MOLAR BASIS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\DECEMBER 2005\DWG\FIG 2.DWG
PLOT/UPDATE: DEC 20 2005 09:18:34

TETRA TECH EC, INC.

JANUARY 2006, MONTHLY SUMMARY OF FIELD ACTIVITIES AND DATA FOR ENHANCED *IN SITU* BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS VIA LACTATE INJECTION

INSTALLATION RESTORATION PROGRAM SITE 40
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CA

Date: January 08, 2006

Prepared by: Hamlet Hamparsumian and Mark E. Losi, Tetra Tech EC, Inc. (TtEC)

Distribution:	**Navy**	**TtEC**	**Agencies**
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	Chris Leadon		

INTRODUCTION

This is the tenth monthly summary report documenting activities conducted in association with groundwater remediation activities at Installation Restoration Program (IRP) Site 40 at Naval Weapons Station Seal Beach, Seal Beach, California. This report provides a brief review of site activities conducted during December and early January 2005 and briefly summarizes the status of the enhanced *in situ* bioremediation (EISB) project. Monitoring and other field activities conducted during the period are summarized in Table 1, and the locations of substrate injection wells and groundwater monitoring wells are shown on Figure 1.

SUMMARY OF FIELD ACTIVITIES

The field activities included ongoing monitoring activities (Table 1) and assessment of relevant data collected during this reporting period (lactate injections were not conducted during this period). Results of the monitoring activities are briefly discussed in the following section.

MONITORING EVALUATION

Groundwater and soil vapor sampling and analysis data, and groundwater level measurements, are briefly discussed below. Groundwater monitoring well data for chemicals of concern (COCs) collected over this monitoring period are included on Figures 1 and 2 (middle-interval and shallow-interval monitoring wells, respectively). In addition, concentration trends (molar basis) over the course of the project are presented graphically by location in Figure 3.

Groundwater Data. The general contaminant concentration trends are discussed in the following subsections. Refer to Figures 1 and 2 for contaminant concentrations, and to Figure 3 for molar concentrations.

The following key observations are noted for COC concentrations in regularly monitored groundwater monitoring wells MW-40-2, -07, -14, -22, and -30 through -39:

1) Middle-interval monitoring wells, including MW-40-22, -14, -31, and -35. (See Figure 1):

- Tetrachloroethene (PCE) levels are currently below the Maximum Contaminant Level (MCL) in the regularly monitored middle-interval monitoring wells.
- Trichloroethene (TCE) levels are at or below the MCL in all middle-interval monitoring wells, except MW-40-35.
- Dichloroethene (DCE) is present in all but one regularly monitored middle-interval monitoring well.
- Vinyl chloride (VC) is present in all regularly monitored middle-interval monitoring wells.
- The above results indicate that the reductive dechlorination process is occurring to completion in these areas.

2) Shallow-interval wells, including MW-40-02, -07, -30, -32, -33, -34, and -36 through -39 (see Figure 2):

- PCE concentrations have remained relatively high [>100 micrograms per liter (μg/L)] and/or have increased in several of the key wells located in the central portion of the site, notably in monitoring wells MW-40-07 (110 μg/L), -30 (150 μg/L), -36 (160 μg/L), and -37 (440 μg/L). Production of DCE has been noted in monitoring wells MW-40-30 (57 μg/L), -36 (22 μg/L), and -37 (63 μg/L), and minor concentrations of VC has been detected in MW-40-30 (1.2 μg/L) and -36 (0.6 μg/L), indicating that complete dechlorination is occurring. However, because the significant decreases in PCE are not consistently noted, the process does not appear to be efficient at these locations at this time.
- PCE concentrations in monitoring wells MW-40-32 and MW-40-34 had initially increased significantly early in the project (less significant increases in TCE were also noted). This is likely attributable to desorption due to the lactate injections. However, PCE concentrations have since decreased to relatively low levels (10 μg/L and 29 μg/L, respectively). Concurrent increases in DCE and subsequent detections of VC indicate that reductive dechlorination is occurring at these locations, although the DCE concentration remains relatively high in MW-40-32 (150 μg/L).
- PCE has been detected at levels slightly above the MCL in MW-40-02, and no COCs have been detected above the reporting limits in MW-40-33, -38, and -39.

The following key observations are noted with respect to COC concentration trends for the monitored natural attenuation (MNA) monitoring wells (MW-40-06, -08, -10, -12, -13, -15, -16, -18, -19, and -20):

1) Middle-interval monitoring wells MW-40-10, -12, -13, -16, -18, and -20 (see Figure 1):

- COCs were either not detected or were detected at trace levels (above the detection limit, but below the reporting limit) in all middle-interval MNA monitoring wells, except MW-40-13, where PCE and TCE were detected for the first time at concentrations of 8.2 μg/L and 9.0 μg/L, respectively.

2) Shallow-interval monitoring wells MW-40-06, -08, -19 and -15 (see Figure 2):

- COCs were either not detected or were detected at trace levels in all MNA wells, except MW-40-08, where PCE and TCE were detected at respective concentrations of 7.5 and 1.5 μg/L. These levels are consistent with concentrations measured during baseline analysis and during subsequent quarterly monitoring events.

Lactate Presence and Geochemical/Microbiological Parameters –

Review of the chemical oxygen demand (COD) (an indicator of sodium lactate presence) data for the January 2006 monitoring event for critical wells suggests that sodium lactate remains prevalent in the middle-interval monitoring wells MW-40-14, -31, and -35. The January 2006 monitoring event COD concentration for the above wells are 4,160 milligrams per liter (mg/L), 5,550 mg/L, and 35,200 mg/L, respectively. These wells, in addition to well MW-40-14, have generally exhibited favorable results with respect to degradation of the COCs in their areas.

COD trends in shallow-interval monitoring wells MW-40-32 and -34, which appear to be responding to the treatment to a more limited extent than the wells noted above, have COD levels of 30.5 mg/L and 42 mg/L (respectively), which represents a slightly increasing trend over the past month. This indicated that while not present at optimal levels, lactate remains in the areas of these wells, and reductive dechlorination will continue to occur at a more limited rate.

Finally, lactate migration to shallow-interval monitoring wells MW-40-30, -36, and -37, which have responded marginally to the EISB treatment, is minimal, with the most recently measured concentrations of 33.3 mg/L, 28.9 mg/L, and 19.4 mg/L, respectively). While some degree of reductive dechlorination is evident in these wells, horizontal migration of lactate is minimal in these areas, and thus, treatment is likely to be limited.

Geochemical data, including electron acceptors and biogenic gases, continue to remain suggestive of a strongly reduced environment in the most critical locations.

Oxidation/reduction potential (ORP) values for wells MW-40-14, -22, -31, and -35, where COD transport is optimal, were –102 millivolts (mV), -111 mV, -87 mV, and -99 mV, respectively. These values are consistent with elevated COD levels and effective treatment. ORP values for MW-40-32 and -34, in which treatment is occurring to a lesser degree than the wells noted above, were –98 mV and +87 mV, respectively. These values are still suggestive of a reducing environment, but the value for well MW-40-34 represents a slight increase over the prior month. ORP values for wells MW-40-30, -36, and -37, in which EISB treatment has been the slowest, were +62 mV, +86 mV, and -3 mV, respectively. While still indicative of a reduced environment, the process appears to be substrate-limited at these locations.

Regarding bioaugmentation and *Dehalococcoides* spp. (DHC) populations, DHC has been consistently detected and cell counts generally exhibited steady or increasing trends over the course of the project, although not in all cases. Relatively high cell densities in the range of 10^6 to 10^7 cells/liter (L) were detected during the most recent sampling event in wells MW-40-14, -30, -32, -33, -35 and -37. An increase of two orders of magnitude was observed in MW-40-37; however, complete dechlorination in this well has not yet been observed. In the other wells, recent increases that may be attributable to bioaugmentation activities are not readily apparent. It is noted, however, that VC was recently detected in MW-14-30, which indicates the onset of complete dechlorination. Wells in which DHC levels are in the range of 10^6 to 10^7 cells/L include MW-40-02, -22, -31, -34, and -36. Overall, these data suggest substantial DHC population in most locations. This corresponds with continuing reductive dechlorination as evidenced by detection of VC in some locations.

Soil Vapor Data. Methane gas surface emissions monitoring was performed on December 21, 2005 and January 17, 2006. Methane gas emissions were not detected within Buildings 239 and 240 and surrounding areas during these monitoring events.

Soil gas monitoring was conducted on December 21, 2005, and January 18 and 24, 2006. The results of probe monitoring indicated that 26 out of the 30 probes that were tested in the field had methane gas concentrations ranging from as low as 13.5 percent up to 98.2 percent in air. The highest methane concentration was detected in the soil gas probe in injection well IW-17. Hydrogen sulfide concentrations ranged from zero parts per million (ppm) to 51 ppm.

Groundwater Levels. Groundwater level measurements were conducted on December 21, 2005 and January 17, 2006. Groundwater elevations within the site, measured on December 21, 2005, ranged from 1.46 feet above mean sea level (msl) in MW-40-20 to 2.18 feet above msl in MW-40-34. Groundwater elevations within the site, measured on January 17, 2006, ranged from 1.57 feet above msl in MW-40-20 to 2.33 feet above msl in IW-16.

SUMMARY AND FOLLOW-UP ACTIVITIES

In summary, COC concentrations are at or near the California MCLs or target cleanup goals in majority of the middle-interval monitoring wells, including MW-40-10, -11, -12, -16, -18, and -20. In other middle-interval monitoring wells (MW-40-13, -14, -22, -31 and -35), COCs are detected at very low concentrations. COCs are not detected or are detected at very low levels (one case) in shallow-interval monitoring wells MW-40-02, -33, -38, and -39. COCs are detected at higher levels in shallow-interval monitoring wells MW-40-07, MW-40-30, MW-40-36, and MW-40-37, where treatment appears to be ineffective at this time. PCE levels in MW-40-07 increased slightly from 90 μg/L to 110 μg/L. PCE and TCE were detected for the first time in downgradient middle-interval monitoring well MW-40-13 (located approximately 10 feet south of shallow-interval monitoring well MW-40-07) at concentrations of 8.2 and 9 mg/L, respectively.

Geochemical and microbiological data indicate that conditions are relatively favorable for reductive dechlorination; however, the process appears to be occurring at a slower rate than was observed during the pilot test, and also appears to be hindered by lack of horizontal substrate transport in the central area of the site.

Other field activities conducted during early February and upcoming field activities include the following:

- Groundwater samples were collected from select injection wells located in the central portion of the plume during early February 2006. The samples were analyzed for geochemistry, COCs, COD and DHC. The results will be discussed in the next monthly report.
- Additional geologic, hydrogeologic, and chemical analysis are planned over the next few months in the central area of the plume in order to better assess the subsurface geology and contaminant distribution, especially in the area near the injection wells. This will help in assessment of the effectiveness of the treatment system in this area. Current plume delineations are based on the groundwater monitoring well data only, and may be overestimating the plume extent. This additional investigation is crucial in assessing EISB optimization options.
- Based on the new COC and geological data, contaminant distributions and subsurface hydrogeological conditions will be re-evaluated, and various optimization alternatives will be assessed. This may involve implementation of a slow release substrate, recirculation, modification of the current injection layout, or a combination of these options.

TABLES

Table 1 Summary of Monitoring Activities Conducted During December 2005/Early January 2006

FIGURES

Figure 1 Chemicals of Concern Results (March 2005 through Early January 2006) Middle-Interval Monitoring Wells

Figure 2 Chemicals of Concern Results (March 2005 through Early January 2006) Shallow-Interval Monitoring Wells

Figure 3 Chemicals of Concern Trends over Time by Location, Molar Basis

TABLES

TABLE 1

SUMMARY OF MONITORING ACTIVITIES CONDUCTED DURING DECEMBER 2005/EARLY JANUARY 2006

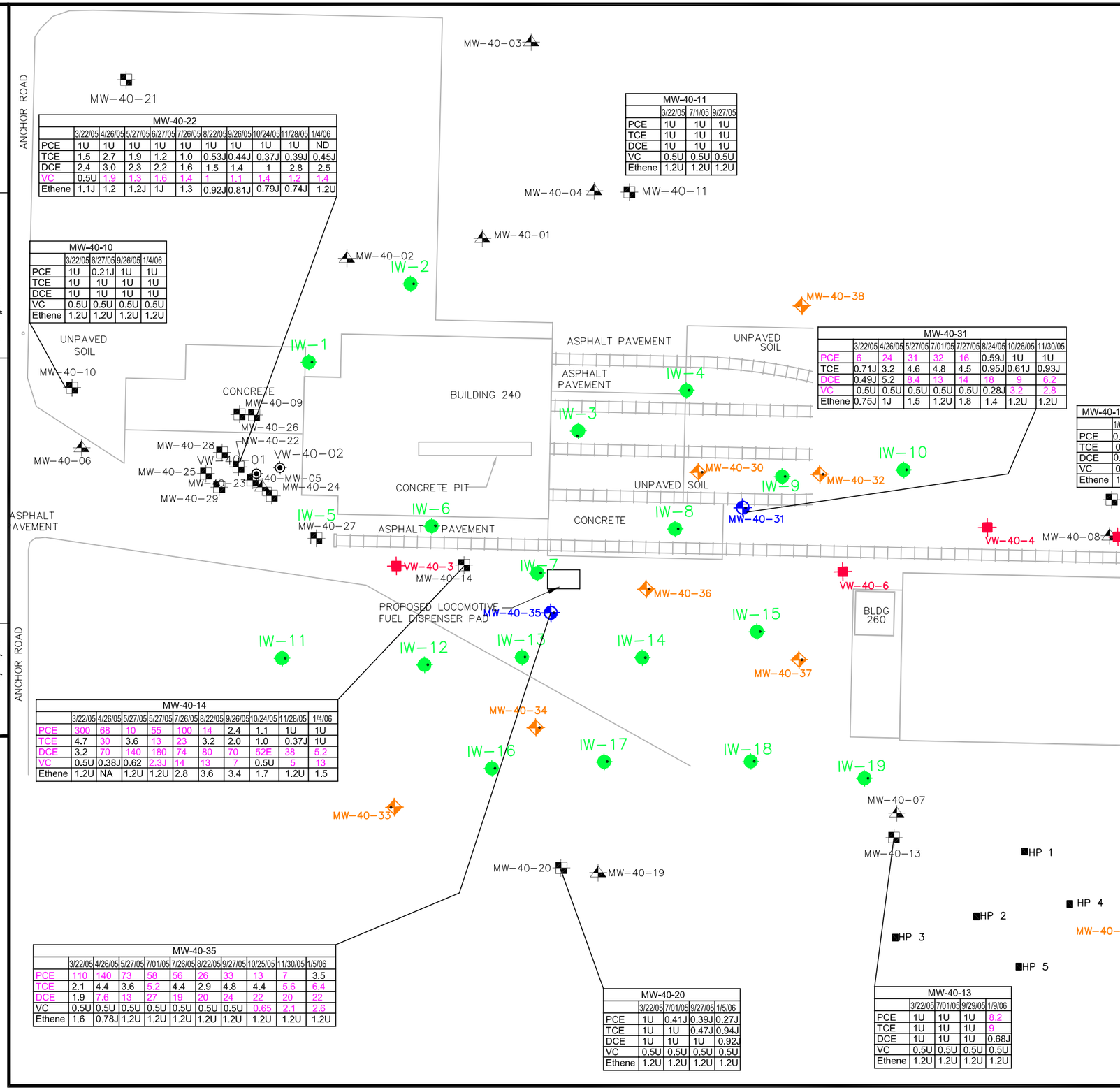
Date	Event	Wells Sampled[1]	Analytes[2]/Parameters	Notes
12/21/05	Surface emissions monitoring	Not applicable	Methane gas concentrations	Inside Building 240 and western portion of Building 239, and areas surrounding the above buildings
1/17/06	Surface emissions monitoring	Not applicable	Methane gas concentrations	Inside Building 240 and western portion of Building 239, and areas surrounding the above buildings
12/21/05	Soil vapor/gas probe monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, and IW-1 through IW-4 and IW-6 through IW-17	Methane, oxygen, carbon dioxide, VOCs, and carbon monoxide	
1/18/06	Soil vapor/gas probe monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, and IW-1 through IW-4 and IW-6 through IW-17	Methane, oxygen, carbon dioxide, VOCs, and carbon monoxide	
1/24/06	Soil vapor/gas probe monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, and IW-1 through IW-4 and IW-6 through IW-17	Methane, hydrogen sulfide, oxygen, carbon dioxide, VOCs, and carbon monoxide	
12/21/05	Groundwater level measurements	MW-40-01, -2, -6, -7, -8, -10, -11, -13, -14, -15, -17, -19, -20, -22, -30 through 39, and IW-1 through IW-17	None	Groundwater level measurements
1/17/06	Groundwater level measurements	MW-40-06, -10, -14, -20, -22, -30 through 39, and IW-1 through IW-17	None	Groundwater level measurements
1/04/06 – 1/10/06	Scheduled monthly laboratory analysis	Groundwater: MW-40-06, -07, -08, -10 through -20, -22, and -30 through –37, and -39	VOCs, dissolved gasses, cations, DNA, water levels, COD, SO_4^{2-}, Fe^{2+}, CO_2, alkalinity, and NO_3^- and additional geochemical parameters.	Field test kits (COD, SO_4^{2-}, Fe^{2+}, CO_2, alkalinity, NO_3^-) not conducted
1/18/06	Soil vapor sampling	VW-40-01, -02, -03, -06, MW-40-34, IW-1, -3, -7	VOCs and fixed gasses	

Notes:

[1]Refer to Figure 1 for well locations
[2]Refer to SAP for complete list of analytes

CO_2 – carbon dioxide
COD – chemical oxygen demand
Fe^{2+} – ferrous iron
NO_3^- - nitrate
SAP – Sampling and Analysis Plan
SO_4^{2-} – sulfate
VOC – volatile organic compound

FIGURES



LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION INSTALLED BY BNI
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION INSTALLED BY BNI
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION INSTALLED BY BNI
- MW-40-30 — SHALLOW-INTERVAL LOCATION MONITORING WELL (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL LOCATION MONITORING WELL (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005

VALUES IN RED EXCEED REMEDIATION CRITERIA

U NOT DETECTED AT DETECTION LIMIT GIVEN

J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT

NA NOT ANALYZED

* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

IW-18 INSTALLED AUGUST 19, 2005

IW-19 INSTALLED SEPTEMBER 10, 2005

MW-40-22

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	ND
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J	0.37J	0.39J	0.45J
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4	1	2.8	2.5
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1	1.4	1.2	1.4
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J	0.79J	0.74J	1.2U

MW-40-11

	3/22/05	7/1/05	9/27/05
PCE	1U	1U	1U
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-10

	3/22/05	6/27/05	9/26/05	1/4/06
PCE	1U	0.21J	1U	1U
TCE	1U	1U	1U	1U
DCE	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U

MW-40-31

	3/22/05	4/26/05	5/27/05	7/01/05	7/27/05	8/24/05	10/26/05	11/30/05
PCE	6	24	31	32	16	0.59J	1U	1U
TCE	0.71J	3.2	4.6	4.8	4.5	0.95J	0.61J	0.93J
DCE	0.49J	5.2	8.4	13	14	18	9	6.2
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.28J	3.2	2.8
Ethene	0.75J	1J	1.5	1.2U	1.8	1.4	1.2U	1.2U

MW-40-12

	1/6/06
PCE	0.53J
TCE	0.3J
DCE	0.44J
VC	0.5U
Ethene	1.2U

MW-40-18

	1/6/06
PCE	1U
TCE	1U
DCE	1U
VC	0.5U
Ethene	1.2U

MW-40-16

	1/6/06
PCE	1U
TCE	1U
DCE	1U
VC	0.5U
Ethene	1.2U

MW-40-14

	3/22/05	4/26/05	5/27/05	5/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06
PCE	300	68	10	55	100	14	2.4	1.1	1U	1U
TCE	4.7	30	3.6	13	23	3.2	2.0	1.0	0.37J	1U
DCE	3.2	70	140	180	74	80	70	52E	38	5.2
VC	0.5U	0.38J	0.62	2.3J	14	13	7	0.5U	5	13
Ethene	1.2U	NA	1.2U	1.2U	2.8	3.6	3.4	1.7	1.2U	1.5

MW-40-35

	3/22/05	4/26/05	5/27/05	7/01/05	7/26/05	8/22/05	9/27/05	10/25/05	11/30/05	1/5/06
PCE	110	140	73	58	56	26	33	13	7	3.5
TCE	2.1	4.4	3.6	5.2	4.4	2.9	4.8	4.4	5.6	6.4
DCE	1.9	7.6	13	27	19	20	24	22	20	22
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.65	2.1	2.6
Ethene	1.6	0.78J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-20

	3/22/05	7/01/05	9/27/05	1/5/06
PCE	1U	0.41J	0.39J	0.27J
TCE	1U	1U	0.47J	0.94J
DCE	1U	1U	1U	0.92J
VC	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U

MW-40-13

	3/22/05	7/01/05	9/29/05	1/9/06
PCE	1U	1U	1U	8.2
TCE	1U	1U	1U	9
DCE	1U	1U	1U	0.68J
VC	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U

Figure 1

CHEMICALS OF CONCERN RESULTS (MARCH 2005 THROUGH EARLY JANUARY 2006) MIDDLE-INTERVAL MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 1.DWG
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: ML
REV: REVISION 0
DRAWN BY: MD
DATE: 08/23/05

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\JANUARY 2006\DWG\FIG 1_MONITORING_WELLS_DEEP.DWG
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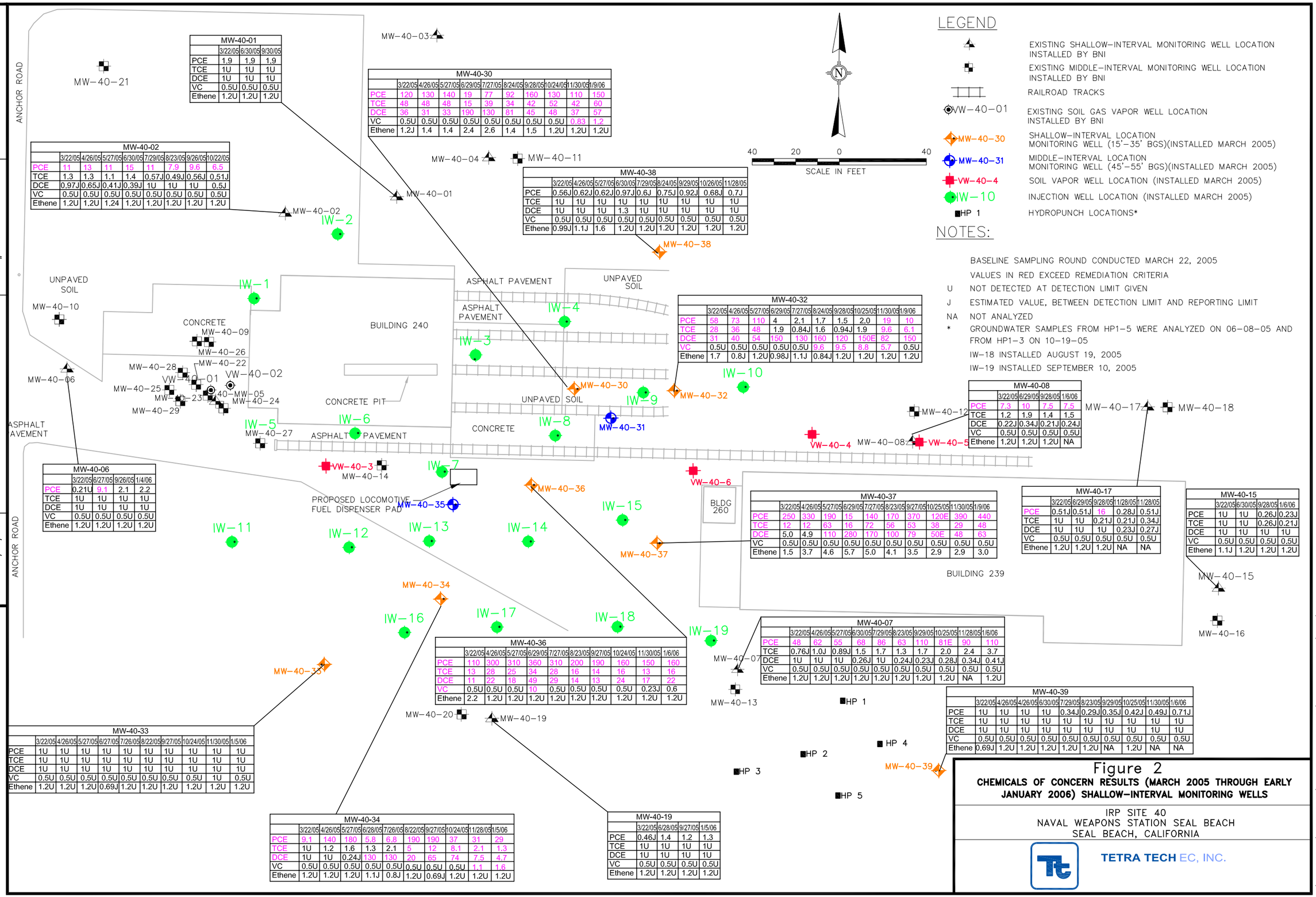

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION INSTALLED BY BNI
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION INSTALLED BY BNI
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION INSTALLED BY BNI
- MW-40-30 — SHALLOW-INTERVAL LOCATION MONITORING WELL (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL LOCATION MONITORING WELL (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005

VALUES IN RED EXCEED REMEDIATION CRITERIA

U NOT DETECTED AT DETECTION LIMIT GIVEN

J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT

NA NOT ANALYZED

* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

IW-18 INSTALLED AUGUST 19, 2005

IW-19 INSTALLED SEPTEMBER 10, 2005

MW-40-01

	3/22/05	6/30/05	9/30/05
PCE	1.9	1.9	1.9
TCE	1U	1U	1U
DCE	1U	1U	1U
VC	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U

MW-40-30

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/24/05	11/30/05	1/9/06
PCE	120	130	140	19	77	92	160	130	110	150
TCE	48	48	48	15	39	34	42	52	42	60
DCE	36	31	33	190	130	81	45	48	37	57
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.83	1.2
Ethene	1.2J	1.4	1.4	2.4	2.6	1.4	1.5	1.2U	1.2U	1.2U

MW-40-02

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/26/05	10/22/05
PCE	11	13	11	15	11	7.9	9.6	6.5
TCE	1.3	1.3	1.1	1.4	0.57J	0.49J	0.56J	0.51J
DCE	0.97J	0.65J	0.41J	0.39J	1U	1U	1U	0.5J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.24	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-38

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/24/05	9/29/05	10/26/05	11/28/05
PCE	0.56J	0.62J	0.62J	0.97J	0.6J	0.75J	0.92J	0.68J	0.7J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1.3	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.99J	1.1J	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-32

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/25/05	11/30/05	1/9/06
PCE	58	73	110	4	2.1	1.7	1.5	2.0	19	10
TCE	28	36	48	1.9	0.84J	1.6	0.94J	1.9	9.6	6.1
DCE	31	40	54	150	130	160	120	150E	82	150
VC	0.5U	0.5U	0.5U	0.5U	0.5U	9.6	9.5	8.8	5.7	0.5U
Ethene	1.7	0.8J	1.2U	0.98J	1.1J	0.84J	1.2U	1.2U	1.2U	1.2U

MW-40-08

	3/22/05	6/29/05	9/28/05	1/6/06
PCE	7.3	10	7.5	7.5
TCE	1.2	1.9	1.4	1.5
DCE	0.22J	0.34J	0.21J	0.24J
VC	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA

MW-40-06

	3/22/05	6/27/05	9/26/05	1/4/06
PCE	0.21U	9.1	2.1	2.2
TCE	1U	1U	1U	1U
DCE	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U

MW-40-37

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/25/05	11/30/05	1/9/06
PCE	250	330	190	15	140	170	370	120E	390	440
TCE	12	12	63	16	72	56	53	38	29	48
DCE	5.0	4.9	110	280	170	100	79	50E	48	63
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.5	3.7	4.6	5.7	5.0	4.1	3.5	2.9	2.9	3.0

MW-40-17

	3/22/05	6/29/05	9/28/05	11/28/05	11/28/05
PCE	0.51J	0.51J	16	0.28J	0.51J
TCE	1U	1U	0.21J	0.21J	0.34J
DCE	1U	1U	1U	0.23J	0.27J
VC	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA

MW-40-15

	3/22/05	6/30/05	9/28/05	1/6/06
PCE	1U	1U	0.26J	0.23J
TCE	1U	1U	0.26J	0.21J
DCE	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U
Ethene	1.1J	1.2U	1.2U	1.2U

MW-40-36

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/24/05	11/30/05	1/6/06
PCE	110	300	310	360	310	200	190	160	150	160
TCE	13	28	25	34	28	16	14	16	13	16
DCE	11	22	18	49	29	14	13	24	17	22
VC	0.5U	0.5U	0.5U	10	0.5U	0.5U	0.5U	0.5U	0.23J	0.6
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-07

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/28/05	1/6/06
PCE	48	62	55	68	86	63	110	81E	90	110
TCE	0.76J	1.0J	0.89J	1.5	1.7	1.3	1.7	2.0	2.4	3.7
DCE	1U	1U	1U	0.26J	1U	0.24J	0.23J	0.28J	0.34J	0.41J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U

MW-40-39

	3/22/05	4/26/05	4/26/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/30/05	1/6/06
PCE	1U	1U	1U	1U	0.34J	0.29J	0.35J	0.42J	0.49J	0.71J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	NA	NA

MW-40-33

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/27/05	10/24/05	11/30/05	1/5/06
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U	0.5U
Ethene	1.2U	1.2U	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-34

	3/22/05	4/26/05	5/27/05	6/28/05	7/26/05	8/22/05	9/27/05	10/24/05	11/28/05	1/5/06
PCE	9.1	140	180	5.8	6.8	190	190	37	31	29
TCE	1U	1.2	1.6	1.3	2.1	5	12	8.1	2.1	1.3
DCE	1U	1U	0.24J	130	130	20	65	74	7.5	4.7
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.1	1.6
Ethene	1.2U	1.2U	1.2U	1.1J	0.8J	1.2U	0.69J	1.2U	1.2U	1.2U

MW-40-19

	3/22/05	6/28/05	9/27/05	1/5/06
PCE	0.46J	1.4	1.2	1.3
TCE	1U	1U	1U	1U
DCE	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U

Figure 2

CHEMICALS OF CONCERN RESULTS (MARCH 2005 THROUGH EARLY JANUARY 2006) SHALLOW-INTERVAL MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 1.DWG
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: ML
REV: REVISION 0
DRAWN BY: MD
DATE: 08/23/05

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\JANUARY 2006\DWG\FIG 2_MONITORING_WELLS_SHALLOW.DWG
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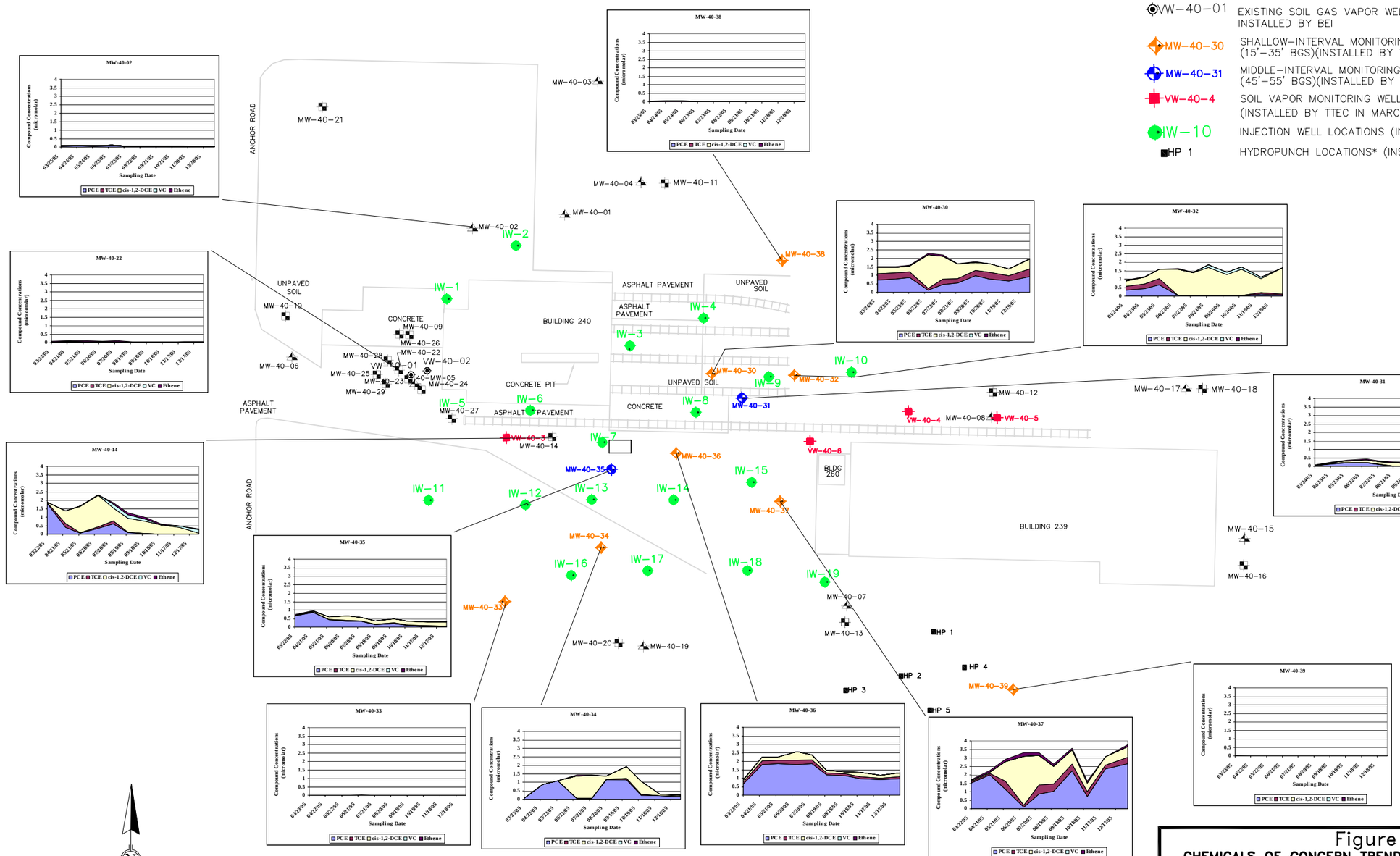

Figure 3
CHEMICALS OF CONCERN TRENDS OVER TIME BY LOCATION, MOLAR BASIS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 3.DWG
DCN: FWSD-RAC
CTO: #0090
APPROVED BY: HH
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DRAWN BY: MD
DATE: 12/16/05

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\JANUARY 2006\DWG\FIG 3.DWG
PLOT/UPDATE: FEB 07 2006 16:18:49

TETRA TECH EC, INC.

MARCH 2006, SUMMARY OF FIELD ACTIVITIES AND DATA FOR ENHANCED *IN SITU* BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS VIA LACTATE INJECTION

INSTALLATION RESTORATION PROGRAM SITE 40
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CA

Date: May 2, 2006

Prepared by: Hamlet Hamparsumian and Mark E. Losi, Tetra Tech EC, Inc. (TtEC)

Distribution:	**Navy**	**TtEC**	**Agencies**
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	Chris Leadon		

INTRODUCTION

This is the eleventh summary report documenting activities conducted in association with groundwater remediation activities at Installation Restoration Program (IRP) Site 40 at Naval Weapons Station Seal Beach, Seal Beach, California. This report provides a brief review of site activities conducted from mid-January 2006 through March 2006, and briefly summarizes the status of contaminant reduction as a result of the enhanced *in situ* bioremediation (EISB) project. Monitoring and other field activities conducted during the period are summarized in Table 1, and the locations of substrate injection wells and groundwater monitoring wells are shown on Figure 1.

SUMMARY OF FIELD ACTIVITIES

The field activities included ongoing monitoring activities (Table 1) and assessment of relevant data collected during this reporting period. Lactate injection ceased on December 16, 2005, and no lactate has been injected since that date and through this reporting period. Results of the monitoring activities are briefly discussed in the following section.

MONITORING EVALUATION

Groundwater and soil vapor sampling and analytical data, and groundwater level measurements, are briefly discussed below. Groundwater monitoring well data for chemicals of concern (COCs) include samples collected in March 2006 and are included on Figures 1 and 2 (middle-interval and shallow-interval monitoring wells, respectively). In addition, current plume maps for tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC) are presented in Figures 3 through 6, respectively, and concentration trends (molar basis) over the course of the project are presented graphically by location in Figure 7.

Groundwater Data

The following key observations focus on COC concentrations in regularly monitored groundwater monitoring wells MW-40-02, -07, -14, -22, and -30 through -39. Results are also included for additional, monitored natural attenuation (MNA) monitoring wells, which were sampled as part of the March event.

1) Regularly monitored middle-interval monitoring wells, including MW-40-22, -14, -31, and -35. (See Figure 1):

   - PCE levels remain below the Maximum Contaminant Level (MCL) (5 micrograms per liter [μg/L]) in the regularly monitored middle-interval monitoring wells and ranged from non-detect to 0.55J μg/L.
   - TCE levels are detected below the MCL (5 μg/L) in middle-interval monitoring wells MW-40-02 and -31, and slightly higher than MCL in MW-40-14 (8.1 μg/L) and -35 (5.6 μg/L).
   - DCE is present above the MCL (6 μg/L) in three of the regularly monitored middle-interval monitoring wells at concentrations ranging from 8.6 μg/L to 16 μg/L. A DCE concentration of 1.9 μg/L was detected in MW-40-31.
   - VC is present above the MCL (0.5 μg/L) in all regularly monitored middle-interval monitoring wells. The highest VC concentration was detected in well MW-40-14 at 17 μg/L. VC levels in the remaining three wells ranged from 0.83 μg/L to 2 μg/L.
   - Results indicate that reductive dechlorination process is occurring beyond DCE in these areas.

2) Regularly monitored shallow-interval wells, including MW-40-02, -07, -30, -32, -33, -34, and -36 through -39 (see Figure 2):

   - In general, PCE concentrations decreased in all shallow-interval monitoring wells and substantially in two of the key wells located in the central portion of the site since the last sampling conducted in early January 2006. These monitoring wells include MW-40-07 (from 110 μg/L to 25 μg/L), and -37 (from 440 μg/L to 100 μg/L). Less substantial decreases were noted in MW-40-30 (from 150 μg/L to 130 μg/L) and -36 (160 μg/L to 140 μg/L).
   - PCE has remained at a concentration slightly above the MCL in MW-40-02 and -32, and no COCs have been detected above the reporting limits in MW-40-33, -38, and -39.
   - Only three out of ten wells indicated TCE concentrations greater than the MCL. TCE levels were generally stable or decreasing. However, substantial decreases were noted in MW-40-30 (from 60 μg/L to 43 μg/L), and -37 (from 48 μg/L to 28 μg/L). In addition, TCE decreased from 6.1 μg/L to 2.6 μg/L (below the MCL) in MW-40-32.
   - Production of DCE has been noted in all wells, except MW-40-02 and -07. DCE concentrations have decreased to varying degrees in most wells (MW-40-30, -34, -36, and -37) and increased slightly in monitoring well MW-40-32 (150 μg/L to 160 μg/L).
   - Relatively low levels of VC have continued to be detected at or above the MCL (0.5 μg/L) in MW-40-30 (0.48J μg/L), -32 (1.8 μg/L), -34 (0.59 μg/L), and -37 (1.2 μg/L). This appears to indicate that dechlorination beyond DCE is occurring, but is still not proceeding efficiently to completion at some locations at this time.

The following key observations are noted with respect to COC concentration trends for the MNA monitoring wells (MW-40-06, -08, -10, -11, -12, -13, -15, -16, -17, -18, -19, and -20):

1) Middle-interval monitoring wells MW-40-10, -11, -12, -13, -16, -18, and -20 (see Figure 1):

   - COCs have decreased in MW-40-13 and are below respective MCLs in all wells.

2) Shallow-interval monitoring wells MW-40-06, -08, -15, -17, and -19 (see Figure 2):

- COCs were either not detected or were detected at trace levels in all MNA wells, except MW-40-08, where PCE and TCE were detected at respective concentrations of 5.5 μg/L and 1.1 μg/L. These levels are consistent with concentrations measured during baseline analysis and during subsequent quarterly monitoring events.
- PCE was not detected above the reporting limit in MW-40-17 during the March event. PCE had been detected in this well at a level of 16 μg/L in September 2005 but has not been detected above the reporting limit since.

Contaminant Plume Delineations –

To aid in assessing plume extents, groundwater samples were collected from all 19 existing injection wells during February 2006. All samples were analyzed for COCs and chemical oxygen demand (COD), and samples from selected injection wells were also analyzed for *Dehalococcoides* (DHC) organisms. This provided more data from additional locations to estimate the plume extents for PCE, TCE, DCE, and VC. Injection wells were sampled because it was expected that remediation was achieved in areas around the injection wells that was not reflected by the monitoring well data alone. We believe, given the injection/monitoring well array, that contamination is likely less extensive than would be represented by delineating plume boundaries, based only on data from monitoring wells, without accounting for areas in between the monitoring wells where contamination was likely minimal.

The estimated plume extents for PCE, TCE, DCE, and VC, based on the February 2006 injection well data and the March 2006 monitoring well data, are presented on Figures 3 through 6, respectively. PCE and TCE were not detected or were detected at very low levels in all injection well samples (Figures 3 and 4). As shown in Figures 5 and 6, DCE production has been relatively extensive, and a less extensive VC plume is present in the central portion of the site. Obviously, it is possible that the low levels of PCE and TCE in the injection wells may be due to displacement of these contaminants as a result of the lactate injection; however, the presence of DCE in the injection wells suggests that this may not be the case. DCE and VC were frequently detected in injection well samples where PCE and TCE were not present, which would not be the case if contaminant displacement was solely accountable for the low PCE and TCE levels in the injection wells. For example, in IW-7, PCE and TCE were not detected above the reporting limit, but DCE was detected at a concentration of 67 μg/L, suggesting that degradation has occurred.

HydroPunch® samples are currently being collected at points between the injection wells and the monitoring wells to further assess COC distributions and evaluate the success of the remediation. Cone penetrometer test (CPT) is also being conducted to further assess the lithology and permeability of the subsurface soils in this area. This information will be used along with COC and COD concentration data for the HydroPunch samples to provide a more accurate assessment of COC extents, lactate distribution, and subsurface permeability for developing EISB system optimization strategies, for finding ways to increase the effectiveness of the current system, and for evaluating other potential alternatives. The data for the injection wells will be discussed in an upcoming report that will evaluate potential options for the EISB system optimization. The plume delineations presented herein will be refined once the current HydroPunch sampling results become available and will be included in the EISB system optimization valuation report.

Lactate Presence and Microbiological/Geochemical Parameters –

COD (an indicator of sodium lactate presence) data for all monitoring events, including the March 2006 event, are plotted by location on Figure 8, to show the trends. Lactate injection ceased on December 16, 2005, and no lactate has been injected since that date and through this reporting period. Trends for critical wells suggest that sodium lactate remains present at elevated levels in middle-interval monitoring wells

MW-40-14, -31, and -35 (although a substantial decrease was observed in MW-40-14 for the March 2006 event). These wells have generally exhibited favorable results with respect to degradation of the COCs in their areas.

COD trends in shallow-interval monitoring wells MW-40-32 and -34, which appear to be responding to the treatment to a more limited extent than the wells noted above, exhibited essentially no change over the previous measurement. This indicated that lactate is present in the areas of these wells, and reductive dechlorination would likely continue to occur.

Lactate migration to shallow-interval monitoring wells MW-40-30, -36, and -37, which have responded marginally to the EISB treatment, actually increased, indicating possible improved dispersion in these areas. Minor corresponding decreases in PCE levels were observed in MW-40-30 and -36, and a major decrease in PCE concentration was evident in MW-40-37 over this period. However, corresponding increases in daughter products were not observed in these wells, and thus it can not be confirmed that the reductions in PCE are due to reductive dechlorination.

Trends reflecting concentrations of DHC organisms in monitoring wells are included on Figure 8. Bioaugmentation was conducted during the week of September 19. Varying trends are observed for DHC, and overall increases are noted in several cases, notably in MW-14, -31, -32, -35, -36, and -37. Because DHC was widely detected during the baseline event, and because evidence for reductive dechlorination beyond DCE is not convincing, it is believed that there is a native strain present at the site that was not detected during the pilot test, but that this strain is not efficient in bringing about reduction of DCE. Based on the pilot test results, it was estimated that the effects of the bioaugmented strain (KB-1) would become evident approximately 4 to 6 months after bioaugmentation occurred. The monitoring well data do not appear to suggest, at this time, increases in DHC levels that may be attributable to the bioaugmentation action. In addition, the COC data do not suggest clear effects of bioaugmentation at this time.

Geochemical data, including electron acceptors and biogenic gases, have consistently indicated a strongly reduced environment in the most critical locations. Oxidation/reduction potential (ORP) values for the most recent four events are plotted by location on Figure 9 to show the recent trends. The data suggest increasing ORP trends at most locations, in spite of stable or increasing COD values. For the key wells located in the central part of the site where treatment has not been optimal (MW-40-30, -34, -36, and -37), ORP values are trending positive and do not reflect conditions that are strongly supportive of reductive dechlorination. While COD data indicate moderately increasing trends in these locations, concentrations are relatively low (generally less than 70 milligrams per liter [mg/L]), and the ORP data suggest that substrate may be depleted or limiting biological activity in these locations.

Soil Vapor Data. Methane gas surface emissions monitoring was performed on February 24 and March 15, 2006. Methane gas emissions were not detected within Buildings 239 and 240 and surrounding areas during these monitoring events.

Soil gas monitoring was conducted on February 24 and March 15, 2006. The results of probe monitoring indicated that 26 out of the 30 probes that were tested in the field had methane gas concentrations ranging from as low as 22.7 percent up to 96.1 percent in air during the February monitoring event and 15.1 percent up to 96.4 percent in air during the March monitoring event. The highest methane concentration was detected in the soil gas probe in injection well IW-17. Hydrogen sulfide concentrations ranged from zero parts per million (ppm) to 26 ppm.

Groundwater Levels. Groundwater level measurements were conducted on February 24 and March 16, 2006. Groundwater elevations within the site, measured on February 24, 2006, ranged from 1.31 feet above mean sea level (msl) in MW-40-10 to 2.24 feet above msl in IW-16. Groundwater elevations within the site, measured on March 16, 2006, ranged from 1.00 feet above msl in MW-40-17 to 2.01 feet above

msl in IW-16. In general, water level measurements collected in February and later in March indicated a drop of approximately 2 to 3.5 inches within the monitoring area.

SUMMARY AND FOLLOW-UP ACTIVITIES

In summary, COC concentrations are at or near the California MCLs or target cleanup goals in majority of the middle-interval monitoring wells, including MW-40-10, -11, -12, -13, -16, -18, and -20. In other middle-interval monitoring wells (MW-40-14, -22, -31 and -35), COCs are detected at very low concentrations. COCs are not detected or detected at very low concentrations (one case) in shallow-interval monitoring wells MW-40-02, -06, 08, -15, -17, -19, -33, -38, and -39. COCs are detected at higher concentrations in shallow-interval monitoring wells MW-40-07, MW-40-30, MW-40-36, and MW-40-37, where minimal reductive dechlorination appears to have taken place. PCE levels in MW-40-07 decreased from 110 μg/L to 25 μg/L. PCE and TCE were detected for the first time in downgradient middle-interval monitoring well MW-40-13 (located approximately 10 feet south of shallow-interval monitoring well MW-40-07) during the prior event (January 9, 2006), but were not detected above the reporting limit during the March event. Plume delineations which account for monitoring well data suggest that reduction of PCE and TCE may be more extensive than the monitoring well data suggest.

Geochemical and microbiological data indicate that conditions are relatively favorable for reductive dechlorination; however, the process still appears to be hindered by lack of horizontal substrate transport in the central area of the site. It does not appear, at this time, that large-scale effects of bioaugmentation have been realized.

Other activities conducted during early May and upcoming field activities include the following:

- Bechtel National, Inc. (BNI) has mobilized to the site to collect additional geologic and hydrogeologic data, and collect groundwater samples for chemical analysis in the central area of the plume in order to better assess the subsurface geology and contaminant distribution, especially in the area near the injection wells at central portion of the plume. This will help in assessment of the effectiveness of the treatment system in this area. This additional investigation is being conducted to also assess EISB optimization options.
- Based on the new COC and geological data, contaminant distributions and subsurface hydrogeological conditions will be re-evaluated, and various optimization alternatives will be assessed. This may involve evaluation and possible implementation of a slow release substrate, recirculation, modification and/or optimization of the current injection layout, or a combination of these approaches.

TABLES

Table 1 Summary of Monitoring Activities Conducted from February and March 2006

FIGURES

Figure 1 Chemical of Concern Results (March 2005 through March 2006) Middle-interval Monitoring Wells

Figure 2 Chemical of Concern Results (March 2005 through March 2006) Shallow-interval Monitoring Wells

Figure 3 PCE Estimated Plume Extent, February-March 2006, Based on Injection and Monitoring Well Results

Figure 4 TCE Estimated Plume Extent, February-March 2006, Based on Injection and Monitoring Well Results

Figure 5 Cis-1,2-DCE Estimated Plume Extent, February-March 2006, Based on Injection and Monitoring Well Results

Figure 6 VC Estimated Plume Extent, February-March 2006, Based on Injection and Monitoring Well Results

Figure 7 Chemical of Concern Trends over Time by Location, Molar Basis

Figure 8 *Dehalococcoides* spp. and COD Trends Over Time by Location

Figure 9 Oxidation/Reduction Potential Trends Over Time, October 2005 Through March 2006 Monitoring Events

TABLES

TABLE 1

SUMMARY OF MONITORING ACTIVITIES CONDUCTED DURING FEBRUARY AND MARCH 2006

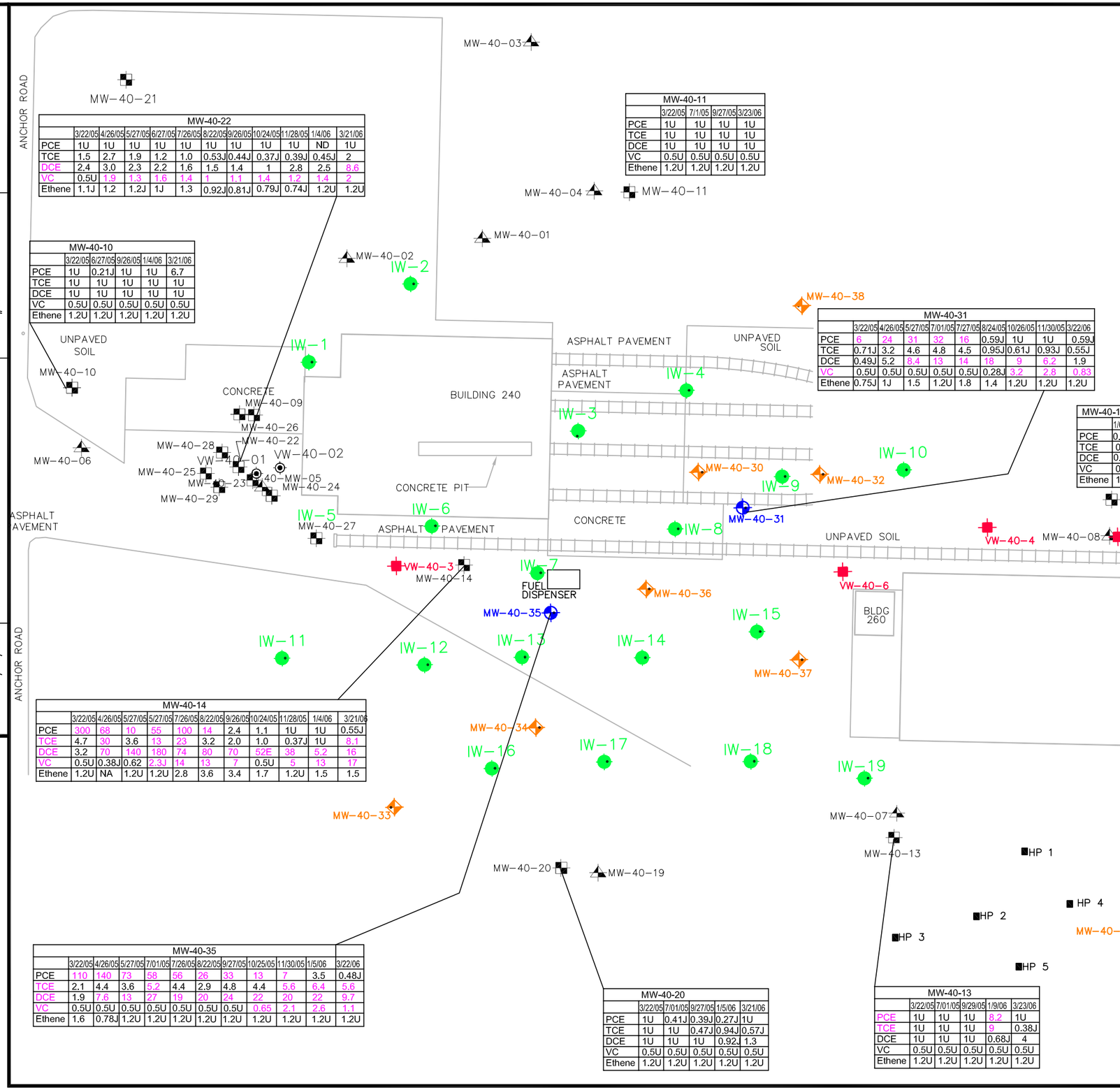
Date	Event	Wells Sampled[1]	Analytes[2]/Parameters	Notes
2/2/06-2/3/06	Injection Well Sampling	IW-3, -4, -7, -8, -9, -10, -13, -14, -15, -16, -17, -18, -19	VOCs, COD, and DNA	
2/21/06	Injection Well Sampling	IW-1, -2, -5, -6, -11, -12	VOCs, COD, and DNA	
2/24/06	Soil vapor/gas probe monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, and IW-1 through IW-4 and IW-6 through IW-17	Methane, oxygen, carbon dioxide, VOCs, and carbon monoxide	
2/24/06	Groundwater level measurements	MW-40-06, -10, -14, -20, -22, -30 through 39, and IW-1 through IW-17	None	Groundwater level measurements
3/15/06	Groundwater level measurements	MW-40-01, -2, -6, -7, -8, -10, -11, -13, -14, -15, -17, -19, -20, -22, -30 through 39, and IW-1 through IW-17	None	Groundwater level measurements
3/15/06	Surface emissions monitoring	Not applicable	Methane gas concentrations	Inside Building 240 and western portion of Building 239, and areas surrounding the above buildings
3/16/06	Soil vapor/gas probe monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, and IW-1 through IW-4 and IW-6 through IW-17	Methane, oxygen, carbon dioxide, VOCs, and carbon monoxide	
3/16/06	Soil vapor sampling	VW-40-01, -02, -03, -06, MW-40-34, IW-1, -3, -7	VOCs and fixed gasses	
3/21/06-3/23/06	Scheduled monthly laboratory analysis	Groundwater: MW-40-06, -07, -08, -10, -11, -13 through -20, -22, and -30 through -39.	VOCs, dissolved gasses, cations, DNA, water levels, COD, CO_2, $^-$ and additional geochemical parameters.	Field test kits (COD, SO_4^{2-}, Fe^{2+}, CO_2, alkalinity, NO_3^-) not conducted

Notes:

[1]Refer to Figure 1 for well locations
[2]Refer to SAP for complete list of analytes

CO_2 – carbon dioxide
COD – chemical oxygen demand
Fe^{2+} – ferrous iron
NO_3^- – nitrate
SO_4^{2-} – sulfate
VOC – volatile organic compound

FIGURES



MW-40-22	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	ND	1U
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J	0.37J	0.39J	0.45J	2
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4	1	2.8	2.5	8.6
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1	1.4	1.2	1.4	2
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J	0.79J	0.74J	1.2U	1.2U

MW-40-11	3/22/05	7/1/05	9/27/05	3/23/06
PCE	1U	1U	1U	1U
TCE	1U	1U	1U	1U
DCE	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U

MW-40-10	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06
PCE	1U	0.21J	1U	1U	6.7
TCE	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-31	3/22/05	4/26/05	5/27/05	7/01/05	7/27/05	8/24/05	10/26/05	11/30/05	3/22/06
PCE	6	24	31	32	16	0.59J	1U	1U	0.59J
TCE	0.71J	3.2	4.6	4.8	4.5	0.95J	0.61J	0.93J	0.55J
DCE	0.49J	5.2	8.4	13	14	18	9	6.2	1.9
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.28J	3.2	2.8	0.83
Ethene	0.75J	1J	1.5	1.2U	1.8	1.4	1.2U	1.2U	1.2U

MW-40-12	1/6/06
PCE	0.53J
TCE	0.3J
DCE	0.44J
VC	0.5U
Ethene	1.2U

MW-40-18	1/6/06	3/23/06
PCE	1U	1U
TCE	1U	1U
DCE	1U	1U
VC	0.5U	0.5U
Ethene	1.2U	1.2U

MW-40-16	1/6/06	3/23/06
PCE	1U	1U
TCE	1U	1U
DCE	1U	1U
VC	0.5U	0.5U
Ethene	1.2U	1.2U

MW-40-14	3/22/05	4/26/05	5/27/05	5/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06
PCE	300	68	10	55	100	14	2.4	1.1	1U	1U	0.55J
TCE	4.7	30	3.6	13	23	3.2	2.0	1.0	0.37J	1U	8.1
DCE	3.2	70	140	180	74	80	70	52E	38	5.2	16
VC	0.5U	0.38J	0.62	2.3J	14	13	7	0.5U	5	13	17
Ethene	1.2U	NA	1.2U	1.2U	2.8	3.6	3.4	1.7	1.2U	1.5	1.5

MW-40-35	3/22/05	4/26/05	5/27/05	7/01/05	7/26/05	8/22/05	9/27/05	10/25/05	11/30/05	1/5/06	3/22/06
PCE	110	140	73	58	56	26	33	13	7	3.5	0.48J
TCE	2.1	4.4	3.6	5.2	4.4	2.9	4.8	4.4	5.6	6.4	5.6
DCE	1.9	7.6	13	27	19	20	24	22	20	22	9.7
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.65	2.1	2.6	1.1
Ethene	1.6	0.78J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-20	3/22/05	7/01/05	9/27/05	1/5/06	3/21/06
PCE	1U	0.41J	0.39J	0.27J	1U
TCE	1U	1U	0.47J	0.94J	0.57J
DCE	1U	1U	1U	0.92J	1.3
VC	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-13	3/22/05	7/01/05	9/29/05	1/9/06	3/23/06
PCE	1U	1U	1U	8.2	1U
TCE	1U	1U	1U	9	0.38J
DCE	1U	1U	1U	0.68J	4
VC	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 — SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA
U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05
INJECTION WELL IW-18 INSTALLED AUGUST 19, 2005
INJECTION WELL IW-19 INSTALLED SEPTEMBER 10, 2005

Figure 1

CHEMICAL OF CONCERN RESULTS (MARCH 2005 THROUGH MARCH 2006) MIDDLE-INTERVAL MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 1.DWG
DCN: FWSD-RAC- CTO: #0090
APPROVED BY: HH
CHECKED BY: ML REV: REVISION 0
DRAWN BY: MD DATE: 04/28/06

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\FEB_MARCH 2006\DWG\FIG 1.DWG
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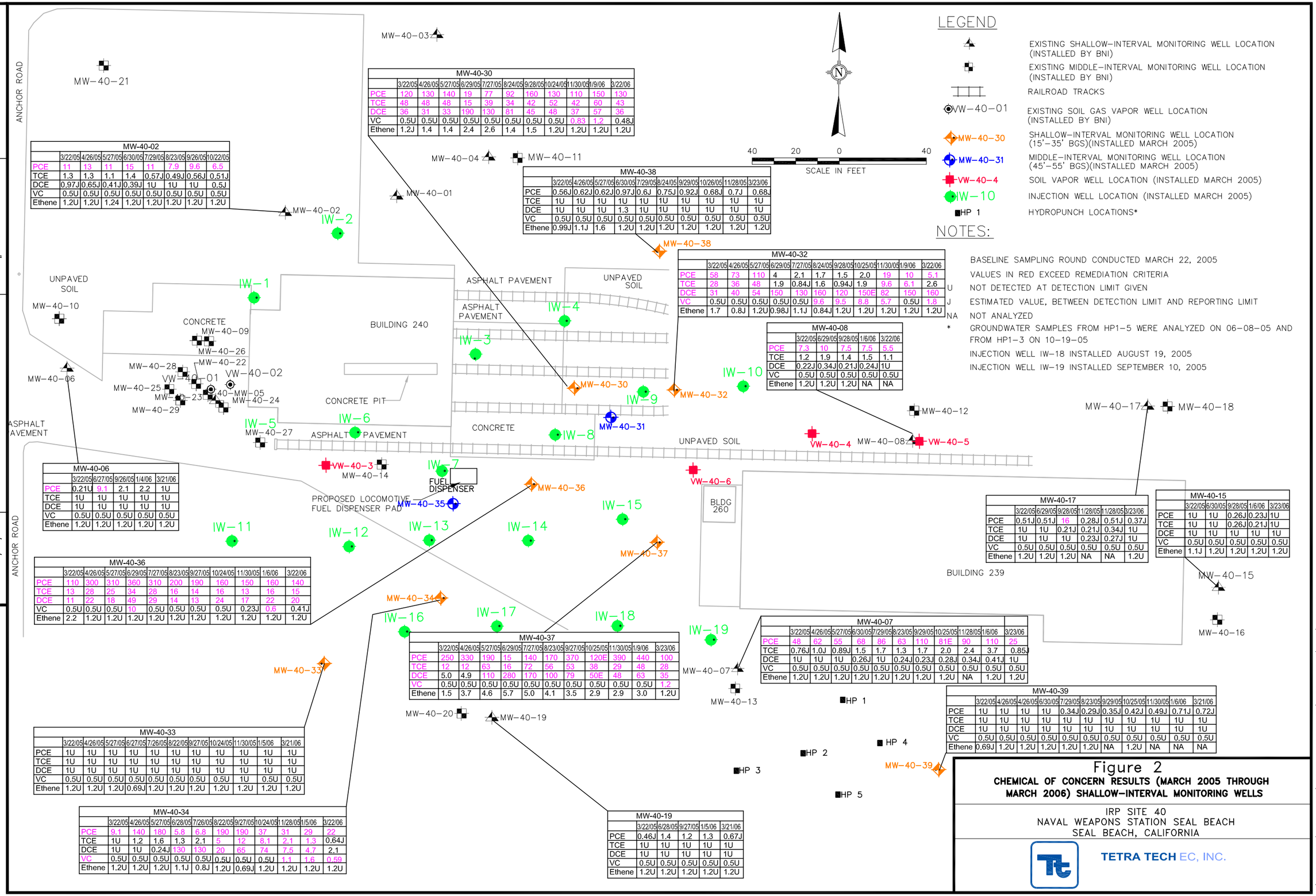

MW-40-02

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/26/05	10/22/05
PCE	11	13	11	15	11	7.9	9.6	6.5
TCE	1.3	1.3	1.1	1.4	0.57J	0.49J	0.56J	0.51J
DCE	0.97J	0.65J	0.41J	0.39J	1U	1U	1U	0.5J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.24	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-30

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/24/05	11/30/05	1/9/06	3/22/06
PCE	120	130	140	19	77	92	160	130	110	150	130
TCE	48	48	48	15	39	34	42	52	42	60	43
DCE	36	31	33	190	130	81	45	48	37	57	36
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.83	1.2	0.48J
Ethene	1.2J	1.4	1.4	2.4	2.6	1.4	1.5	1.2U	1.2U	1.2U	1.2U

MW-40-38

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/24/05	9/29/05	10/26/05	11/28/05	3/23/06
PCE	0.56J	0.62J	0.62J	0.97J	0.6J	0.75J	0.92J	0.68J	0.7J	0.68J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1.3	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.99J	1.1J	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-32

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/25/05	11/30/05	1/9/06	3/22/06
PCE	58	73	110	4	2.1	1.7	1.5	2.0	19	10	5.1
TCE	28	36	48	1.9	0.84J	1.6	0.94J	1.9	9.6	6.1	2.6
DCE	31	40	54	150	130	160	120	150E	82	150	160
VC	0.5U	0.5U	0.5U	0.5U	0.5U	9.6	9.5	8.8	5.7	0.5U	1.8
Ethene	1.7	0.8J	1.2U	0.98J	1.1J	0.84J	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-08

	3/22/05	6/29/05	9/28/05	1/6/06	3/22/06
PCE	7.3	10	7.5	7.5	5.5
TCE	1.2	1.9	1.4	1.5	1.1
DCE	0.22J	0.34J	0.21J	0.24J	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA

MW-40-06

	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06
PCE	0.21U	9.1	2.1	2.2	1U
TCE	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-17

	3/22/05	6/29/05	9/28/05	11/28/05	11/28/05	3/23/06
PCE	0.51J	0.51J	16	0.28J	0.51J	0.37J
TCE	1U	1U	0.21J	0.21J	0.34J	1U
DCE	1U	1U	1U	0.23J	0.27J	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	1.2U

MW-40-15

	3/22/05	6/30/05	9/28/05	1/6/06	3/23/06
PCE	1U	1U	0.26J	0.23J	1U
TCE	1U	1U	0.26J	0.21J	1U
DCE	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.1J	1.2U	1.2U	1.2U	1.2U

MW-40-36

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/24/05	11/30/05	1/6/06	3/22/06
PCE	110	300	310	360	310	200	190	160	150	160	140
TCE	13	28	25	34	28	16	14	16	13	16	15
DCE	11	22	18	49	29	14	13	24	17	22	20
VC	0.5U	0.5U	0.5U	10	0.5U	0.5U	0.5U	0.5U	0.23J	0.6	0.41J
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-37

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/25/05	11/30/05	1/9/06	3/23/06
PCE	250	330	190	15	140	170	370	120E	390	440	100
TCE	12	12	63	16	72	56	53	38	29	48	28
DCE	5.0	4.9	110	280	170	100	79	50E	48	63	35
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.2
Ethene	1.5	3.7	4.6	5.7	5.0	4.1	3.5	2.9	2.9	3.0	1.2U

MW-40-07

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/28/05	1/6/06	3/23/06
PCE	48	62	55	68	86	63	110	81E	90	110	25
TCE	0.76J	1.0J	0.89J	1.5	1.7	1.3	1.7	2.0	2.4	3.7	0.85J
DCE	1U	1U	1U	0.26J	1U	0.24J	0.23J	0.28J	0.34J	0.41J	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	1.2U

MW-40-39

	3/22/05	4/26/05	4/26/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/30/05	1/6/06	3/21/06
PCE	1U	1U	1U	1U	0.34J	0.29J	0.35J	0.42J	0.49J	0.71J	0.72J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	NA	NA	NA

MW-40-33

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/27/05	10/24/05	11/30/05	1/5/06	3/21/06
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-34

	3/22/05	4/26/05	5/27/05	6/28/05	7/26/05	8/22/05	9/27/05	10/24/05	11/28/05	1/5/06	3/22/06
PCE	9.1	140	180	5.8	6.8	190	190	37	31	29	22
TCE	1U	1.2	1.6	1.3	2.1	5	12	8.1	2.1	1.3	0.64J
DCE	1U	1U	0.24J	130	130	20	65	74	7.5	4.7	2.1
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.1	1.6	0.59
Ethene	1.2U	1.2U	1.2U	1.1J	0.8J	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U

MW-40-19

	3/22/05	6/28/05	9/27/05	1/5/06	3/21/06
PCE	0.46J	1.4	1.2	1.3	0.67J
TCE	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U

Figure 2

CHEMICAL OF CONCERN RESULTS (MARCH 2005 THROUGH MARCH 2006) SHALLOW-INTERVAL MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 2.DWG
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: ML
REV: REVISION 0
DRAWN BY: MD
DATE: 04/28/06

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\APRIL 2006\DWG\FIG 2.DWG
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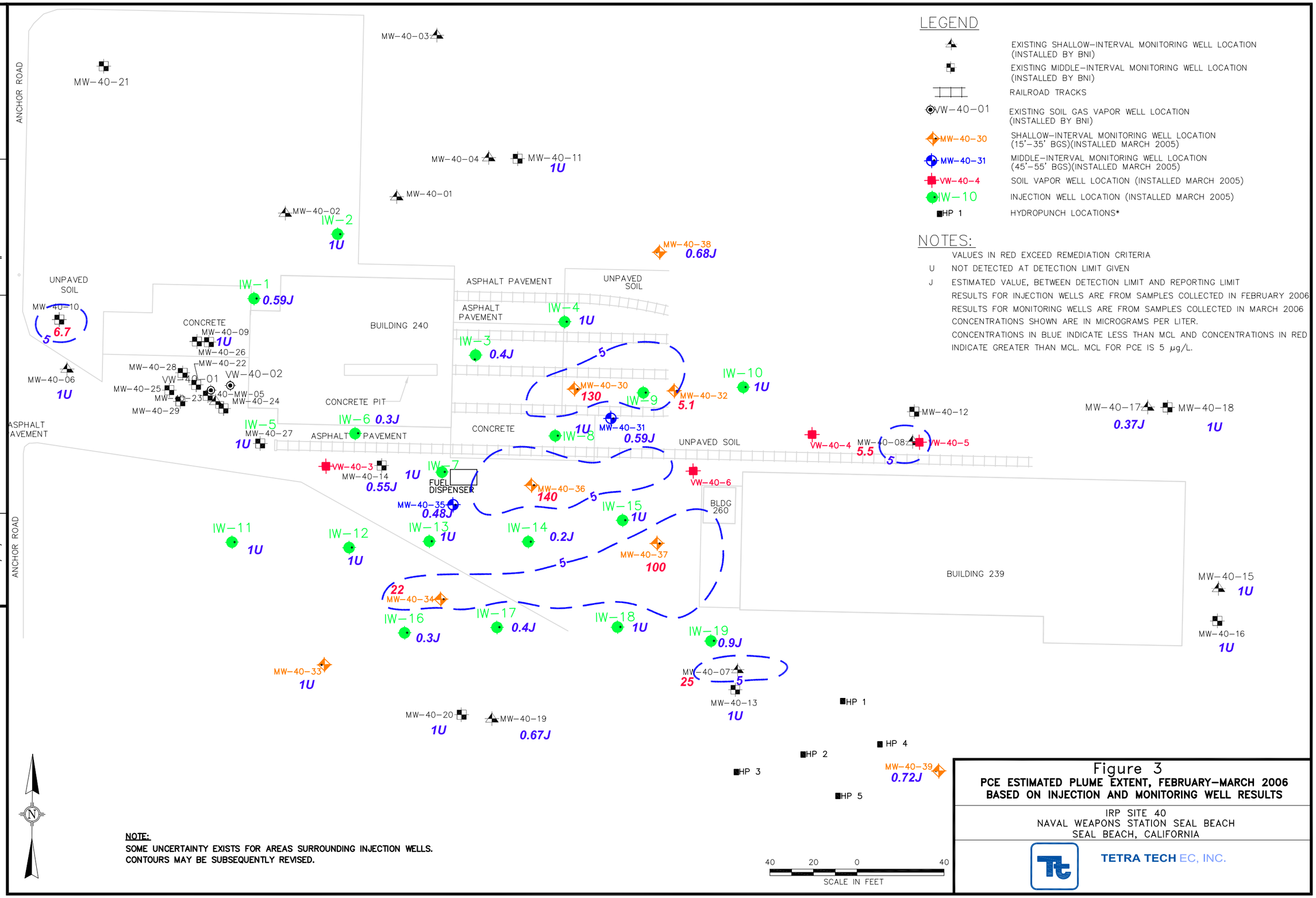

Figure 3
PCE ESTIMATED PLUME EXTENT, FEBRUARY-MARCH 2006
BASED ON INJECTION AND MONITORING WELL RESULTS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 3.DWG
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: HH
REV: REVISION 0
DRAWN BY: MD
DATE: 4/28/06

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\FEB_MARCH 2006\DWG\FIG 3.DWG
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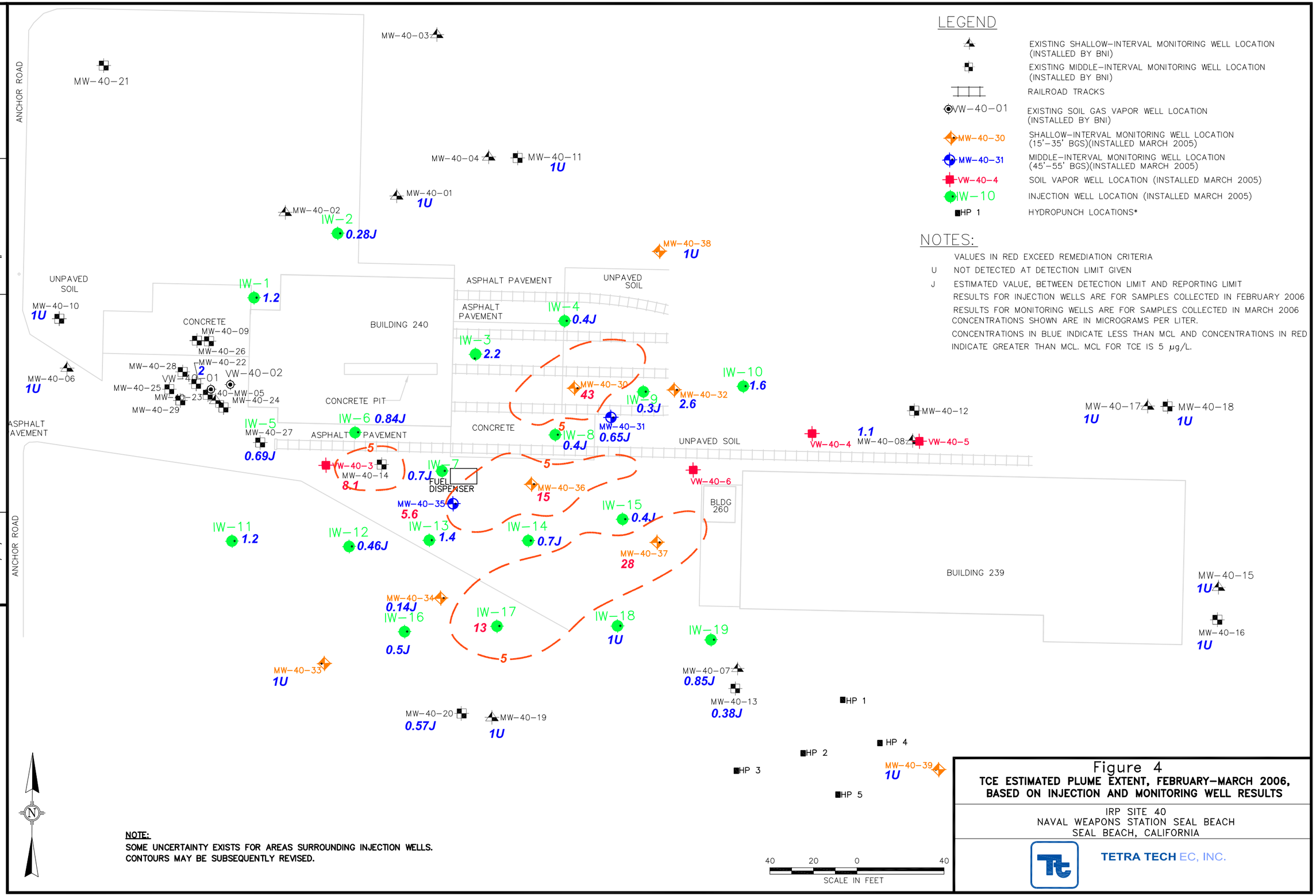

NOTE:
SOME UNCERTAINTY EXISTS FOR AREAS SURROUNDING INJECTION WELLS.
CONTOURS MAY BE SUBSEQUENTLY REVISED.

Figure 4
TCE ESTIMATED PLUME EXTENT, FEBRUARY–MARCH 2006, BASED ON INJECTION AND MONITORING WELL RESULTS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 4.DWG
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: HH
REV: REVISION 0
DRAWN BY: MD
DATE: 4/28/06

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\FEB_MARCH 2006\DWG\FIG 4.DWG
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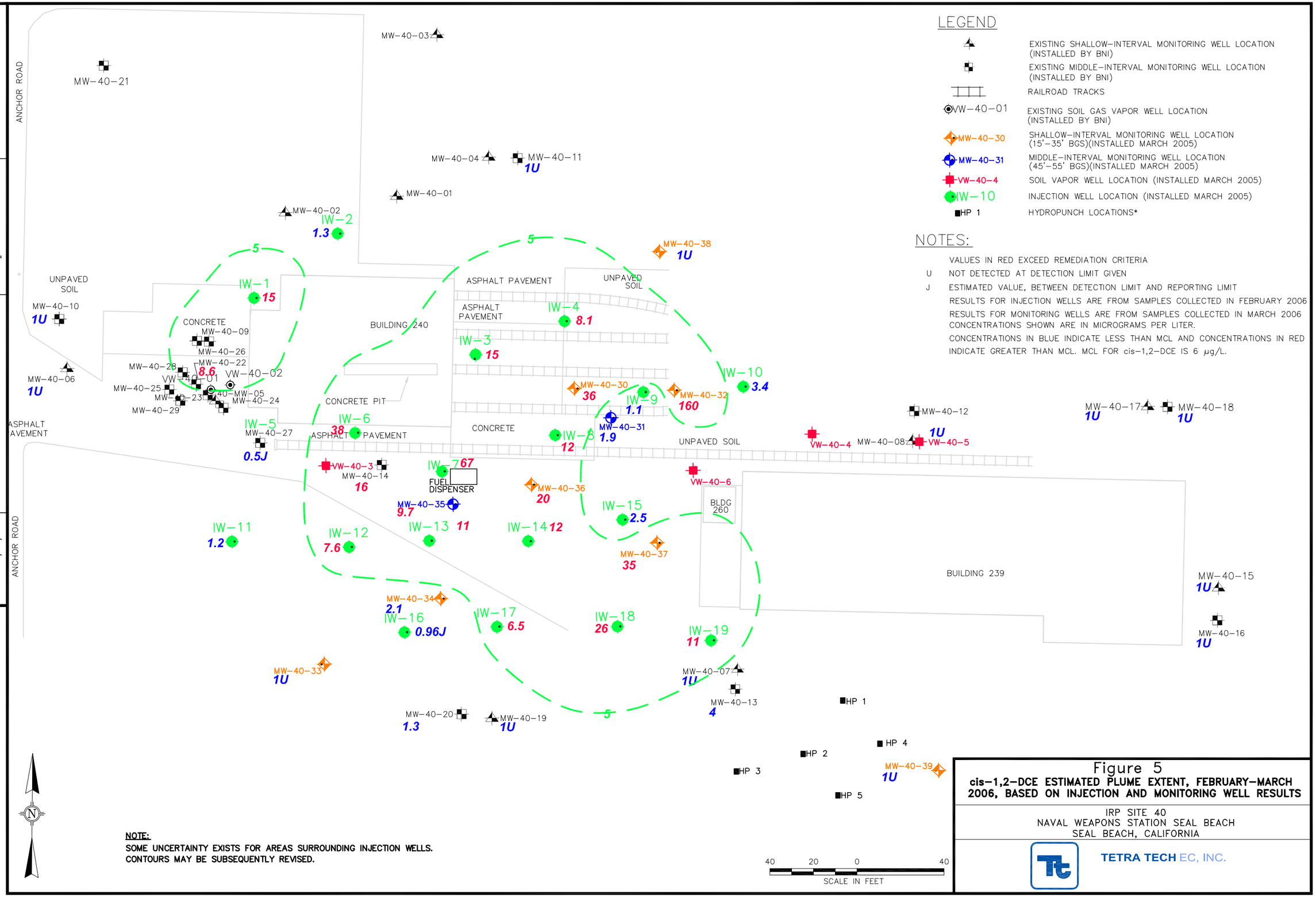

NOTE:
SOME UNCERTAINTY EXISTS FOR AREAS SURROUNDING INJECTION WELLS.
CONTOURS MAY BE SUBSEQUENTLY REVISED.

Figure 5
cis-1,2-DCE ESTIMATED PLUME EXTENT, FEBRUARY-MARCH 2006, BASED ON INJECTION AND MONITORING WELL RESULTS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 5.DWG
DCN: FWSD-RAC-
CTO: #0090
APPROVED BY: HH
CHECKED BY: HH
REV: REVISION 0
DRAWN BY: MD
DATE: 04/28/06

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\APRIL 2006\DWG\FIG 5.DWG
PLOT/UPDATE: MAY 02 2006 16:24:08

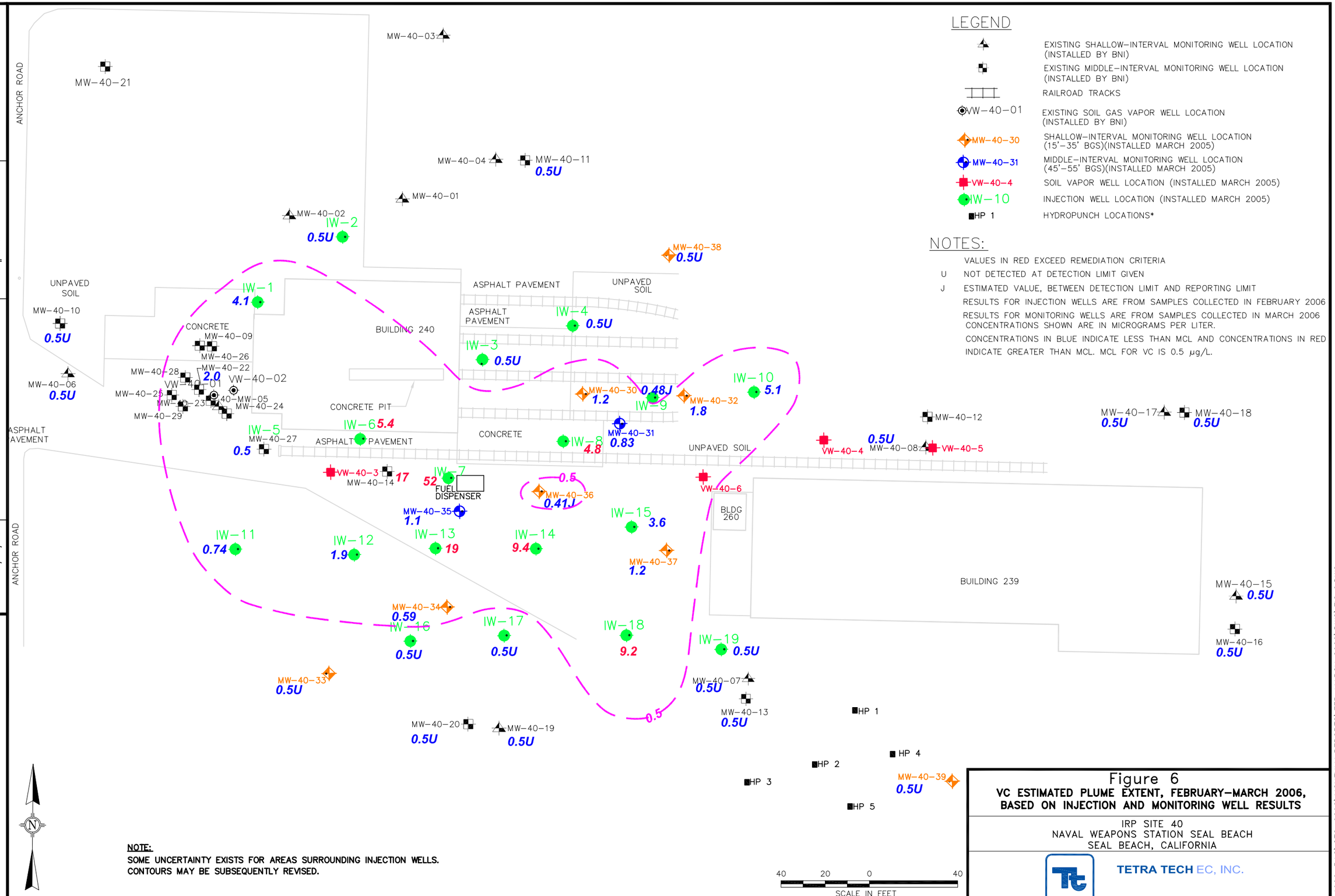

Figure 6
VC ESTIMATED PLUME EXTENT, FEBRUARY–MARCH 2006, BASED ON INJECTION AND MONITORING WELL RESULTS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

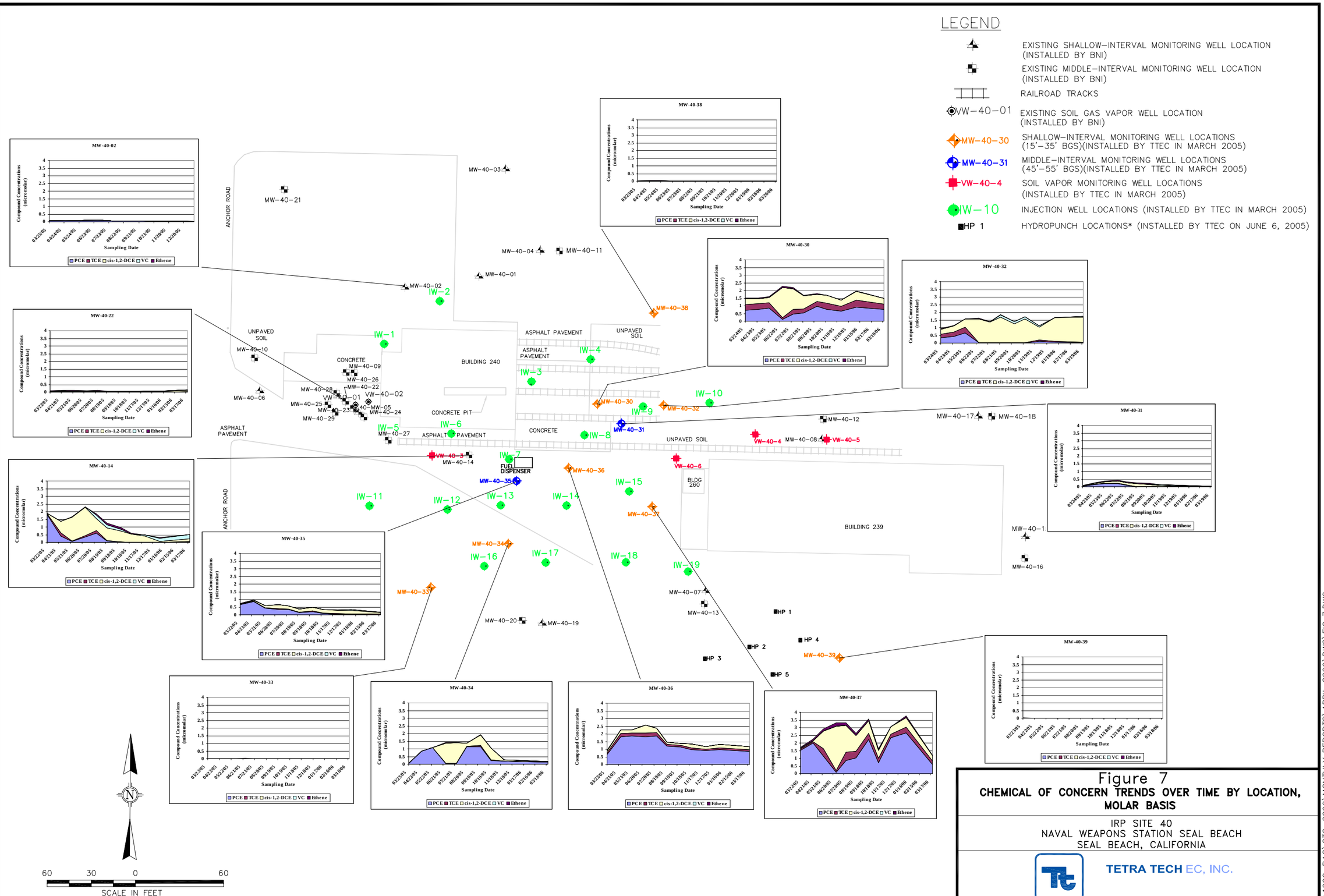

Figure 7

CHEMICAL OF CONCERN TRENDS OVER TIME BY LOCATION, MOLAR BASIS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 7.DWG
DCN: FWSD-RAC
CTO: #0090
APPROVED BY: HH
CHECKED BY: MT
REV: REVISION 0
DRAWN BY: MD
DATE: 04/28/06

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\APRIL 2006\DWG\FIG 7.DWG
PLOT/UPDATE: MAY 02 2006 16:25:14

DRAWING NO: FIG 8.DWG

DCN: FWSD-RAC CTO: #0090

APPROVED BY: HH

CHECKED BY: MT REV: REVISION 0

DRAWN BY: MD DATE: 04/28/06

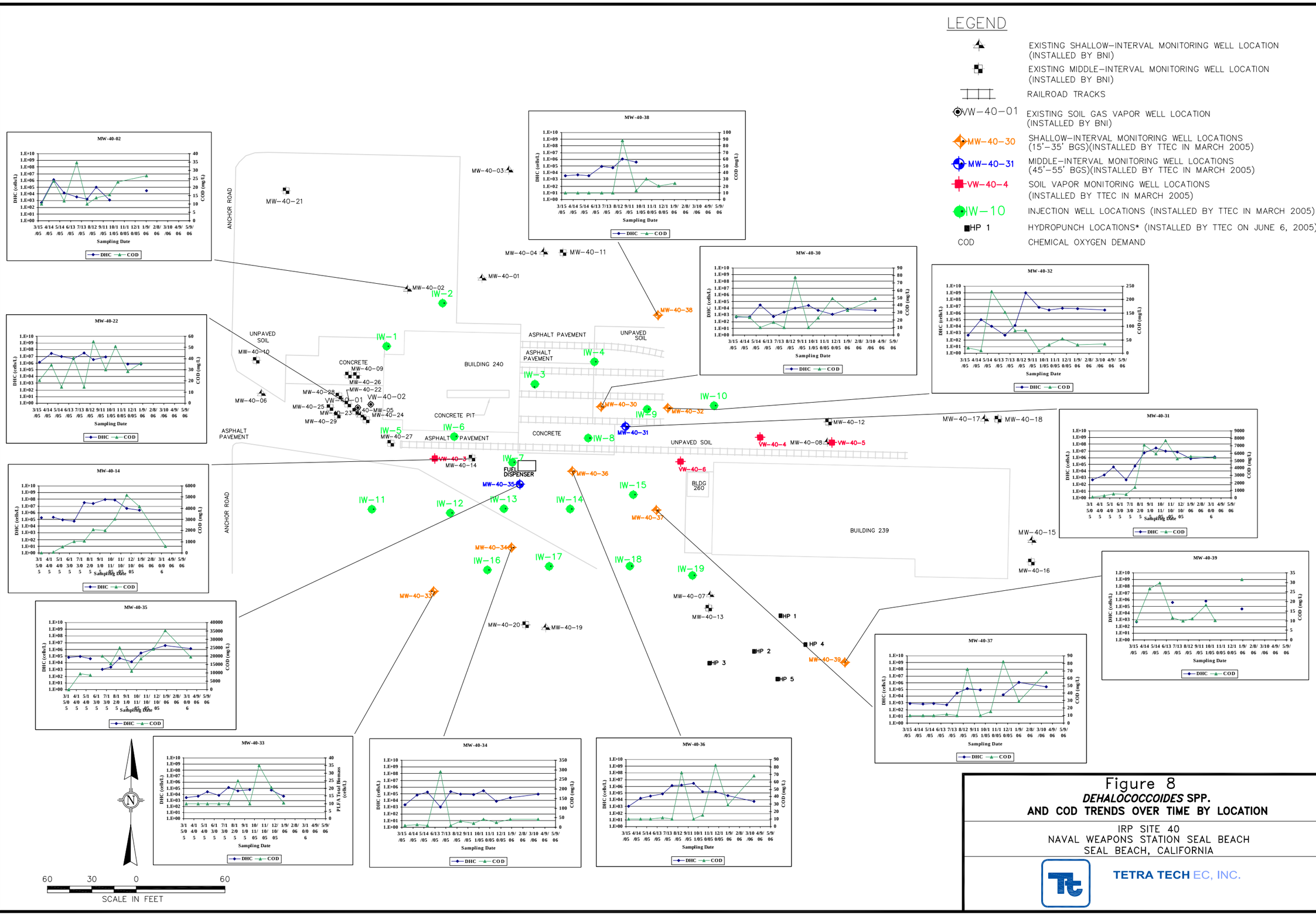

Figure 8

***DEHALOCOCCOIDES* SPP. AND COD TRENDS OVER TIME BY LOCATION**

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\FEB_MARCH 2006\DWG\FIG 8.DWG
PLOT/UPDATE: APR 28 2006 12:09:30

DRAWING NO: FIG 9.DWG

DCN: FWSD-RAC | CTO: #0090

APPROVED BY: HH

CHECKED BY: MT | REV: REVISION 0

DRAWN BY: MD | DATE: 04/28/06

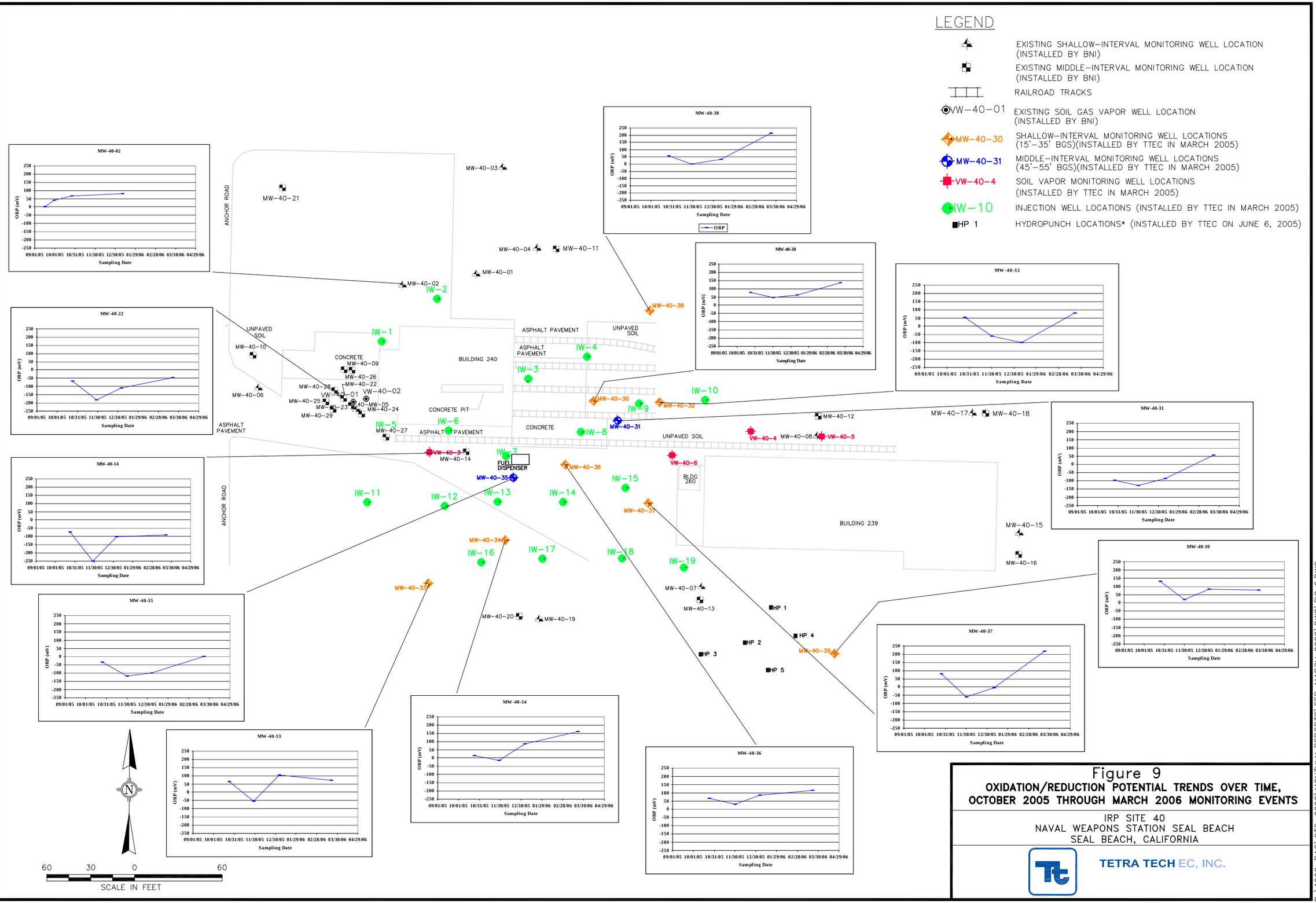

Figure 9

OXIDATION/REDUCTION POTENTIAL TRENDS OVER TIME, OCTOBER 2005 THROUGH MARCH 2006 MONITORING EVENTS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

P:\1990-RAC\CTO-0090\MONTHLY REPORTS\FEB_MARCH 2006\DWG\FIG 9.DWG
PLOT/UPDATE: APR 28 2006 12:12:08

TETRA TECH EC, INC.

SUMMARY OF FIELD ACTIVITIES AND DATA FOR ENHANCED *IN SITU* BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS FOR JUNE/JULY AND SEPTEMBER 2006

INSTALLATION RESTORATION PROGRAM SITE 40
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CA

Date: October 31, 2006

Prepared by: Hamlet Hamparsumian and Mark E. Losi, Tetra Tech EC, Inc. (TtEC)

Distribution:

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Pei-Fen Tamashiro	Katherine Leibel (DTSC)
Chris Leadon	

INTRODUCTION

This summary report provides a brief review of site activities conducted from mid-June 2006 through September 2006 in association with groundwater remediation activities at Installation Restoration Program (IRP) Site 40 at Naval Weapons Station Seal Beach, Seal Beach, California. This report briefly summarizes the status of contaminant reduction as a result of the enhanced *in situ* bioremediation (EISB) project. Monitoring and other field activities conducted during the period are summarized in Table 1.

SUMMARY OF FIELD ACTIVITIES

The field activities for this period included groundwater, soil vapor/gas and surface emissions monitoring. Table 1 illustrates monitoring conducted at the site and the dates when they were conducted. This report includes assessment of relevant data collected during the June/July and September sampling events. Lactate injection ceased on December 16, 2005, and no lactate has been injected since that date and through this reporting period. Results of the monitoring activities are briefly discussed in the following section.

MONITORING EVALUATION

Groundwater and soil vapor sampling and analytical data, and groundwater level measurements, are briefly discussed below. Groundwater monitoring well data for chemicals of concern (COCs) include samples collected through September 2006 and are included on Figures 1 and 2 (middle-interval and shallow-interval monitoring wells, respectively). Other data discussed herein are summarized in Tables 2 and 3.

Groundwater Data

The following key observations focus on COC concentrations in regularly monitored groundwater monitoring wells MW-40-02, -07, -14, -22, and -30 through -39. Results for additional monitoring wells, which are sampled less frequently but were not sampled during the current reporting period are included on Figures 1 and 2, but are not discussed.

1) For regularly monitored middle-interval monitoring wells, including MW-40-22, -14, -31, and -35. (See Figure 1):

   - Tetrachloroethene (PCE) levels remain below the Maximum Contaminant Level (MCL) (5 micrograms per liter [μg/L]) in the regularly monitored middle-interval monitoring wells and ranged from non-detect to 0..49J μg/L.
   - Trichloroethene (TCE) levels are detected below the MCL (5 μg/L) in middle-interval monitoring wells MW-40-22, -31, and 35, and slightly higher than MCL in MW-40-14 (11 μg/L).
   - Dichloroethene (DCE) is present above the MCL (6 μg/L) in two of the regularly monitored middle-interval monitoring wells at concentrations of 11 μg/L (MW-40-14) to 6.6 μg/L (MW-40-35). Notably, DCE has decreased to below the reporting level in MW-40-31.
   - Vinyl chloride (VC) is present above the MCL (0.5 μg/L) in three of the regularly monitored middle-interval monitoring wells. The highest VC concentration was detected in well MW-40-14 at 11 μg/L. VC levels in the remaining three wells ranged from 0.49J μg/L to 1.8 μg/L.
   - Results indicate that reductive dechlorination process is occurring beyond DCE in these areas, and the concentrations have been significantly reduced, notably in wells MW-40-14 and -35.

2) For regularly monitored shallow-interval wells, including MW-40-02, -07, -30, -32, -33, -34, and -36 through -39 (see Figure 2):

   - PCE concentrations decreased significantly in MW-40-37 from 120 μg/L to 1.3 μg/L (below the MCL), and continued to exhibit a decreasing trend in well MW-40-30 (evident over the past several events).
   - PCE levels in MW-40-34, and -36 (other key wells located in the central portion of the site) did not exhibit significant changes, and have remained relatively stable over the past year. However, PCE levels increased in MW-40-32 (from 5.1 μg/L in March 2006 to 39 μg/L in September 2006), and in MW-40-07 (from 25 μg/L in March 2006, to 100 μg/L and 94 μg/L in July and September 2006, respectively).
   - PCE has remained at a concentration (6.5 μg/L) slightly above the MCL in MW-40-02. PCE remained below the reporting limit in MW-40-33 and -38, and was detected in MW-40-39 at levels of 1.7 μg/L and 2.4 μg/L during the July and September events, respectively.
   - Four of ten regularly monitoring wells (MW-40-30, -32, -36, -37) indicated TCE concentrations greater than the MCL. In MW-40-30 and -36, TCE concentrations fluctuated, and no clear increasing or decreasing trends were noted. In MW-40-37, the concentration increased from 28 μg/L to 46 μg/L from March to July, but data from the September event showed a decrease to 16 μg/L. Finally, TCE increased from 2.6 μg/L (March 2006) to 20 μg/L (September 2006) in MW-40-32.
   - Production of DCE has been noted in most wells. DCE concentrations are generally stable or decreasing to varying degrees in many wells, notably MW-40-30, -32, -34, and -36. Additionally, DCE has increased significantly (from 36 μg/L to 140 μg/L), in MW-40-37, which coincides with a major decrease in the PCE concentration, indicating PCE breakdown in this well.

- Relatively low levels of VC continue to be detected at or above the MCL (0.5 μg/L) in MW-40-30 (0.65 μg/L), -32 (1.8 μg/L), -34 (0.67 μg/L), -36 (0.6 μg/L), and -37 (4.5 μg/L) (September 2006 data). This provides evidence that dechlorination beyond DCE is occurring, but that it still may not be proceeding efficiently to completion at some locations at this time.

The following key observations are noted with respect to COC concentration trends for the monitored natural attenuation (MNA) monitoring wells (MW-40-06, -08, -10, -11, -12, -13, -15, -16, -17, -18, -19, and -20):

1) For middle-interval monitoring wells MW-40-10, -11, -12, -13, -16, -18, and -20 (see Figure 1):
   - COCs are below respective MCLs in all wells.
2) For shallow-interval monitoring wells MW-40-06, -08, -15, -17, and -19 (see Figure 2):
   - COCs were either not detected or were detected at trace levels in all MNA wells, except MW-40-08, where PCE and TCE were detected at concentrations of 6.6 μg/L and 1.4 μg/L, respectively. These levels are consistent with concentrations measured during baseline analysis and during subsequent quarterly monitoring events.
   - PCE was not detected above the reporting limit in MW-40-17 during the July or September event. PCE had been detected in this well at a level of 16 μg/L in September 2005 but has not been detected above the reporting limit since.

Lactate Presence and Microbiological/Geochemical Parameters –

Chemical Oxygen Demand (COD) – an indicator of sodium lactate presence – data for the July and September 2006 events are presented in Table 2. Lactate injection ceased on December 16, 2005, and no lactate has been injected since that date and through this reporting period. Concentrations in critical wells suggest that sodium lactate is present but is decreasing in middle-interval monitoring well MW-40-14 (from 316 milligrams per liter [mg/L] in July to 56.2 mg/L in September), and remains present at elevated levels in MW-40-31 (1,790 mg/L in September), and -35 (10,000 mg/L). These wells have exhibited favorable results with respect to degradation of the COCs in their areas.

COD levels in shallow-interval monitoring wells MW-40-32 and -34, which appear to be responding to the treatment to a more limited extent than the wells noted above, remain relatively low (32 mg/L and 25.4 mg/L, respectively, September data). This indicates that lactate is limited in the areas of these wells, and reductive dechlorination would likely continue to occur at a slow rate. September monitoring data indicate that COD concentrations in shallow-interval monitoring wells MW-40-30 and -36, which have responded marginally to the EISB treatment, are also low (36.4 mg/L and 14.4 mg/L, respectively). COC levels were relatively stable in these wells, indicating little progress in remediating these areas. COD levels in MW-40-37 were also low over this period, measured at 14.7 mg/L (July) and 16.6 mg/L (September), and do not explain the COC data, which suggest that substantial PCE degradation occurred at this location. Volatile fatty acid (VFA) data, where collected, are in general agreement with the COD findings.

Data reflecting concentrations of Dehalococcoides spp. (DHC) organisms and total biomass in monitoring wells are included in Table 2. DHC levels ranged from 1.15×10^4 to 5.17×10^6 cells/L, and biomass concentrations ranged from 1.61×10^8 to 2.02×10^9 cells/L. In general, DHC and biomass data suggest that microbial activity and DHC in particular are reasonably prevalent at this site.

Geochemical data for the July and September 2006 sampling events, including electron acceptors, alkalinity, and oxidation/reduction potential (ORP), are presented in Table 3. Basically, the data have consistently indicated a reduced environment based on nitrate and oxygen depletion. ORP data, which is a

measurement of the degree the system is reduced, ranged from -120 millivolts (mV) (MW-40-20) to 168 mV (MW-40-39), and were greater than zero mV in 18 of 24 wells (September data). It is generally believed that ORP levels of less than zero mV are required for optimal reductive dechlorination. As can be seen in Table 3, ORP values are negative for wells MW-40-14 (-60 mV), -31 (-13 mV), and -35 (-48 mV) (September data), where sufficient lactate is present and significant reductive dechlorination has been observed. Conversely, positive ORP values are observed in MW-40-30 (90 mV) and -36 (81 mV), where treatment has been relatively ineffective.

Soil Vapor Data. Methane gas surface emissions monitoring was performed on July 18 and September 18, 2006. Methane gas emissions were not detected within Buildings 239 and 240 and surrounding areas during these monitoring events.

Soil gas monitoring was conducted on July 18 and September 14, 2006. The results of probe monitoring indicated that 26 out of the 30 probes tested in the field had methane gas present at concentrations ranging from as low as 12.7 percent and up to 94.8 percent in air during the July monitoring event, and from as low as 11.9 percent and up to 90.6 percent in air during the September monitoring event. The highest methane concentrations were detected in the soil gas probe in injection well IW-17. Hydrogen sulfide concentrations ranged from zero parts per million (ppm) to 55 ppm in July 2006, and zero to 33 ppm in September 2006 monitoring events.

Groundwater Levels. Groundwater level measurements were conducted on June 23 and September 13, 2006. Groundwater elevations within the site, measured on June 23, 2006, ranged from 1.06 feet above mean sea level (msl) in IW-16 to 2.26 feet above msl in IW-2. Groundwater elevations within the site, measured on September 13, 2006, ranged from 1.18 feet above msl in MW-40-16 to 2.35 feet above msl in IW-2. In general, water level measurements collected in June and September indicated a rise of approximately 1 to 1.5 inches within the monitoring area.

SUMMARY AND FOLLOW-UP ACTIVITIES

In summary, COC concentrations remain at or near the California MCLs or target cleanup goals in a majority of the middle-interval monitoring wells, including MW-40-10, -11, -12, -13, -16, -18, and -20. In other middle-interval monitoring wells (MW-40-14, -22, -31 and -35), COCs were detected at very low concentrations. COCs were not detected or detected at very low concentrations in shallow-interval monitoring wells MW-40-02, -06, 08, -15, -17, -19, -33, -38, and -39. COCs were detected at higher concentrations in shallow-interval monitoring wells MW-40-07, MW-40-30, MW-40-32, MW-40-34, and MW-40-36, where treatment has been inconsistent or negligible. PCE levels in MW-40-07 increased from 25 μg/L to 94 μg/L (based on September data). COC concentrations in MW-40-17 did not suggest lateral plume movement in the easterly direction; however, an increase in PCE level in MW-40-07, in conjunction with a very slight increase on PCE level in MW-40-39 (to 2.4 μg/L), may suggest minimal plume migration in the southeasterly direction.

Geochemical and microbiological data indicate that conditions are still relatively favorable for reductive dechlorination; however, the process still appears to be hindered by lack of horizontal substrate transport in the central area of the site.

Other activities and upcoming field activities include the following:

- Tetra Tech EC, Inc. (TtEC) has evaluated all available data, and has recommended injection of a supplemental electron donor consisting of a slow-release lactate material (Hydrogen Release Compound) as a means of optimizing the system.

- A Draft Technical Memorandum/EISB System Optimization Work Plan has been prepared and was submitted to the regulatory agencies on September 12, 2006. TtEC plans to proceed with field activities associated with implementing this optimization as soon as procurement of vendors and material are completed.

TABLES

Table 1 Summary of Monitoring Activities Conducted During June/July and September 2006

Table 2 COD, VFA, DHC, and PLFA Data Collected During July and September 2006

Table 3 Anions, Alkalinity, DO, and ORP Data Collected During July and September 2006

FIGURES

Figure 1 Chemical of Concern Results (March 2005 through September 2006) Middle-Interval Monitoring Wells

Figure 2 Chemical of Concern Results (March 2005 through September 2006) Shallow-Interval Monitoring Wells

TABLES

TABLE 1

SUMMARY OF MONITORING ACTIVITIES CONDUCTED DURING JUNE/JULY AND SEPTEMBER 2006

Date	Event	Wells Sampled[1]	Analytes[2]/Parameters	Notes
6/23/06	Summa Canister Test	Not Applicable	None	Tested Summa canister on vapor well to ensure proper functioning before vapor sampling.
6/23/06	Groundwater level measurements	MW-40-01, -06, 07, 08, -10, -11, -13, -14, -15, -17, -19, -20, -22, -30 through 39, and IW-1 through IW-17.	Not Applicable	Groundwater level measurements
7/11/06–7/13/06	Scheduled monthly laboratory analysis	Groundwater: MW-40-06, -07, -08, -10, -11, -13 through -20, -22, and -30 through -39.	VOCs, dissolved gases, cations, DNA, water levels, COD, and additional geochemical parameters	
7/18/06	Soil vapor/gas probe monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, and IW-1 through IW-4 and IW-6 through IW-17.	Methane, oxygen, carbon dioxide, VOCs, and carbon monoxide	
7/18/06	Surface emissions monitoring	Not applicable	Methane gas concentrations	Inside Building 240 and western portion of Building 239, and areas surrounding the above buildings
7/19/06	Soil vapor sampling	VW-40-01, -02, -03, -06, MW-40-34, IW-1, -3, and -7.	VOCs and fixed gases	
9/13/06	Groundwater level measurements	MW-40-01, -02, -06, 07, 08, -10, -11, -13, -14, -15, -17, -19, -20, -22, -30 through 39, and IW-1 through IW-17.	Not Applicable	Groundwater level measurements
9/14/06	Soil vapor/gas probe monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, and IW-1 through IW-4 and IW-6 through IW-17.	Methane, oxygen, carbon dioxide, VOCs, and carbon monoxide	
9/14/06	Soil vapor sampling	VW-40-01, -02, -03, -06, MW-40-34, IW-1, -3, and -7.	VOCs and fixed gases	
9/18/06	Surface emissions monitoring	Not applicable	Methane gas concentrations	Inside Building 240 and western portion of Building 239, and areas surrounding the above buildings
9/19/06–9/21/06	Scheduled monthly laboratory analysis	Groundwater: MW-40-06, -07, -08, -10, -11, -13 through -20, -22, and -30 through -39.	VOCs, dissolved gases, cations, DHC, water levels, COD, and additional geochemical parameters	

Notes:

[1]Refer to Figure 1 for well locations.
[2]Not all analytes run on all wells.

COD – chemical oxygen demand
DHC – *Dehalococcoides* spp.
VOC – volatile organic compound

TABLE 2

COD, VFA, DHC, AND PLFA DATA COLLECTED DURING JULY AND SEPTEMBER 2006

Location	COD (mg/L)		Acetic Acid (mg/L)		Propionic Acid (mg/L)		Butyric Acid (mg/L)		DHC (cells/L)		Total PLFA Biomass (cells/L)	
	July	September	July	September	July	September	July	September	July	September	July	September
MW-40-06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40-07	428	40.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40-10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40-11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40-13	3010	1920	103.1	142.5	<1	342.4	<1	<1	8.96E+04	1.77E+04	1.06E+09	8.31E+08
MW-40-14	316	56.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40-15	17.2	16.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40-16	147	108	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40-17	17.2	18.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40-18	86.7	77.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40-19	159	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40-20	6610	6840	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40-22	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40-30	24.9	36.4	<1	<1	<1	<1	<1	<1	1.14E+03	1.15E+04	3.41E+08	7.12E+08
MW-40-31	3780	1790	751.2	411.9	1597	140.4	<1	<1	1.74E+05	3.24E+05	2.91E+09	1.70E+09
MW-40-32	14.7	32	<1	<1	<1	<1	<1	<1	1.11E+06	3.45E+06	2.51E+08	1.94E+08
MW-40-33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40-34	17.2	25.4	<1	<1		<1	<1	<1	7.91E+04	2.61E+04	1.37E+08	8.97E+08
MW-40-35	9950	10000	2995	5810	4118	5487	907.6	699.3	2.79E+05	7.70E+04	2.52E+09	2.02E+09
MW-40-36	22.4	14.4	<1	<1	<1	<1	<1	<1	7.03E+04	3.88E+04	1.77E+08	1.61E+08
MW-40-37	14.7	16.6	<1	<1	<1	<1	<1	<1	1.81E+05	5.17E+06	1.64E+08	6.17E+08
MW-40-38	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40-39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Pyruvic acid and formic acid were not detected; lactic acid was detected only once (in MW-40-35 during the July event at 30.1 mg/L).

cells/L - cells per liter
COD - Chemical Oxygen Demand:
DHC - *Dehalococcoides* spp.
mg/L - milligrams per liter
NA - not analyzed
PLFA - phospholipid fatty acids
VFA - Volatile Fatty Acid

TABLE 3

ANIONS, ALKALINITY, DO, AND ORP DATA COLLECTED DURING JULY AND SEPTEMBER 2006

	Chloride (mg/L)		Nitrite (mg/L)		Nitrate (mg/L)		Sulfate (mg/L)		Alkalinity (mg/L)		DO (mg/L)		ORP mV	
Location	**July**	**September**	**July**	**September**	**July**	**September**	**July**	**September**	**July**	**September**	**July**	**September**	**July**	**September**
MW-40-06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.14	0.13	176	143
MW-40-07	428	420	0.1 U	0.1 U	1.64	1.47	288	281	282	248	0.13	NA	-25	153
MW-40-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.16	NA	102	142
MW-40-10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.26	0.27	94	112
MW-40-11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.35	NA	-34	2
MW-40-13	2120	1200	0.1 U	0.1 U	2.14	0.5 U	0.679	44.3	2890	1520	0.06	NA	-115	18
MW-40-14	316	304	0.1 U	0.2 U	0.08 J	0.2 U	34.8	17.7	1440	1300	0.08	0.08	-79	-60
MW-40-15	459	464	0.1 U	0.1 U	4.83	0.447	272	254	324	328	0.55	NA	-26	152
MW-40-16	3630	3820	0.1 U	0.1 U	0.1 U	0.1 U	520	507	175	175	0.25	NA	-45	155
MW-40-17	228	243	0.1 U	0.1 U	4.73	4.86	157	157	314	325	0.13	NA	88	145
MW-40-18	2800	2980	0.1 U	0.1 U	0.1 U	0.1 U	287	283	125	130	0.12	NA	38	152
MW-40-19	159	153	0.1 U	0.1 U	1.38	1.03	101	99.4	171	175	0.20	0.10	81	97
MW-40-20	1390	1460	0.1 U	0.5 U	0.2 U	0.5 U	1.36	3.24	4490	4450	0.11	0.33	-123	-120
MW-40-22	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.10	0.08	-100	-84
MW-40-30	149	153	0.1 U	0.1 U	1.74	0.256	138	143	349	393	0.11	NA	19	90
MW-40-31	737	673	0.1 U	0.1 U	0.2 U	0.5 U	1.11	2.15 J	3590	4050	0.05	NA	-122	-13
MW-40-32	154	163	0.1 U	0.1 U	0.1 U	0.1 U	68.4	69.4	584	560	0.08	NA	-50	47
MW-40-33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.23	0.16	45	101
MW-40-34	187	239	0.1 U	0.1 U	0.91	0.1 U	149	183	354	348	0.12	NA	123	87
MW-40-35	487	482	0.1 U	0.1 U	1 U	1.0 U	2.61 J	11.8	5040	5650	0.06	NA	-80	-48
MW-40-36	263	280	0.1 U	0.1 U	0.57	0.441	169	177	464	490	0.11	NA	35	81
MW-40-37	408	419	0.1 U	0.1 U	0.1 U	0.1 U	256	248	394	438	0.13	NA	-76	53
MW-40-38	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.09	NA	-59	-23
MW-40-39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.19	NA	-19	168

Notes:

DO - dissolved oxygen

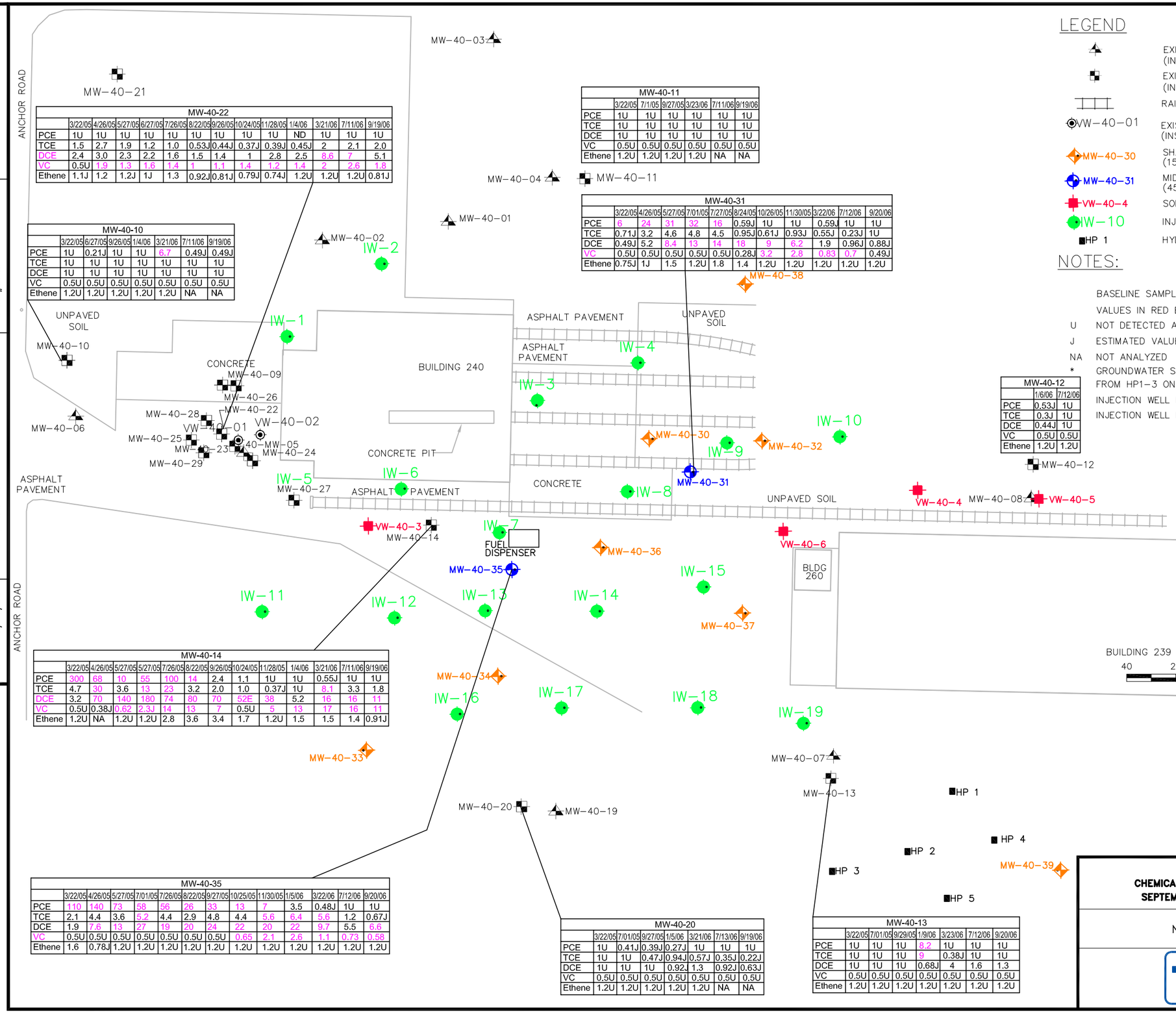
mg/L - milligrams per liter

mV - millivolts

NA - not analyzed

ORP - oxidation/reduction potential

FIGURES



LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 — SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005

VALUES IN RED EXCEED REMEDIATION CRITERIA

U NOT DETECTED AT DETECTION LIMIT GIVEN

J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT

NA NOT ANALYZED

* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

INJECTION WELL IW-18 INSTALLED AUGUST 19, 2005

INJECTION WELL IW-19 INSTALLED SEPTEMBER 10, 2005

MW-40-22

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	ND	1U	1U	1U
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J	0.37J	0.39J	0.45J	2	2.1	2.0
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4	1	2.8	2.5	8.6	7	5.1
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1	1.4	1.2	1.4	2	2.6	1.8
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J	0.79J	0.74J	1.2U	1.2U	1.2U	0.81J

MW-40-11

	3/22/05	7/1/05	9/27/05	3/23/06	7/11/06	9/19/06
PCE	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	NA	NA

MW-40-31

	3/22/05	4/26/05	5/27/05	7/01/05	7/27/05	8/24/05	10/26/05	11/30/05	3/22/06	7/12/06	9/20/06
PCE	6	24	31	32	16	0.59J	1U	1U	0.59J	1U	1U
TCE	0.71J	3.2	4.6	4.8	4.5	0.95J	0.61J	0.93J	0.55J	0.23J	1U
DCE	0.49J	5.2	8.4	13	14	18	9	6.2	1.9	0.96J	0.88J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.28J	3.2	2.8	0.83	0.7	0.49J
Ethene	0.75J	1J	1.5	1.2U	1.8	1.4	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-10

	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06
PCE	1U	0.21J	1U	1U	6.7	0.49J	0.49J
TCE	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA

MW-40-12

	1/6/06	7/12/06
PCE	0.53J	1U
TCE	0.3J	1U
DCE	0.44J	1U
VC	0.5U	0.5U
Ethene	1.2U	1.2U

MW-40-18

	1/6/06	3/23/06	7/13/06	9/21/06
PCE	1U	1U	1U	1U
TCE	1U	1U	1U	1U
DCE	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	NA	NA

MW-40-16

	1/6/06	3/23/06	7/13/06	9/21/06
PCE	1U	1U	1U	1U
TCE	1U	1U	1U	1U
DCE	1U	1U	1U	1U
VC	0.5U	0.5U	1U	1U
Ethene	1.2U	1.2U	NA	NA

MW-40-14

	3/22/05	4/26/05	5/27/05	5/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06
PCE	300	68	10	55	100	14	2.4	1.1	1U	1U	0.55J	1U	1U
TCE	4.7	30	3.6	13	23	3.2	2.0	1.0	0.37J	1U	8.1	3.3	1.8
DCE	3.2	70	140	180	74	80	70	52E	38	5.2	16	16	11
VC	0.5U	0.38J	0.62	2.3J	14	13	7	0.5U	5	13	17	16	11
Ethene	1.2U	NA	1.2U	1.2U	2.8	3.6	3.4	1.7	1.2U	1.5	1.5	1.4	0.91J

MW-40-35

	3/22/05	4/26/05	5/27/05	7/01/05	7/26/05	8/22/05	9/27/05	10/25/05	11/30/05	1/5/06	3/22/06	7/12/06	9/20/06
PCE	110	140	73	58	56	26	33	13	7	3.5	0.48J	1U	1U
TCE	2.1	4.4	3.6	5.2	4.4	2.9	4.8	4.4	5.6	6.4	5.6	1.2	0.67J
DCE	1.9	7.6	13	27	19	20	24	22	20	22	9.7	5.5	6.6
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.65	2.1	2.6	1.1	0.73	0.58
Ethene	1.6	0.78J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-20

	3/22/05	7/01/05	9/27/05	1/5/06	3/21/06	7/13/06	9/19/06
PCE	1U	0.41J	0.39J	0.27J	1U	1U	1U
TCE	1U	1U	0.47J	0.94J	0.57J	0.35J	0.22J
DCE	1U	1U	1U	0.92J	1.3	0.92J	0.63J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA

MW-40-13

	3/22/05	7/01/05	9/29/05	1/9/06	3/23/06	7/12/06	9/20/06
PCE	1U	1U	1U	8.2	1U	1U	1U
TCE	1U	1U	1U	9	0.38J	1U	1U
DCE	1U	1U	1U	0.68J	4	1.6	1.3
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

Figure 1

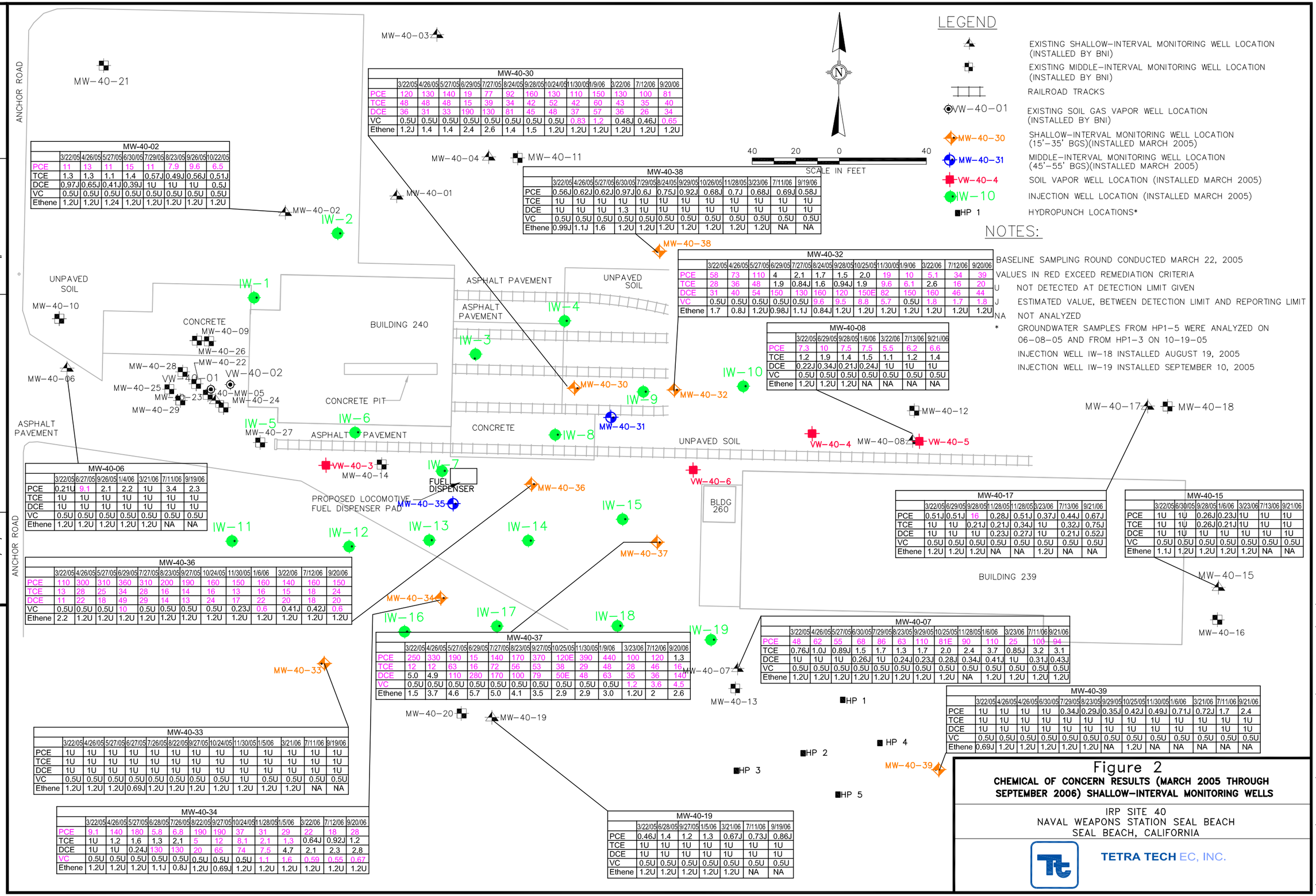
CHEMICAL OF CONCERN RESULTS (MARCH 2005 THROUGH SEPTEMBER 2006) MIDDLE-INTERVAL MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 1.DWG
DCN: ECSD-RACIV-
CTO: #0090
APPROVED BY: HH
CHECKED BY: ML
REV: REVISION 0
DRAWN BY: MD
DATE: 10/17/06

P:\3210-RAC IV\CTO-0010\MONTHLY REPORTS\OCTOBER 2006\DWG\FIG 1.DWG
PLOT/UPDATE: OCT 17 2006 15:12:30



MW-40-30

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/24/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06
PCE	120	130	140	19	77	92	160	130	110	150	130	100	81
TCE	48	48	48	15	39	34	42	52	42	60	43	35	40
DCE	36	31	33	190	130	81	45	48	37	57	36	26	34
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.83	1.2	0.48J	0.46J	0.65
Ethene	1.2J	1.4	1.4	2.4	2.6	1.4	1.5	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-02

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/26/05	10/22/05
PCE	11	13	11	15	11	7.9	9.6	6.5
TCE	1.3	1.3	1.1	1.4	0.57J	0.49J	0.56J	0.51J
DCE	0.97J	0.65J	0.41J	0.39J	1U	1U	1U	0.5J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.24	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-38

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/24/05	9/29/05	10/26/05	11/28/05	3/23/06	7/11/06	9/19/06
PCE	0.56J	0.62J	0.62J	0.97J	0.6J	0.75J	0.92J	0.68J	0.7J	0.68J	0.69J	0.58J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1.3	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.99J	1.1J	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA

MW-40-32

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/25/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06
PCE	58	73	110	4	2.1	1.7	1.5	2.0	19	10	5.1	34	39
TCE	28	36	48	1.9	0.84J	1.6	0.94J	1.9	9.6	6.1	2.6	16	20
DCE	31	40	54	150	130	160	120	150E	82	150	160	46	44
VC	0.5U	0.5U	0.5U	0.5U	0.5U	9.6	9.5	8.8	5.7	0.5U	1.8	1.7	1.8
Ethene	1.7	0.8J	1.2U	0.98J	1.1J	0.84J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-08

	3/22/05	6/29/05	9/28/05	1/6/06	3/22/06	7/13/06	9/21/06
PCE	7.3	10	7.5	7.5	5.5	6.2	6.6
TCE	1.2	1.9	1.4	1.5	1.1	1.2	1.4
DCE	0.22J	0.34J	0.21J	0.24J	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-06

	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06
PCE	0.21U	9.1	2.1	2.2	1U	3.4	2.3
TCE	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA

MW-40-17

	3/22/05	6/29/05	9/28/05	11/28/05	11/28/05	3/23/06	7/13/06	9/21/06
PCE	0.51J	0.51J	16	0.28J	0.51J	0.37J	0.44J	0.67J
TCE	1U	1U	0.21J	0.21J	0.34J	1U	0.32J	0.75J
DCE	1U	1U	1U	0.23J	0.27J	1U	0.21J	0.52J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	1.2U	NA	NA

MW-40-15

	3/22/05	6/30/05	9/28/05	1/6/06	3/23/06	7/13/06	9/21/06
PCE	1U	1U	0.26J	0.23J	1U	1U	1U
TCE	1U	1U	0.26J	0.21J	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.1J	1.2U	1.2U	1.2U	1.2U	NA	NA

MW-40-36

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/24/05	11/30/05	1/6/06	3/22/06	7/12/06	9/20/06
PCE	110	300	310	360	310	200	190	160	150	160	140	160	150
TCE	13	28	25	34	28	16	14	16	13	16	15	18	24
DCE	11	22	18	49	29	14	13	24	17	22	20	18	20
VC	0.5U	0.5U	0.5U	10	0.5U	0.5U	0.5U	0.5U	0.23J	0.6	0.41J	0.42J	0.6
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-37

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/25/05	11/30/05	1/9/06	3/23/06	7/12/06	9/20/06
PCE	250	330	190	15	140	170	370	120E	390	440	100	120	1.3
TCE	12	12	63	16	72	56	53	38	29	48	28	46	16
DCE	5.0	4.9	110	280	170	100	79	50E	48	63	35	36	140
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.2	3.6	4.5
Ethene	1.5	3.7	4.6	5.7	5.0	4.1	3.5	2.9	2.9	3.0	1.2U	2	2.6

MW-40-07

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/28/05	1/6/06	3/23/06	7/11/06	9/21/06
PCE	48	62	55	68	86	63	110	81E	90	110	25	100	94
TCE	0.76J	1.0J	0.89J	1.5	1.7	1.3	1.7	2.0	2.4	3.7	0.85J	3.2	3.1
DCE	1U	1U	1U	0.26J	1U	0.24J	0.23J	0.28J	0.34J	0.41J	1U	0.31J	0.43J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	1.2U	1.2U	1.2U

MW-40-39

	3/22/05	4/26/05	4/26/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/30/05	1/6/06	3/21/06	7/11/06	9/21/06
PCE	1U	1U	1U	1U	0.34J	0.29J	0.35J	0.42J	0.49J	0.71J	0.72J	1.7	2.4
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	NA	NA	NA	NA	NA

MW-40-33

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/27/05	10/24/05	11/30/05	1/5/06	3/21/06	7/11/06	9/19/06
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA

MW-40-34

	3/22/05	4/26/05	5/27/05	6/28/05	7/26/05	8/22/05	9/27/05	10/24/05	11/28/05	1/5/06	3/22/06	7/12/06	9/20/06
PCE	9.1	140	180	5.8	6.8	190	190	37	31	29	22	18	28
TCE	1U	1.2	1.6	1.3	2.1	5	12	8.1	2.1	1.3	0.64J	0.92J	1.2
DCE	1U	1U	0.24J	130	130	20	65	74	7.5	4.7	2.1	2.3	2.8
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.1	1.6	0.59	0.55	0.67
Ethene	1.2U	1.2U	1.2U	1.1J	0.8J	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-19

	3/22/05	6/28/05	9/27/05	1/5/06	3/21/06	7/11/06	9/19/06
PCE	0.46J	1.4	1.2	1.3	0.67J	0.73J	0.86J
TCE	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA

Figure 2

CHEMICAL OF CONCERN RESULTS (MARCH 2005 THROUGH SEPTEMBER 2006) SHALLOW-INTERVAL MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: FIG 2.DWG
DCN: FWSD-RAC- CTO: #0090
APPROVED BY: HH
CHECKED BY: ML REV: REVISION 0
DRAWN BY: MD DATE: 04/28/06

P:\3210-RAC IV\CTO-0010\MONTHLY REPORTS\OCTOBER 2006\DWG\FIG 2.DWG
PLOT/UPDATE: OCT 17 2006 15:02:46

TETRA TECH EC, INC.

SUMMARY OF FIELD ACTIVITIES AND DATA FOR ENHANCED IN SITU BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS FOR JANUARY 2007

INSTALLATION RESTORATION PROGRAM SITE 40 NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CA

Date: February 15, 2007

Prepared by: Hamlet Hamparsumian and Mark E. Losi, Tetra Tech EC, Inc. (TtEC)

Distribution:

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INTRODUCTION

This summary report provides a brief review of site activities conducted in January 2007 in association with groundwater remediation activities at Installation Restoration Program (IRP) Site 40 at Naval Weapons Station Seal Beach, Seal Beach, California. This report briefly summarizes the status of contaminant reduction as a result of the enhanced in-situ bioremediation (EISB) project. Monitoring and other field activities conducted during the period are summarized in Table 1.

SUMMARY OF FIELD ACTIVITIES

The field activities for this period included groundwater, soil vapor/gas, and surface emissions monitoring. Table 1 illustrates monitoring activities conducted at the site and the dates when they were conducted. This report includes assessment of relevant data collected during the January sampling event. Lactate injection ceased on December 16, 2005, and no lactate has been injected since that date and through this reporting period. Results of the monitoring activities are briefly discussed in the following section.

MONITORING EVALUATION

Groundwater and soil vapor sampling and analytical data as well as groundwater level measurements are briefly discussed below. Groundwater monitoring well data for chemicals of concern (COCs) include samples collected through January 2007 and are included on Figures 1 and 2 (middle-interval and shallow-interval monitoring wells, respectively). Other data discussed herein are summarized in Tables 2 and 3.

Groundwater Data

The following key observations focus on COC concentrations in regularly monitored groundwater monitoring wells MW-40-02, -07, -14, -22, and -30 through -39. Results for additional monitoring wells, which are sampled less frequently but were not sampled during the current reporting period are included on Figures 1 and 2, but are not discussed.

1) For regularly monitored middle-interval monitoring wells, including MW-40-14, -22, -31, and -35, see Figure 1:

   - Tetrachloroethene (PCE) levels remain below the Maximum Contaminant Level (MCL) (5 micrograms per liter [μg/L]) in the regularly monitored middle-interval monitoring wells and ranged from non-detect to 0.47J μg/L.
   - Trichloroethene (TCE) levels were detected below the MCL (5 μg/L) in the middle-interval monitoring wells and ranged from non-detect to 1.2 μg/L.
   - Dichloroethene (DCE) is no longer present above the MCL (6 μg/L) in any of the regularly monitored middle-interval monitoring wells. In the prior event (September, 2006), DCE had been detected at a concentrations of 11 μg/L (MW-40-14) to 6.6 μg/L (MW-40-35), but DCE has decreased to below the reporting level in both of these wells.
   - Vinyl chloride (VC) is present above the MCL (0.5 μg/L) in two of the regularly monitored middle-interval monitoring wells, MW-40-14 and -22. Results show that VC decreased in MW-40-35 to below the MCL over this period. The VC concentration decreased in well MW-40-14 from 11 μg/L to 4.6 μg/L, and VC remains present in MW-40-22 at a concentration of 1.6 μg/L.
   - Results indicate that reductive dechlorination process has occurred beyond DCE in these areas, and is essentially complete.

2) For regularly monitored shallow-interval wells, including MW-40-02, -07, -30, -32, -33, -34, and -36 through -39 (see Figure 2):

   - The PCE concentration remained below the MCL in MW-40-37 (2.1 μg/L), and continued to exhibit a decreasing trend in well MW-40-30 (evident over the past several events).
   - PCE levels in MW-40-34 and -36 (other key wells located in the central portion of the site) exhibit decreasing trends. This was most evident in MW-40-36, where PCE decreased from 150 μg/L in September 2006 to 87 μg/L in January 2007. Over this period, PCE decreased from 28 μg/L to 22 μg/L in MW-40-34. In addition, PCE levels increased slightly in MW-40-32 (from 39 μg/L to 50 μg/L), but decreased in MW-40-07 (from 94 μg/L to 83 μg/L).
   - PCE remained below the reporting limit in MW-40-33 and -38, and was detected in MW-40-39 at a level of 2.5 μg/L during the January 2007 event. PCE has remained at a concentration (6.5 μg/L) slightly above the MCL in MW-40-02. This well was last monitored on October 22, 2005. MW-40-02 will be monitored during the April 2007 quarterly monitoring event.
   - Three of ten regularly monitoring wells (MW-40-30, -32, and -36,) had TCE concentrations greater than the MCL. In MW-40-30 and -36, TCE concentrations have fluctuated, and no clear increasing or decreasing trends have been noted. In MW-40-37, the concentration decreased from 16 μg/L to 0.94J μg/L, continuing a trend that began with the September 2006 event. Finally, TCE increased from 20 μg/L to 23 μg/L in MW-40-32.
   - Production of DCE has been noted in many wells, indicating the breakdown of PCE and TCE. DCE trends have generally not been clear, with variable increases and decreases noted in most wells where production has been significant (notably MW-40-30, -32, -34, and -36). Additionally, the DCE level remained elevated in MW-40-37 (140 μg/L), where

degradation of PCE and TCE has been significant. DCE levels are expected to fluctuate, especially in wells where PCE and/or TCE are still present and undergoing degradation.

- Relatively low levels of VC continue to be detected at or above the MCL (0.5 μg/L) in MW-40-14 (4.6 μg/L), MW-40-22 (1.6 μg/L), MW-40-32 (1.2 μg/L), MW-40-34 (0.53 μg/L), MW-40-36 (0.95 μg/L), and MW-40-37 (18 μg/L). This provides evidence that dechlorination beyond DCE is occurring, but that it still may not be proceeding efficiently to completion at some locations at this time. As with DCE, VC levels are expected to fluctuate in wells where parent compounds are still present and undergoing degradation.

The following key observations are noted with respect to COC concentration trends for the monitored natural attenuation (MNA) monitoring wells (MW-40-06, -08, -10, -11, -12, -13, -15, -16, -17, -18, -19, and -20):

1) For middle-interval monitoring wells MW-40-10, -11, -12, -13, -16, -18, and -20 (see Figure 1):
   - COCs are below respective MCLs in all wells.
2) For shallow-interval monitoring wells MW-40-06, -08, -15, -17, and -19 (see Figure 2):
   - COCs were either not detected or were detected at levels below the MCLs in all MNA wells except MW-40-08, where PCE was detected at concentrations of 5.4 μg/L. These levels are consistent with concentrations measured during baseline analysis and during subsequent quarterly monitoring events.

Lactate Presence and Microbiological/Geochemical Parameters

Chemical Oxygen Demand (COD) – an indicator of sodium lactate presence – data for the January 2007 event are presented in Table 2. Lactate injection ceased on December 16, 2005, and no lactate has been injected since that date and through this reporting period. The data suggest that sodium lactate is still present, but concentrations continue to decrease in critical middle-interval monitoring wells. COD in MW-40-14 has decreased from 56.2 milligrams per liter (mg/L) in September 2006 to 37.1 mg/L in January 2007. Similarly, the lactate level in MW-40-31 decreased from 1,790 mg/L in September 2006 to 84.4 mg/L in January 2007; and in MW-40-35 from 10,000 mg/L in September 2006 to 6,970 in January 2007. These wells have exhibited favorable results with respect to degradation of the COCs in their areas.

COD levels in shallow-interval monitoring wells MW-40-32 and -34, which appear to have responded to the treatment to a more limited extent than the wells noted above, remain relatively low as of January 2007 (26.1 mg/L and 28.5 mg/L, respectively). This indicates that lactate is limited in the areas of these wells, and reductive dechlorination would likely continue to occur at a slow rate. January 2007 monitoring data indicate that COD concentrations in shallow-interval monitoring wells MW-40-30 and -36, which have responded marginally to the EISB treatment, are also low (14.5 mg/L in both wells). COC levels were relatively stable in these wells, indicating little progress in remediating these areas. The COD level in MW-40-37 was also low over this period, and measured at 21.5 mg/L. This is somewhat anomalous, as substantial PCE degradation occurred at this location. Volatile fatty acid (VFA) data, where collected, indicate that the presence of VFAs coincide with the highest COD levels.

Data reflecting concentrations of *Dehalococcoides* spp. (DHC) organisms and total biomass in monitoring wells are included in Table 2. DHC levels ranged from 3.42×10^4 to 8.34×10^6 cells/L, and biomass concentrations ranged from 1.94×10^8 to 2.03×10^9 cells/L. In general, these levels are considered to be moderate to high; and DHC and biomass data continue to suggest that microbial activity and DHC in particular are reasonably prevalent at this site.

Geochemical data for the January 2007 sampling event, including electron acceptors, alkalinity, and oxidation/reduction potential (ORP), are presented in Table 3. Basically, the data have consistently indicated a reduced environment based on nitrate and oxygen depletion. ORP data, which is a measurement of the degree the system is reduced, ranged from -203 millivolts (mV) (MW-40-35) to 196 mV (MW-40-08), and were greater than zero mV in 21 of 24 wells. It is generally believed that ORP levels of less than zero mV are required for optimal reductive dechlorination. As can be seen in Table 3, ORP values are negative for wells MW-40-31 (-121 mV) and MW-40-35 (-203 mV), where sufficient lactate is present and significant reductive dechlorination has been observed. Conversely, positive ORP values are observed in MW-40-30 (77 mV), MW-40-32 (76 mV), and MW-40-36 (51 mV), where treatment has been relatively ineffective.

Soil Vapor Data. Methane gas surface emissions monitoring was performed on January 8, 2007. Methane gas emissions were not detected within Buildings 239 and 240 and surrounding areas during this monitoring event.

Soil gas monitoring was conducted on January 12, 2007. The results of probe monitoring indicated that 28 out of the 30 probes tested in the field had methane gas present at concentrations ranging from as low as 59.7 percent and up to 82.2 percent in air during the January monitoring event. The highest methane concentrations were detected in the soil gas probe in injection well IW-15. Hydrogen sulfide concentrations ranged from zero parts per million (ppm) to 12 ppm in January 2007.

Groundwater Levels. Groundwater level measurements were conducted on January 11, 2007. Groundwater elevations within the site ranged from 0.07 feet above mean sea level (msl) in MW-40-08 to 2.68 feet above msl in MW-40-02. In general, water level measurements collected in January 2007 did not indicate a significant change in groundwater level within the monitoring area.

SUMMARY AND FOLLOW-UP ACTIVITIES

In summary, COC concentrations remain at or near the California MCLs or target cleanup goals in a majority of the middle-interval monitoring wells, including MW-40-10, -11, -12, -13, -16, -18, -20, -31, and -35. In other middle-interval monitoring wells (MW-40-14 and -22), only VC was detected at concentrations approaching the MCLs. COCs were not detected or detected at very low concentrations in shallow-interval monitoring wells MW-40-02, -06, -08, -15, -17, -19, -33, -38, and -39. All or some COCs were detected at higher concentrations in shallow-interval monitoring wells MW-40-07, MW-40-30, MW-40-32, and MW-40-36, where treatment has been inconsistent or negligible. However, changes in COC levels that are consistent with reductive dechlorination are now evident in MW-40-34 and MW-40-37.

COC concentrations increased slightly in MW-40-17, but did not clearly suggest lateral plume movement in the easterly direction. PCE levels in MW-40-07 decreased slightly from 94 μg/L to 83 μg/L, and remained stable in MW-40-39 (to 2.4 μg/L). This is not suggestive of plume migration in the southeasterly direction.

Geochemical and microbiological data indicate that conditions are still relatively favorable for reductive dechlorination, but are becoming less so. In addition, the process still appears to be hindered by lack of horizontal substrate transport in the central area of the site.

Other activities and upcoming field activities (and modifications) include the following:

- Tetra Tech EC, Inc. (TtEC) has evaluated all available data, and has recommended injection of a supplemental electron donor consisting of a slow-release lactate material (Hydrogen Release Compound [HRC]) as a means of optimizing the system. A Final Technical

Memorandum/EISB System Optimization Work Plan was submitted to the regulatory agencies on November 17, 2006. Concurrences were received from the Regional Water Quality Control Board (RWQCB) and the Department of Toxic Substances Control (DTSC) on January 8, and January 17, 2007, respectively. Field activities for HRC injection are anticipated to take place in late February or early March 2007.

On January 22, 2007, TtEC, on behalf of the Navy, sent an e-mail to RWQCB and DTSC requesting comment regarding changes the Navy proposes to make to the groundwater monitoring frequency at IRP Site 40. Based on the review of the monitoring data for the last 18 months at Site 40 (since March 2005 through September 2006), the Navy proposed the following changes to the existing monitoring plan:

- Continue monitoring of wells **MW-40-7, -8, -14, -22, -30, -31, -32, -34, -35, -36, and -37** on a **QUARTERLY** basis.
- Reduce the monitoring and sampling of wells **MW-40-02, -06, -10, -11, -13, -15, -16, -17, -18, -19, -20, -38, and -39 to SEMIANNUALLY**.

The monitoring wells installed as part of the enhanced in-situ bioremediation performance monitoring and several of the existing wells that were Bechtel during the investigation and pilot study phase were being monitored on a monthly basis from March 2005 until December 2005, after which the monitoring frequency was reduced to quarterly.

Groundwater monitoring wells proposed for semiannual monitoring have consistently shown non-detect or very low concentration levels of the COCs for at least a year and many of them for a longer period and since the beginning of the performance monitoring which began in early 2005.

Figure 1 indicates the concentrations of COCs in the middle-interval monitoring wells, and Figure 2 indicates the concentrations of COCs in the shallow-interval monitoring wells.

Those wells that will continue to be monitored on a quarterly basis are those that are still indicating COC concentrations above the cleanup goals, since the beginning of the project, and those with COC concentrations beginning to drop but that do not yet have sufficient data to show a reliable trend.

RWQCB and DTSC have provided their concurrence on the reduced monitoring frequency. The revised monitoring frequency will be implemented starting with the April 2007 quarterly monitoring event.

TABLES

Table 1 Summary of Monitoring Activities Conducted During January 2007

Table 2 COD, VFA, DHC, and PLFA Data Collected During January 2007

Table 3 Anions, Alkalinity, DO, and ORP Data Collected During January 2007

FIGURES

Figure 1 Chemical of Concern Results (March 2005 through January 2007) Middle-Interval Monitoring Wells

Figure 2 Chemical of Concern Results (March 2005 through January 2007) Shallow-Interval Monitoring Wells

TABLES

TABLE 1

SUMMARY OF MONITORING ACTIVITIES CONDUCTED DURING JANUARY 2007

Date	Event	Wells Sampled[1]	Analytes[2]/Parameters	Notes
1/8/07	Soil vapor sampling	VW-40-01, -02, -03, -04, -06, MW-40-34, IW-1, -3, and -7.	VOCs and fixed gases	
1/9/07-1/11/07	Scheduled groundwater monitoring	Groundwater: MW-40-06, -07, -08, -10, -11, -13 through -20, -22, and -30 through -39.	VOCs, dissolved gases, cations, DNA, water levels, COD, and additional geochemical parameters	Laboratory and field parameters
1/11/07	Surface emissions monitoring	Not applicable	Methane gas concentrations	Inside Building 240 and western portion of Building 239, and areas surrounding the above buildings
1/11/07	Groundwater level measurements	MW-40-01, -02, -06, 07, 08, -10, -11, -13, -14, -15, -17, -19, -20, -22, -30 through 39, and IW-1 through IW-17.	Not Applicable	Groundwater level measurements
1/12/07	Soil vapor/gas probe monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, and IW-1 through IW-4 and IW-6 through IW-17.	Methane, oxygen, carbon dioxide, VOCs, and carbon monoxide	

Notes:

[1]Refer to Figure 1 for well locations.
[2]Not all analytes run on all wells.

COD – chemical oxygen demand
VOC – volatile organic compound

TABLE 2

COD, VFA, DHC, AND PLFA DATA COLLECTED DURING JANUARY 2007

Location	COD (mg/L)	Acetic Acid (mg/L)	Propionic Acid (mg/L)	Butyric Acid (mg/L)	DHC (cells/L)	Total PLFA Biomass (cells/L)
MW-40-06	NA	NA	NA	NA	NA	NA
MW-40-07	37.1	NA	NA	NA	NA	NA
MW-40-08	NA	NA	NA	NA	NA	NA
MW-40-10	NA	NA	NA	NA	NA	NA
MW-40-11	NA	NA	NA	NA	NA	NA
MW-40-13	455	100.1	193.7	<1	3.42E+04	1.21E+09
MW-40-14	37.1	NA	NA	NA	NA	NA
MW-40-15	27.5	NA	NA	NA	NA	NA
MW-40-16	243	NA	NA	NA	NA	NA
MW-40-17	41.4	NA	NA	NA	NA	NA
MW-40-18	206	NA	NA	NA	NA	NA
MW-40-19	13.9	NA	NA	NA	NA	NA
MW-40-20	4130	NA	NA	NA	NA	NA
MW-40-22	NA	NA	NA	NA	NA	NA
MW-40-30	14.5	<1	<1	<1	5.90E+04	1.94E+08
MW-40-31	84.4	<1	<1	<1	1.01E+05	1.35E+09
MW-40-32	26.1	<1	<1	<1	8.34E+06	2.65E+08
MW-40-33	NA	NA	NA	NA	NA	NA
MW-40-34	28.5	<1	<1	<1	2.85E+05	1.49E+09
MW-40-35	6970	1927	3552	121.2	7.03E+04	2.03E+09
MW-40-36	14.5	<1	<1	<1	2.70E+05	8.94E+08
MW-40-37	21.5	<1	<1	<1	3.79E+06	9.74E+08
MW-40-38	NA	NA	NA	NA	NA	NA
MW-40-39	NA	NA	NA	NA	NA	NA

Notes:

Pyruvic acid and formic acid were not detected; lactic acid was detected only once (in MW-40-35 during the July event at 30.1 mg/L).

cells/L – cells per liter
COD – chemical oxygen demand
DHC – *Dehalococcoides* spp.
mg/L – milligrams per liter
NA – not analyzed
PLFA – phospholipid fatty acids
VFA – volatile fatty acid

TABLE 3

ANIONS, ALKALINITY, DO, AND ORP DATA COLLECTED DURING JANUARY 2007

Location	Chloride (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	DO (mg/L)	ORP (mV)
MW-40-06	NA	NA	NA	NA	NA	0.20	149
MW-40-07	432	0.1 U	2.21	291	288	0.14	117
MW-40-08	NA	NA	NA	NA	NA	0.42	196
MW-40-10	NA	NA	NA	NA	NA	0.37	105
MW-40-11	NA	NA	NA	NA	NA	0.13	206
MW-40-13	2820	0.1U	0.079J	0.403J	2480	0.12	121
MW-40-14	NA	NA	NA	NA	NA	0.23	30
MW-40-15	470	0.1 U	4.87	265	350	0.86	165
MW-40-16	4230	0.1 U	0.1 U	522	180	0.24	185
MW-40-17	260	0.1 U	4.77	161	335	0.26	111
MW-40-18	3230	0.1 U	0.1 U	320	140	0.23	195
MW-40-19	162	0.1 U	0.167	2.0	178	0.46	111
MW-40-20	1450	0.1U	0.083J	111	4760	0.13	-20
MW-40-22	NA	NA	NA	NA	NA	0.17	71
MW-40-30	159	0.1 U	0.11	148	405	0.18	77
MW-40-31	667	0.2 U	0.134J	4.18	3640	0.13	-121
MW-40-32	134	0.1 U	0.1 U	70.9	715	0.12	76
MW-40-33	NA	NA	NA	NA	NA	0.29	57
MW-40-34	251	0.1 U	0.1 U	170	375	0.23	137
MW-40-35	442	0.1 U	0.123J	0.787J	6130	0.18	-203
MW-40-36	272	0.1 U	0.1U	176	538	0.20	51
MW-40-37	425	0.1 U	0.083J	252	463	0.16	111
MW-40-38	NA	NA	NA	NA	NA	0.16	115
MW-40-39	NA	NA	NA	NA	NA	0.62	49

Notes:

DO – dissolved oxygen

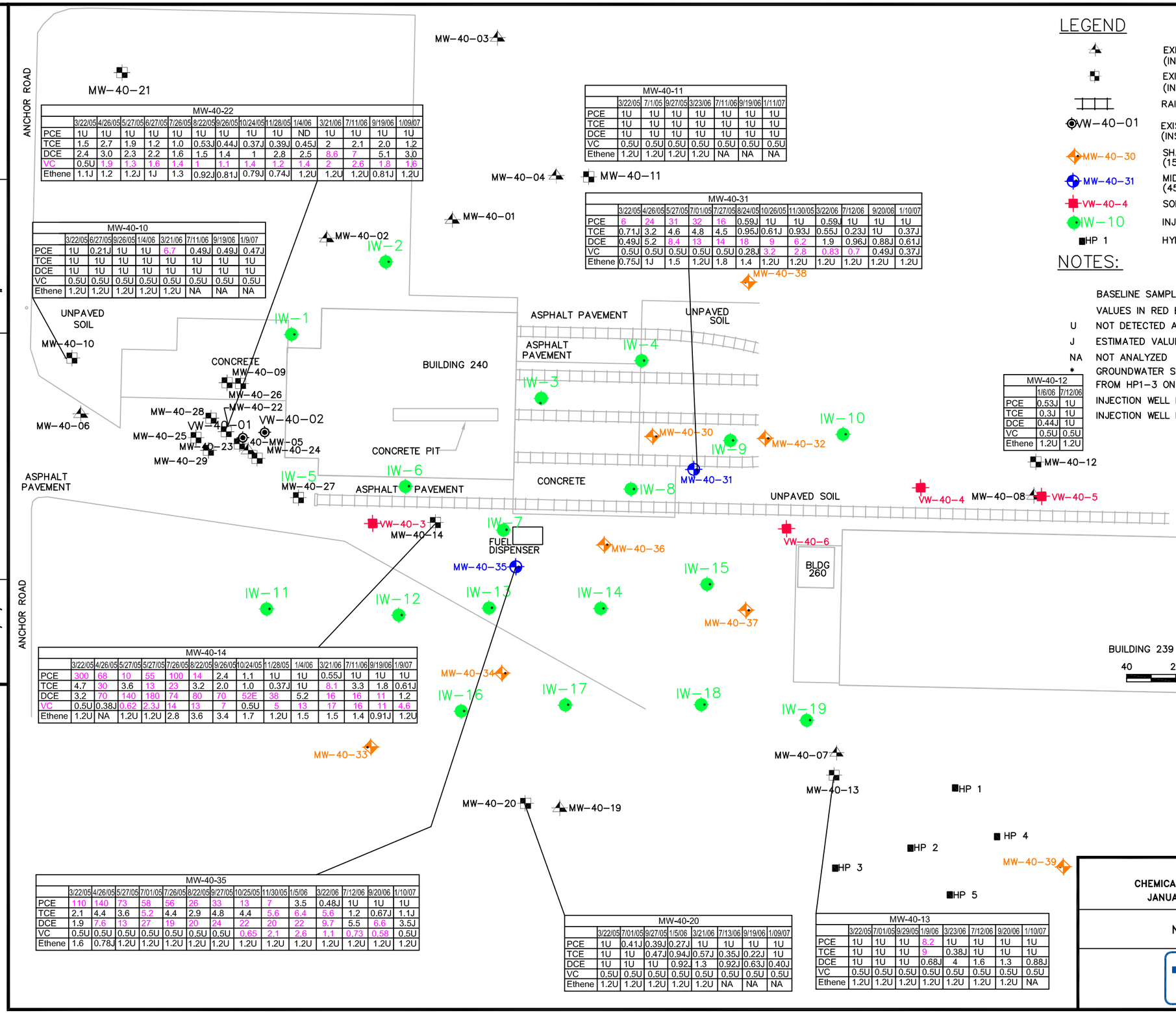
mg/L – milligrams per liter

mV – millivolts

NA – not analyzed

ORP – oxidation/reduction potential

FIGURES



MW-40-22	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/09/07
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	ND	1U	1U	1U	1U
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J	0.37J	0.39J	0.45J	2	2.1	2.0	1.2
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4	1	2.8	2.5	8.6	7	5.1	3.0
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1	1.4	1.2	1.4	2	2.6	1.8	1.6
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J	0.79J	0.74J	1.2U	1.2U	1.2U	0.81J	1.2U

MW-40-11	3/22/05	7/1/05	9/27/05	3/23/06	7/11/06	9/19/06	1/11/07
PCE	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-31	3/22/05	4/26/05	5/27/05	7/01/05	7/27/05	8/24/05	10/26/05	11/30/05	3/22/06	7/12/06	9/20/06	1/10/07
PCE	6	24	31	32	16	0.59J	1U	1U	0.59J	1U	1U	1U
TCE	0.71J	3.2	4.6	4.8	4.5	0.95J	0.61J	0.93J	0.55J	0.23J	1U	0.37J
DCE	0.49J	5.2	8.4	13	14	18	9	6.2	1.9	0.96J	0.88J	0.61J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.28J	3.2	2.8	0.83	0.7	0.49J	0.37J
Ethene	0.75J	1J	1.5	1.2U	1.8	1.4	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-10	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07
PCE	1U	0.21J	1U	1U	6.7	0.49J	0.49J	0.47J
TCE	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-14	3/22/05	4/26/05	5/27/05	5/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07
PCE	300	68	10	55	100	14	2.4	1.1	1U	1U	0.55J	1U	1U	1U
TCE	4.7	30	3.6	13	23	3.2	2.0	1.0	0.37J	1U	8.1	3.3	1.8	0.61J
DCE	3.2	70	140	180	74	80	70	52E	38	5.2	16	16	11	1.2
VC	0.5U	0.38J	0.62	2.3J	14	13	7	0.5U	5	13	17	16	11	4.6
Ethene	1.2U	NA	1.2U	1.2U	2.8	3.6	3.4	1.7	1.2U	1.5	1.5	1.4	0.91J	1.2U

MW-40-35	3/22/05	4/26/05	5/27/05	7/01/05	7/26/05	8/22/05	9/27/05	10/25/05	11/30/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07
PCE	110	140	73	58	56	26	33	13	7	3.5	0.48J	1U	1U	1U
TCE	2.1	4.4	3.6	5.2	4.4	2.9	4.8	4.4	5.6	6.4	5.6	1.2	0.67J	1.1J
DCE	1.9	7.6	13	27	19	20	24	22	20	22	9.7	5.5	6.6	3.5J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.65	2.1	2.6	1.1	0.73	0.58	0.5U
Ethene	1.6	0.78J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-20	3/22/05	7/01/05	9/27/05	1/5/06	3/21/06	7/13/06	9/19/06	1/09/07
PCE	1U	0.41J	0.39J	0.27J	1U	1U	1U	1U
TCE	1U	1U	0.47J	0.94J	0.57J	0.35J	0.22J	1U
DCE	1U	1U	1U	0.92J	1.3	0.92J	0.63J	0.40J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-13	3/22/05	7/01/05	9/29/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07
PCE	1U	1U	1U	8.2	1U	1U	1U	1U
TCE	1U	1U	1U	9	0.38J	1U	1U	1U
DCE	1U	1U	1U	0.68J	4	1.6	1.3	0.88J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA

MW-40-12	1/6/06	7/12/06
PCE	0.53J	1U
TCE	0.3J	1U
DCE	0.44J	1U
VC	0.5U	0.5U
Ethene	1.2U	1.2U

MW-40-18	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07
PCE	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	NA	NA	NA

MW-40-16	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07
PCE	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U
VC	0.5U	0.5U	1U	1U	0.5U
Ethene	1.2U	1.2U	NA	NA	NA

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 — SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

- BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
- VALUES IN RED EXCEED REMEDIATION CRITERIA
- U — NOT DETECTED AT DETECTION LIMIT GIVEN
- J — ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
- NA — NOT ANALYZED
- * — GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05
- INJECTION WELL IW-18 INSTALLED AUGUST 19, 2005
- INJECTION WELL IW-19 INSTALLED SEPTEMBER 10, 2005

Figure 1

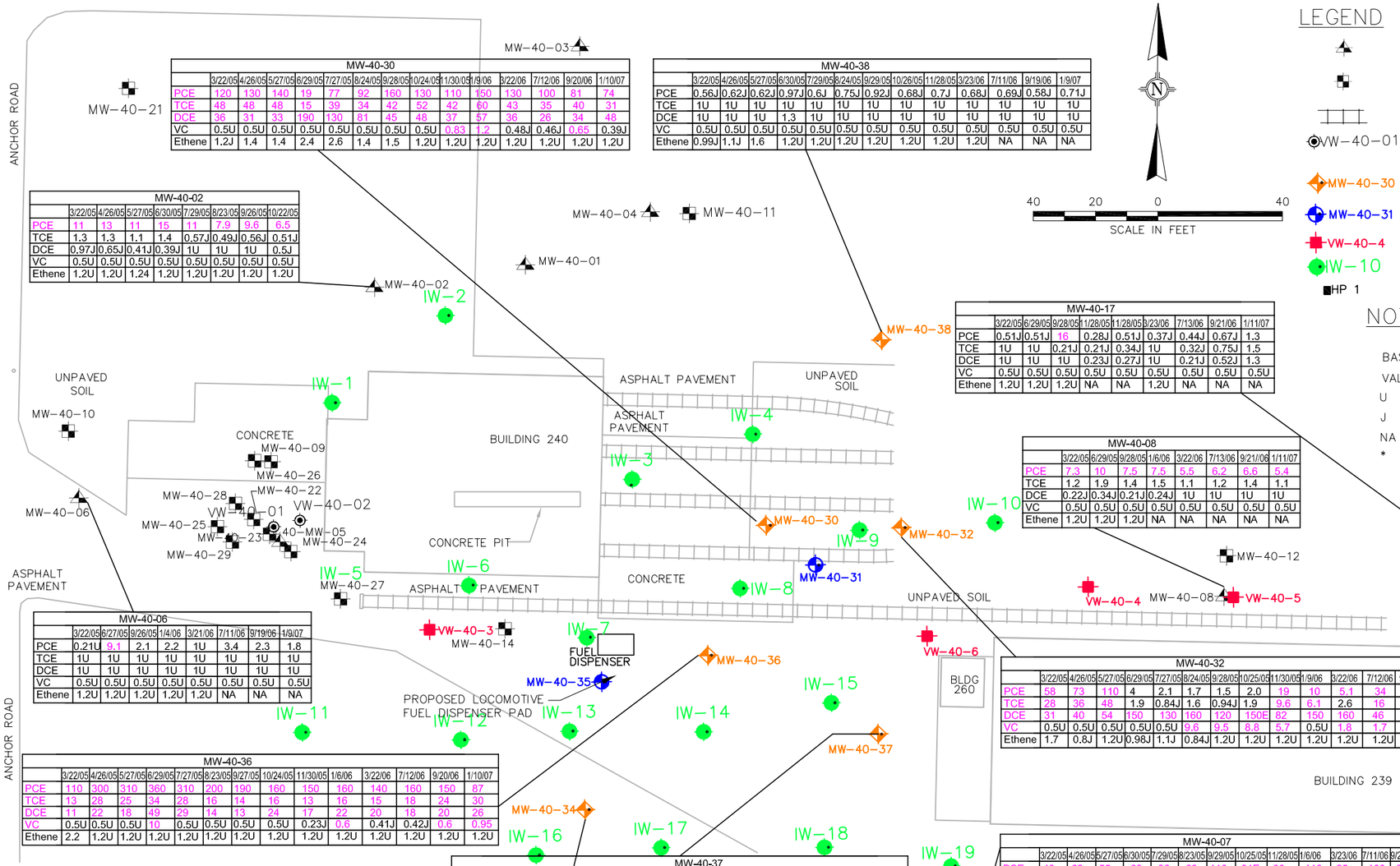
CHEMICAL OF CONCERN RESULTS (MARCH 2005 THROUGH JANUARY 2007) MIDDLE-INTERVAL MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 07068311.DWG
DCN: ECSD-RACIV-07-0683
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV: REVISION 0
DRAWN BY: MD
DATE: 02/13/07

P:\3210-RAC IV\CTO-0010\Dwg\070683\07068311.DWG
PLOT/UPDATE: FEB 13 2007 15:42:13



MW-40-30	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/24/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07
PCE	120	130	140	19	77	92	160	130	110	150	130	100	81	74
TCE	48	48	48	15	39	34	42	52	42	60	43	35	40	31
DCE	36	31	33	190	130	81	45	48	37	57	36	26	34	48
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.83	1.2	0.48J	0.46J	0.65	0.39J
Ethene	1.2J	1.4	1.4	2.4	2.6	1.4	1.5	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-38	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/24/05	9/29/05	10/26/05	11/28/05	3/23/06	7/11/06	9/19/06	1/9/07
PCE	0.56J	0.62J	0.62J	0.97J	0.6J	0.75J	0.92J	0.68J	0.7J	0.68J	0.69J	0.58J	0.71J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1.3	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.99J	1.1J	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-02	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/26/05	10/22/05
PCE	11	13	11	15	11	7.9	9.6	6.5
TCE	1.3	1.3	1.1	1.4	0.57J	0.49J	0.56J	0.51J
DCE	0.97J	0.65J	0.41J	0.39J	1U	1U	1U	0.5J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.24	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-17	3/22/05	6/29/05	9/28/05	11/28/05	11/28/05	3/23/06	7/13/06	9/21/06	1/11/07
PCE	0.51J	0.51J	16	0.28J	0.51J	0.37J	0.44J	0.67J	1.3
TCE	1U	1U	0.21J	0.21J	0.34J	1U	0.32J	0.75J	1.5
DCE	1U	1U	1U	0.23J	0.27J	1U	0.21J	0.52J	1.3
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	1.2U	NA	NA	NA

MW-40-08	3/22/05	6/29/05	9/28/05	1/6/06	3/22/06	7/13/06	9/21/06	1/11/07
PCE	7.3	10	7.5	7.5	5.5	6.2	6.6	5.4
TCE	1.2	1.9	1.4	1.5	1.1	1.2	1.4	1.1
DCE	0.22J	0.34J	0.21J	0.24J	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-15	3/22/05	6/30/05	9/28/05	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07
PCE	1U	1U	0.26J	0.23J	1U	1U	1U	1U
TCE	1U	1U	0.26J	0.21J	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.1J	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-06	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07
PCE	0.21U	9.1	2.1	2.2	1U	3.4	2.3	1.8
TCE	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-32	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/25/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07
PCE	58	73	110	4	2.1	1.7	1.5	2.0	19	10	5.1	34	39	50
TCE	28	36	48	1.9	0.84J	1.6	0.94J	1.9	9.6	6.1	2.6	16	20	23
DCE	31	40	54	150	130	160	120	150E	82	150	160	46	44	30
VC	0.5U	0.5U	0.5U	0.5U	0.5U	9.6	9.5	8.8	5.7	0.5U	1.8	1.7	1.8	1.2
Ethene	1.7	0.8J	1.2U	0.98J	1.1J	0.84J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-36	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/24/05	11/30/05	1/6/06	3/22/06	7/12/06	9/20/06	1/10/07
PCE	110	300	310	360	310	200	190	160	150	160	140	160	150	87
TCE	13	28	25	34	28	16	14	16	13	16	15	18	24	30
DCE	11	22	18	49	29	14	13	24	17	22	20	18	20	26
VC	0.5U	0.5U	0.5U	10	0.5U	0.5U	0.5U	0.5U	0.23J	0.6	0.41J	0.42J	0.6	0.95
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-37	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/25/05	11/30/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07
PCE	250	330	190	15	140	170	370	120E	390	440	100	120	1.3	2.1
TCE	12	12	63	16	72	56	53	38	29	48	28	46	16	0.94J
DCE	5.0	4.9	110	280	170	100	79	50E	48	63	35	36	140	140
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.2	3.6	4.5	18
Ethene	1.5	3.7	4.6	5.7	5.0	4.1	3.5	2.9	2.9	3.0	1.2U	2	2.6	4.1

MW-40-07	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/28/05	1/6/06	3/23/06	7/11/06	9/21/06	1/9/07
PCE	48	62	55	68	86	63	110	81E	90	110	25	100	94	83
TCE	0.76J	1.0J	0.89J	1.5	1.7	1.3	1.7	2.0	2.4	3.7	0.85J	3.2	3.1	2.7
DCE	1U	1U	1U	0.26J	1U	0.24J	0.23J	0.28J	0.34J	0.41J	1U	0.31J	0.43J	0.34J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-39	3/22/05	4/26/05	4/26/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/30/05	1/6/06	3/21/06	7/11/06	9/21/06	1/9/07
PCE	1U	1U	1U	1U	0.34J	0.29J	0.35J	0.42J	0.49J	0.71J	0.72J	1.7	2.4	2.5
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	NA	NA	NA	NA	NA	NA

MW-40-33	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/27/05	10/24/05	11/30/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-34	3/22/05	4/26/05	5/27/05	6/28/05	7/26/05	8/22/05	9/27/05	10/24/05	11/28/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07
PCE	9.1	140	180	5.8	6.8	190	190	37	31	29	22	18	28	22
TCE	1U	1.2	1.6	1.3	2.1	5	12	8.1	2.1	1.3	0.64J	0.92J	1.2	1.0
DCE	1U	1U	0.24J	130	130	20	65	74	7.5	4.7	2.1	2.3	2.8	1.8
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.1	1.6	0.59	0.55	0.67	0.53
Ethene	1.2U	1.2U	1.2U	1.1J	0.8J	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-19	3/22/05	6/28/05	9/27/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07
PCE	0.46J	1.4	1.2	1.3	0.67J	0.73J	0.86J	0.67J
TCE	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 HYDROPUNCH LOCATIONS*

NOTES:

BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005

VALUES IN RED EXCEED REMEDIATION CRITERIA

U NOT DETECTED AT DETECTION LIMIT GIVEN

J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT

NA NOT ANALYZED

* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

INJECTION WELL IW-18 INSTALLED AUGUST 19, 2005

INJECTION WELL IW-19 INSTALLED SEPTEMBER 10, 2005

Figure 2

CHEMICAL OF CONCERN RESULTS (MARCH 2005 THROUGH JANUARY 2007) SHALLOW-INTERVAL MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 07068312.DWG
DCN: FWSD-RAC-07-0683
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV: REVISION 0
DRAWN BY: MD
DATE: 2/6/07

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TETRA TECH EC, INC.

SUMMARY OF FIELD ACTIVITIES AND DATA FOR ENHANCED IN-SITU BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS FOR April 2007

INSTALLATION RESTORATION PROGRAM SITE 40 NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CA

Date: May 14, 2007

Prepared by: Hamlet Hamparsumian and Mark E. Losi, Tetra Tech EC, Inc. (TtEC)

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INTRODUCTION

This summary report provides a brief review of site activities conducted in April 2007 in association with groundwater remediation activities (enhanced in-situ bioremediation [EISB]) at Installation Restoration Program (IRP) Site 40 at Naval Weapons Station Seal Beach, Seal Beach, California. This report includes presentation and assessment of relevant data collected during the April 2007 sampling event. Also contained herein is a summary of the general status of the project.

Sodium lactate injection ceased on December 16, 2005, and no sodium lactate has been injected since that date. With regulator approval, Hydrogen Release Compound® (HRC®) was applied to the central area of the site during the week beginning April 16, after the April 2007 sampling event had been completed. HRC® is a slow-release form of lactate injected in a tight grid, and is expected to migrate into areas where delivery of soluble sodium lactate has proved difficult. The data set discussed herein will serve as baseline data against which the effectiveness of the HRC® application will be assessed. A brief description of HRC® and how it was applied is also included in this summary report.

SUMMARY OF FIELD ACTIVITIES

The field activities for this period included groundwater, soil gas, and surface emissions monitoring, and HRC® injection. Monitoring activities, along with the dates they were conducted, are listed Table 1.

MONITORING EVALUATION

Groundwater and soil gas sampling and analytical data as well as groundwater level measurements are briefly discussed below. For the April 2007 monitoring event, chemicals of concern (COCs) along with a focused suite of microbial and geochemical parameters were measured in select wells in which contamination is or had been prevalent (see Table 1). Several additional monitoring points not regularly monitored were assessed as well. Groundwater monitoring well data for COCs collected from the beginning of the project (March 2005) through April 2007 are included on Figures 1 and 2 (middle-interval and shallow-interval monitoring wells, respectively). Other data discussed herein are summarized in Tables 2 and 3.

Groundwater Data

The following key observations focus on COC concentrations in groundwater monitoring wells MW-40-07, -08, -14, -22, -30 through -32, and -34 through -37. Samples from additional monitoring points were also collected and analyzed during the April 2007 event, and results are also discussed herein. These include two injection wells (IW-09 and IW-19), three temporary well (hydropunch) locations (HP-1, HP-4, and HP-5), and one additional monitoring well (MW-40-39). Results for the monitoring wells are included on Figures 1 and 2.

1) Key observations for regularly monitored middle-interval monitoring wells, including MW-40-14, -22, -31, and -35 (see Figure 1) are summarized below:

    - Tetrachloroethene (PCE) concentrations were below the detection limit (1 microgram per liter [μg/L]) in each of the middle-interval monitoring wells.
    - Trichloroethene (TCE) levels were below the Maximum Contaminant Level (MCL) (5 μg/L) in the middle-interval monitoring wells and ranged from as low as 0.29J μg/L to 1.1 μg/L.
    - Dichloroethene (DCE) remained below the MCL (6 μg/L) in each of the regularly monitored middle-interval monitoring wells, ranging from 0.45J μg/L to 2.6 μg/L.
    - Vinyl chloride (VC) is present above the MCL (0.5 μg/L) in two of the regularly monitored middle-interval monitoring wells, MW-40-14 and -22. Results show that VC remained below the MCL in MW-40-31 and -35 over this period. The VC concentration continued to decrease in well MW-40-14 from 4.6 μg/L to 2.8 μg/L, and VC remains present in MW-40-22 at a concentration of 1.1 μg/L.
    - Results indicate that a reductive dechlorination process has occurred beyond DCE in these areas, and all contaminants are below or very near the MCLs.

2) Key observations for regularly monitored shallow-interval wells, including MW-40-07, -08, -30, -32, -34, -36, -37, and -39 (see Figure 2) are summarized below:

    - The PCE concentration in MW-40-37 was 1.1 μg/L and has now been below the MCL since September 2006.
    - The PCE level in MW-40-36 continued to decrease, from 87 μg/L in January 2007 to 44 μg/L in April 2007. PCE also decreased in MW-40-07, from 83 μg/L to 49 μg/L.
    - Over this period, PCE remained stable in MW-40-08 (5.4 μg/L in January 2007 and 5.3 μg/L in April 2007), MW-40-34 (22 μg/L in January 2007 and 24 μg/L in April 2007), and in MW-40-32 (50 μg/L in January 2007 and 47 μg/L in April 2007).
    - The PCE concentrations increased from 74 μg/L to 91 μg/L in well MW-40-30.
    - Three of monitoring wells sampled during the April 2007 event (MW-40-30, -32, and -36,) had TCE concentrations greater than the MCL. In MW-40-30, TCE concentrations continue to fluctuate, and no clear increasing or decreasing trends are apparent. TCE in MW-40-32 remained stable (23 μg/L in January 2007 and 22 μg/L in April 2007), and increased in MW-40-36 from 30 μg/L in January 2007 to 85 μg/L in April 2007 (this corresponded with a similar decrease in PCE concentration, possibly indicating breakdown of PCE).

- Production of DCE has been noted in many wells, indicating the breakdown of PCE and TCE. While past DCE trends have generally not been clear, recent decreases were observed in several wells where production had been significant (notably MW-40-32, -36, and -37). Additionally, the DCE level increased in MW-40-30 from 48 μg/L in January 2007 to 70 μg/L in April 2007. DCE levels are expected to fluctuate, especially in wells where PCE and/or TCE are still present and undergoing degradation. DCE was not detected in wells MW-40-07 and -08, and remained below the MCL in well MW-40-34 (1.9 μg/L).

- Relatively low levels of VC continue to be detected at or above the MCL (0.5 μg/L) in MW-40-32 (0.97 μg/L), MW-40-34 (0.66 μg/L), MW-40-36 (0.65 μg/L), and MW-40-37 (18 μg/L). This provides evidence that dechlorination beyond DCE is occurring, but that it still may not be proceeding efficiently to completion at some locations at this time. As with DCE, VC levels are expected to fluctuate in wells where parent compounds are still present and undergoing degradation.

- Ethene continues to be detected in well MW-40-37, indicating that complete dechlorination is occurring at this location.

3) Key observations for the two injection wells (IW-09 and IW-19) and three hydropunch locations (HP-1, HP-4, HP-5) (see Figure 2) are summarized below:

    - Contaminants were not detected in IW-9; only ethene was detected at 0.81J μg/L.

    - Only minor amounts of TCE (0.67J μg/L) and DCE (2.5 μg/L) were detected in samples from IW-19, both below respective MCLs.

    - No other contaminants were detected in the injection well samples, and no contaminants were detected in samples from any of the three temporary well (hydropunch) locations.

Lactate Presence and Microbiological/Geochemical Parameters

Chemical Oxygen Demand (COD) – an indicator of sodium lactate presence – data for the April 2007 event are presented in Table 2. As noted above, lactate injection ceased on December 16, 2005, and no lactate has been injected since that date and through this reporting period. The data continue to suggest that sodium lactate is still present, but concentrations are relatively low, and are stable or decreasing in most monitoring wells. The COD concentration in MW-40-14 was 49.1 milligrams per liter [mg/L] in April 2007, compared with 37.1 mg/L in the prior event (January 2007). The lactate level in MW-40-31 was 109 mg/L in April 2007, which is comparable to the concentration measured in January 2007 of 84.4 mg/L. In MW-40-35, the COD level in April 2007 was 4,240 mg/L vs. 6,970 measured in January 2007. This represents a continued decreasing trend in this well. These wells have exhibited favorable results with respect to degradation of the COCs in their areas, and relatively low and/or declining COD levels would be expected, since no lactate has been recently added to the system.

COD levels in shallow-interval monitoring wells MW-40-32 and -34, in which reductive dechlorination has been variable, remain relatively low as of April 2007 (37.6 mg/L and 12.3 mg/L, respectively). This indicates that lactate is limited in the areas of these wells, which is in line with the inconsistent reductive dechlorination that has been observed. April 2007 monitoring data indicate that COD concentrations in shallow-interval monitoring well MW-40-30, which has responded minimally to the EISB treatment, remains low as well (28.4 mg/L). However in MW-40-36, the COD concentration increased from 14.5 mg/L in January 2007 to 53.7 in April, 2007, which may reflect transport of residual lactate to this location. PCE has exhibited decreasing trends in MW-40-36 over the prior two monitoring periods, and

TCE has shown an increase, which is consistent with the COD data, and may indicate some success in stimulating reductive dechlorination in this area (which has proved resistant to treatment in the past). The COD levels in MW-40-37 and -39 were low over this period, measured at 13.3 mg/L and 24.5 mg/L, respectively. This is somewhat anomalous for MW-40-37, as substantial PCE degradation appears to have occurred at this location. COD in samples from the injection wells and hydropunch locations ranged from 13.2 mg/L to 99.5 mg/L and volatile fatty acids (VFAs) were only detected in MW-40-35, which has the highest COD levels.

Data reflecting concentrations of *Dehalococcoides* spp. (DHC) organisms and total biomass in monitoring wells and other sampling points are included in Table 2. DHC levels in the monitoring well samples ranged from 1.20×10^4 cells/L (MW-40-30) to 5.38×10^6 cells/L (MW-40-32), and biomass concentrations ranged from 1.09×10^8 cells/L (MW-40-32) to 1.45×10^9 cells/L (MW-40-34). Cell counts in injection well and hydropunch samples were within this range. In general, these levels are considered to be moderate to high. DHC and biomass data continue to suggest that microbial presence and diversity are favorable for reductive dechlorination at this site.

Geochemical data for the January 2007 sampling event, including electron acceptors, alkalinity, and oxidation/reduction potential (ORP), are presented in Table 3. The data continue to indicate a reduced environment in areas where COCs are present, based on nitrate and oxygen depletion (DO and nitrate were detected in the hydropunch samples, but these are located downgradient of the plume). ORP, which is a measurement of the degree the system is reduced, ranged from -3 millivolts (mV) (MW-40-22) to 110 mV (MW-40-39), and were greater than zero mV in 15 of the 17 wells in which it was measured. It is generally believed that ORP levels of less than zero mV are required for optimal reductive dechlorination. These data, in conjunction with the COD data suggesting that lactate is largely depleted, indicate the need for additional dosing with electron donor to lower the ORP. As mentioned above, HRC® was applied to the site following the April 2007 monitoring event, and the effectiveness of this material in re-establishing optimal conditions for reductive dechlorination will be assessed in future reports.

Soil Gas Data. Methane gas surface emissions monitoring was performed on April 5, 2007. Methane gas emissions were not detected within Buildings 239 and 240 and surrounding areas during this monitoring event.

Soil gas monitoring was conducted on April 5, 2007. The results of probe monitoring indicated that the 30 probes tested in the field had methane gas present at concentrations ranging from as low as 12.2 percent and up to 89.1 percent in air during the April 2007 monitoring event. The highest methane concentrations were detected in the soil gas probe in MW-40-35. Hydrogen sulfide was not detected in 28 out of 30 probes. The highest hydrogen sulfide concentration was 11 parts per million (ppm) and was detected in MW-40-35.

Groundwater Levels. Groundwater level measurements were conducted on April 5, 2007. Groundwater elevations within the site ranged from 1.10 feet above mean sea level (msl) in MW-40-20 to 2.03 feet above msl in IW-2. In general, water level measurements collected in April 2007 did not indicate a significant change in groundwater level within the monitoring area in comparison with the elevations measured during the January monitoring event.

SUMMARY AND CONCLUSIONS

In summary, COC concentrations and a focused suite of microbial and geochemical parameters were measured in a select number of wells. At this time, only VC slightly exceeds the California MCL or target cleanup goals in two middle-interval wells, MW-40-14 (2.8 μg/L) and -22 (1.1 μg/L). In each of these wells, the VC concentrations are generally decreasing over the past year of monitoring. Higher COC

concentrations are still evident in shallow wells MW-40-30, -32, -34, and MW-40-36, where treatment has been inconsistent or negligible. However in MW-40-36, PCE levels have shown a consistent decrease over the past four monitoring events, and TCE and DCE have increased over this period. This suggests an improvement in the response of this well to the treatment. In addition, MW-40-37, which also had not responded well initially to the lactate injections, now shows clear evidence of reductive dechlorination, as PCE and TCE has not been detected over the prior two events, and DCE and VC have been generated. Finally, changes in COC levels consistent with reductive dechlorination are becoming evident in MW-40-34.

The PCE concentration decreased slightly in MW-40-07, but a consistently decreasing trend is not evident in this well. This, however, in conjunction with the absence of COCs in the samples from the hydropunch locations (HP-1, -4, and -5), suggests that the plume is not migrating laterally in the shallow portion of the aquifer.

Geochemical and microbiological data indicate that conditions are still somewhat favorable for reductive dechlorination. However the process should be enhanced by addition of HRC®, which was applied to the central area of the site after the April 2007 monitoring event was conducted.

HRC® INJECTION ACTIVITIES

Application of the HRC® was conducted April 16–27, 2007. All field work was conducted under direct supervision of the Tetra Tech EC, Inc. (TtEC) project geologist. HRC® was procured from Regenesis Bioremediation Products located in San Clemente, California, and was delivered to the site in 5-gallon-capacity plastic buckets each weighing approximately 30 pounds.

The injection of the material was conducted by Precision Sampling Inc., located in Richmond, California. The substrate was injected into the groundwater at 109 locations (95 locations in the central portion of the plume, at 7 locations around MW-40-07 and at 7 locations around MW-40-34). The injection field in the central portion of the plume consisted of an array of 9 by 11 injection points, covering an area of approximately 90 feet by 110 feet. The injection points had a spacing of approximately 10 feet, and each row was offset 5 feet from the next row to optimize coverage of the area.

Before injection, the locations of the injection points were surveyed and marked in the field. A geophysical survey of the areas where the injection points were located was performed for utility clearance. Prior to injection, each location was hand-augered down to 5 feet below ground surface (bgs) to ensure no presence of subsurface utilities. HRC® was applied at a rate of approximately 7.5 pounds per linear foot from 12 feet bgs to 35 feet bgs at each of the 109 locations using a direct push technology (DPT) rig. A total of 18,300 pounds of HRC® was injected into the ground. The locations of the injection points are shown on Figure 3.

Prior to injection the HRC® was heated to about 150 degrees Fahrenheit in a steel water bath on the contractor's support truck. After heating, HRC® was placed into the positive displacement pump and pumped under high pressure (up to 650 pounds per square inch [psi]) into the formation in 1-foot sections. The injection at each point was conducted from the top (approximately 12 feet bgs) and progressively downward in order to create lateral fractures and increase the horizontal distribution into the formation to the extent possible.

Upon completion of HRC® material injection in each location, the remaining insertion rods were removed and the borehole (from 12 feet bgs to ground surface) was filled with bentonite chips and matched to ground surface. The insertion rods were then cleaned and the crew mobilized to the next location.

FOLLOW-ON ACTIVITIES

Upcoming field activities (and modifications) include the following:

- TtEC will be collecting groundwater samples from the monitoring wells that are located within the injection areas and will analyze the samples for COD concentrations in order to obtain some early information toward determining the HRC® diffusion rate and extent of migration from the close by injection points. The sampling will be conducted during the week of May 14, 2007. Field parameters such as ORP will also be measured.

As noted in the February 2007 summary report, the monitoring plan was modified (with approval of the agencies) as follows:

- Continue monitoring of wells **MW-40-7, -8, -14, -22, -30, -31, -32, -34, -35, -36, and -37** on a **QUARTERLY** basis.
- Reduce the monitoring and sampling of wells **MW-40-02, -06, -10, -11, -13, -15, -16, -17, -18, -19, -20, -38, and -39 to SEMI-ANNUALLY**.

Accordingly, the next quarterly event will be conducted during the first week of July 2007, and will include the complete set of wells. As noted above, the next report will provide for additional on going assessment of the HRC® that was recently applied.

TABLES

Table 1 Summary of Monitoring Activities Conducted During April 2007

Table 2 COD, VFA, DHC, and PLFA Data Collected During April 2007

Table 3 Anions, Alkalinity, DO, and ORP Data Collected During April 2007

FIGURES

Figure 1 Chemical of Concern Results (March 2005 through April 2007) Middle-Interval Monitoring Wells

Figure 2 Chemical of Concern Results (March 2005 through April 2007) Shallow-Interval Monitoring Wells

Figure 3 HRC® Treatment Area and Location of Injection Grid/Points

TABLES

TABLE 1

SUMMARY OF MONITORING ACTIVITIES CONDUCTED DURING JANUARY 2007

Date	Event	Wells Sampled[1]	Analytes[2]/Parameters	Notes
4/3/07-4/4/07	Scheduled groundwater monitoring	Groundwater: MW-40-07, -08, -14, -22, -30 through -32, and -34 through -37.	VOCs, dissolved gases, cations, DNA, water levels, COD, and additional geochemical parameters	Laboratory and field parameters
2/28/07	Additional groundwater monitoring	IW-09, IW-19, HP-1, HP-4, HP-5, and MW-40-39	VOCs, dissolved gases, cations, DNA, water levels, COD, and additional geochemical parameters	Laboratory and field parameters, MW-40-39 analyzed for COD, and field parameters (DO and ORP) only
4/5/07	Soil gas sampling	VW-40-01, -02, -03, -06, MW-40-34, IW-1, -3, and -7.	VOCs and fixed gases	
4/5/07	Surface emissions monitoring	Not applicable	Methane gas concentrations	Inside Building 240 and western portion of Building 239, and areas surrounding the above buildings
4/5/07	Groundwater level measurements	MW-40-01, -02, -06, 07, 08, -10, -11, -13, -14, -15, -17, -19, -20, -22, -30 through 39, and IW-1 through IW-17.	Not Applicable	Groundwater level measurements
4/5/07	Soil gas probe monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, and IW-1 through IW-4 and IW-6 through IW-17.	Methane, oxygen, carbon dioxide, VOCs, and carbon monoxide	

Notes:

[1]Refer to Figure 1 for well locations.
[2]Not all analytes run on all wells.

COD – chemical oxygen demand
DNA – deoxyribonucleic acid
DO – dissolved oxygen
ORP – oxidation/reduction potential
VOC – volatile organic compound

TABLE 2

COD, VFA, DHC, AND PLFA DATA COLLECTED DURING APRIL 2007

Location	COD (mg/L)	Acetic Acid (mg/L)	Propionic Acid (mg/L)	Butyric Acid (mg/L)	DHC (cells/L)	Total PLFA Biomass (cells/L)
IW-09	88.2	<1	<1	<1	7.20E+04	5.81E+08
IW-19	13.2	<1	<1	<1	7.01E+05	5.50E+08
HP-1	99.5	NA	NA	NA	NA	NA
HP-4	58.6	NA	NA	NA	NA	NA
HP-5	24.5	NA	NA	NA	NA	NA
MW-40-07	19.2	NA	NA	NA	NA	NA
MW-40-14	49.1	NA	NA	NA	NA	NA
MW-40-22	35.3	NA	NA	NA	NA	NA
MW-40-30	28.4	<1	<1	<1	1.20E+04	1.93E+08
MW-40-31	109	<1	<1	<1	6.71E+04	5.54E+08
MW-40-32	37.6	<1	<1	<1	5.38E+06	1.09E+08
MW-40-34	12.3	<1	<1	<1	7.72E+04	1.45E+09
MW-40-35	4240	1781	2988	63.9	9.31E+04	1.17E+09
MW-40-36	53.7	<1	<1	<1	9.67E+04	1.64E+08
MW-40-37	13.3	<1	<1	<1	1.60E+06	6.55E+08
MW-40-39	24.5	NA	NA	NA	NA	NA

Notes:

cells/L – cells per liter

COD – chemical oxygen demand

DHC – *Dehalococcoides* spp.

mg/L – milligrams per liter

NA – not analyzed

PLFA – phospholipid fatty acids

VFA – volatile fatty acid

TABLE 3

ANIONS, ALKALINITY, DO, AND ORP DATA COLLECTED DURING APRIL 2007

Location	Chloride (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	DO (mg/L)	ORP (mV)
IW-09	40.8	0.288	0.976	149	370	0.6	83
IW-19	413	0.1 U	0.1 U	313	490	0.16	-52
HP-1	711	0.1 U	14.7	525	285	3.58	98
HP-4	711	0.1 U	17.8	675	338	1.87	96
HP-5	411	0.1 U	5.08	342	365	1.81	106
MW-40-07	437	0.1 U	2.85	300	300	0.12	111
MW-40-08	NA	NA	NA	NA	NA	0.16	105
MW-40-22	290	0.1 U	0.0986 J	49.2	970	0.17	-3
MW-40-30	161	0.1 U	0.0661 J	147	383	0.15	103
MW-40-31	596	0.1 U	0.127	6.31	3650	0.14	49
MW-40-32	125	0.1 U	0.1 U	67.2	645	0.14	79
MW-40-33	NA	NA	NA	NA	NA	NA	NA
MW-40-34	192	0.1 U	0.0931 J	129	350	0.11	90
MW-40-35	460	0.2 U	0.254	1.93	6250	0.14	50
MW-40-36	277	0.1 U	0.0991 J	188	535	0.14	91
MW-40-37	450	0.1 U	0.1 U	261	530	0.16	89
MW-40-39	NA	NA	NA	NA	NA	2.91	110

Notes:

DO – dissolved oxygen

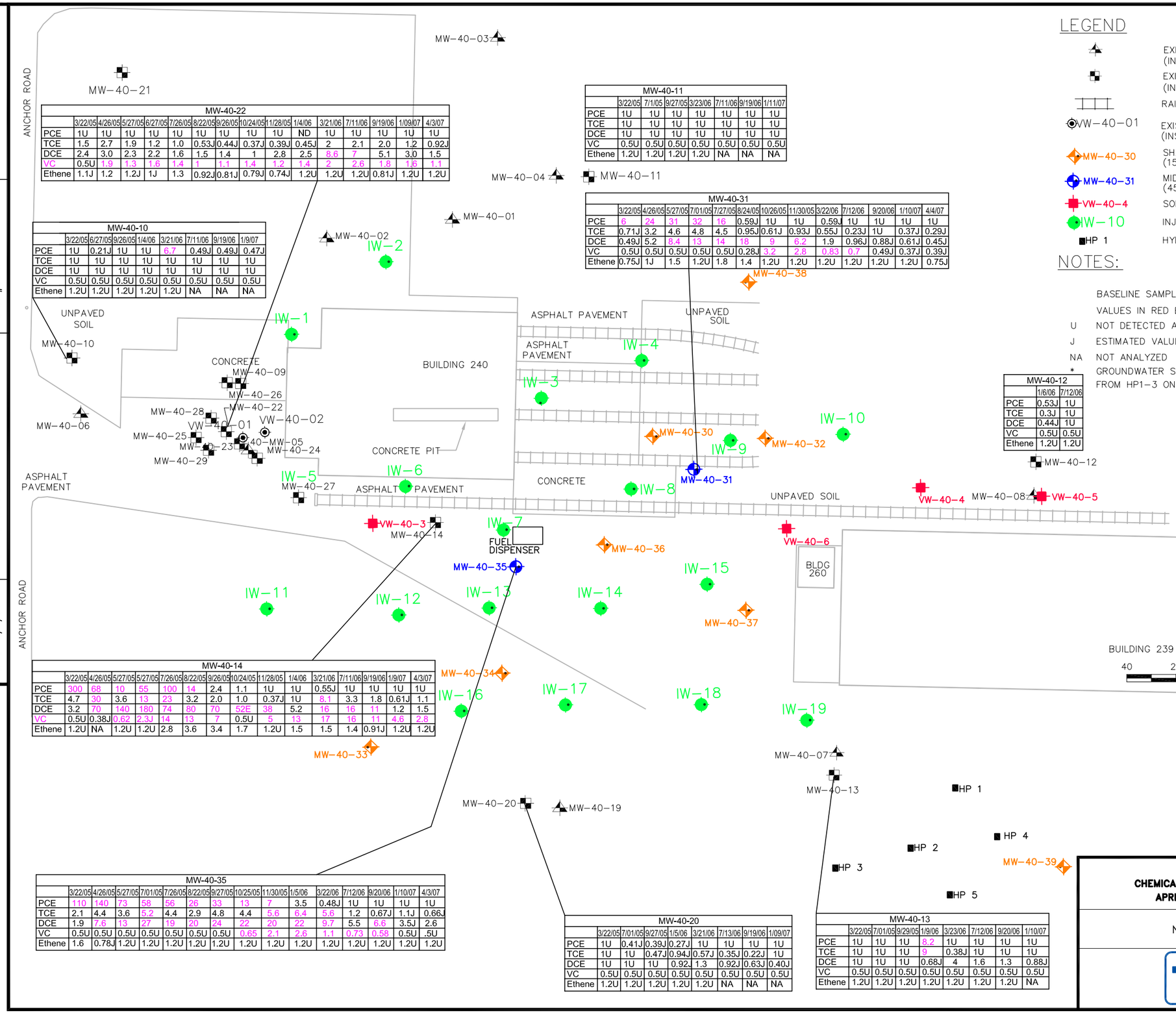
mg/L – milligrams per liter

mV – millivolts

NA – not analyzed

ORP – oxidation/reduction potential

FIGURES



MW-40-22	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/09/07	4/3/07
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	ND	1U	1U	1U	1U	1U
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J	0.37J	0.39J	0.45J	2	2.1	2.0	1.2	0.92J
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4	1	2.8	2.5	8.6	7	5.1	3.0	1.5
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1	1.4	1.2	1.4	2	2.6	1.8	1.6	1.1
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J	0.79J	0.74J	1.2U	1.2U	1.2U	0.81J	1.2U	1.2U

MW-40-11	3/22/05	7/1/05	9/27/05	3/23/06	7/11/06	9/19/06	1/11/07
PCE	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-10	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07
PCE	1U	0.21J	1U	1U	6.7	0.49J	0.49J	0.47J
TCE	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-31	3/22/05	4/26/05	5/27/05	7/01/05	7/27/05	8/24/05	10/26/05	11/30/05	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07
PCE	6	24	31	32	16	0.59J	1U	1U	0.59J	1U	1U	1U	1U
TCE	0.71J	3.2	4.6	4.8	4.5	0.95J	0.61J	0.93J	0.55J	0.23J	1U	0.37J	0.29J
DCE	0.49J	5.2	8.4	13	14	18	9	6.2	1.9	0.96J	0.88J	0.61J	0.45J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.28J	3.2	2.8	0.83	0.7	0.49J	0.37J	0.39J
Ethene	0.75J	1J	1.5	1.2U	1.8	1.4	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.75J

MW-40-14	3/22/05	4/26/05	5/27/05	5/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	4/3/07
PCE	300	68	10	55	100	14	2.4	1.1	1U	1U	0.55J	1U	1U	1U	1U
TCE	4.7	30	3.6	13	23	3.2	2.0	1.0	0.37J	1U	8.1	3.3	1.8	0.61J	1.1
DCE	3.2	70	140	180	74	80	70	52E	38	5.2	16	16	11	1.2	1.5
VC	0.5U	0.38J	0.62	2.3J	14	13	7	0.5U	5	13	17	16	11	4.6	2.8
Ethene	1.2U	NA	1.2U	1.2U	2.8	3.6	3.4	1.7	1.2U	1.5	1.5	1.4	0.91J	1.2U	1.2U

MW-40-35	3/22/05	4/26/05	5/27/05	7/01/05	7/26/05	8/22/05	9/27/05	10/25/05	11/30/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07
PCE	110	140	73	58	56	26	33	13	7	3.5	0.48J	1U	1U	1U	1U
TCE	2.1	4.4	3.6	5.2	4.4	2.9	4.8	4.4	5.6	6.4	5.6	1.2	0.67J	1.1J	0.66J
DCE	1.9	7.6	13	27	19	20	24	22	20	22	9.7	5.5	6.6	3.5J	2.6
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.65	2.1	2.6	1.1	0.73	0.58	0.5U	.5U
Ethene	1.6	0.78J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-20	3/22/05	7/01/05	9/27/05	1/5/06	3/21/06	7/13/06	9/19/06	1/09/07
PCE	1U	0.41J	0.39J	0.27J	1U	1U	1U	1U
TCE	1U	1U	0.47J	0.94J	0.57J	0.35J	0.22J	1U
DCE	1U	1U	1U	0.92J	1.3	0.92J	0.63J	0.40J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-13	3/22/05	7/01/05	9/29/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07
PCE	1U	1U	1U	8.2	1U	1U	1U	1U
TCE	1U	1U	1U	9	0.38J	1U	1U	1U
DCE	1U	1U	1U	0.68J	4	1.6	1.3	0.88J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA

MW-40-12	1/6/06	7/12/06
PCE	0.53J	1U
TCE	0.3J	1U
DCE	0.44J	1U
VC	0.5U	0.5U
Ethene	1.2U	1.2U

MW-40-18	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07
PCE	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	NA	NA	NA

MW-40-16	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07
PCE	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U
VC	0.5U	0.5U	1U	1U	0.5U
Ethene	1.2U	1.2U	NA	NA	NA

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 — SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005

VALUES IN RED EXCEED REMEDIATION CRITERIA

U NOT DETECTED AT DETECTION LIMIT GIVEN

J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT

NA NOT ANALYZED

* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

Figure 1

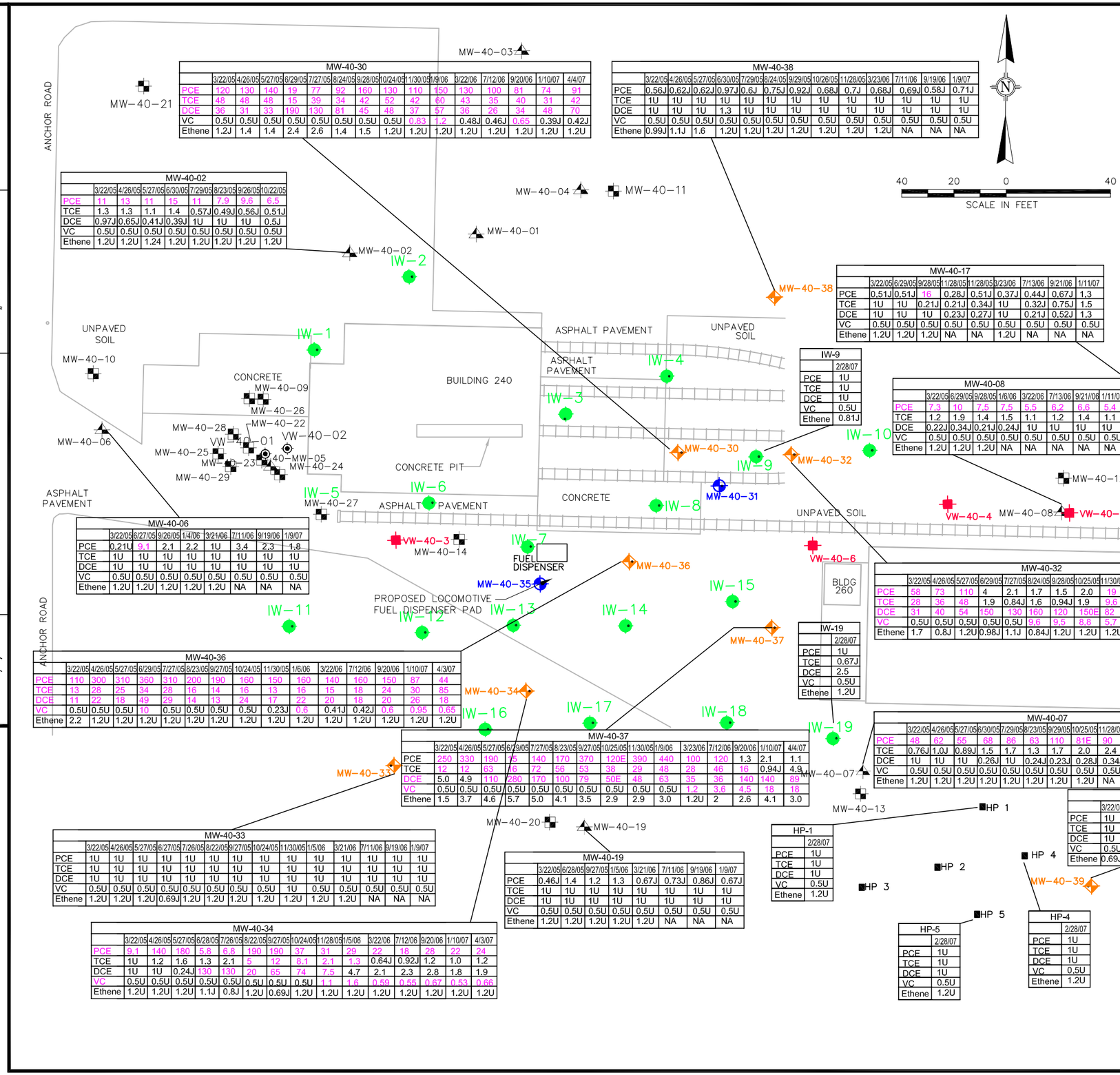
CHEMICAL OF CONCERN RESULTS (MARCH 2005 THROUGH APRIL 2007) MIDDLE-INTERVAL MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 07122601.DWG
DCN: ECSD-RACIV-07-1226
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV: REVISION 0
DRAWN BY: MD
DATE: 5/1/07

P:\3210-RAC IV\CTO-0010\Dwg\071226\07122601.DWG
PLOT/UPDATE: FEB 13 2007 15:42:13



LEGEND

- EXISTING SHALLOW–INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE–INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW–40–01 EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW–40–30 SHALLOW–INTERVAL MONITORING WELL LOCATION (15'–35' BGS)(INSTALLED MARCH 2005)
- MW–40–31 MIDDLE–INTERVAL MONITORING WELL LOCATION (45'–55' BGS)(INSTALLED MARCH 2005)
- VW–40–4 SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW–10 INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 HYDROPUNCH LOCATIONS*

40 20 0 40
SCALE IN FEET

NOTES:

BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005

VALUES IN RED EXCEED REMEDIATION CRITERIA

U NOT DETECTED AT DETECTION LIMIT GIVEN

J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT

NA NOT ANALYZED

* GROUNDWATER SAMPLES FROM HP1–5 WERE ANALYZED ON 06–08–05 AND FROM HP1–3 ON 10–19–05

MW-40-30

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/24/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07
PCE	120	130	140	19	77	92	160	130	110	150	130	100	81	74	91
TCE	48	48	48	15	39	34	42	52	42	60	43	35	40	31	42
DCE	36	31	33	190	130	81	45	48	37	57	36	26	34	48	70
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.83	1.2	0.48J	0.46J	0.65	0.39J	0.42J
Ethene	1.2J	1.4	1.4	2.4	2.6	1.4	1.5	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-38

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/24/05	9/29/05	10/26/05	11/28/05	3/23/06	7/11/06	9/19/06	1/9/07
PCE	0.56J	0.62J	0.62J	0.97J	0.6J	0.75J	0.92J	0.68J	0.7J	0.68J	0.69J	0.58J	0.71J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1.3	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.99J	1.1J	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-02

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/26/05	10/22/05
PCE	11	13	11	15	11	7.9	9.6	6.5
TCE	1.3	1.3	1.1	1.4	0.57J	0.49J	0.56J	0.51J
DCE	0.97J	0.65J	0.41J	0.39J	1U	1U	1U	0.5J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.24	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-17

	3/22/05	6/29/05	9/28/05	11/28/05	11/28/05	3/23/06	7/13/06	9/21/06	1/11/07
PCE	0.51J	0.51J	16	0.28J	0.51J	0.37J	0.44J	0.67J	1.3
TCE	1U	1U	0.21J	0.21J	0.34J	1U	0.32J	0.75J	1.5
DCE	1U	1U	1U	0.23J	0.27J	1U	0.21J	0.52J	1.3
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	1.2U	NA	NA	NA

IW-9

	2/28/07
PCE	1U
TCE	1U
DCE	1U
VC	0.5U
Ethene	0.81J

MW-40-08

	3/22/05	6/29/05	9/28/05	1/6/06	3/22/06	7/13/06	9/21/06	1/11/07	4/4/07
PCE	7.3	10	7.5	7.5	5.6	6.2	6.6	5.4	5.3
TCE	1.2	1.9	1.4	1.5	1.1	1.2	1.4	1.1	1.1
DCE	0.22J	0.34J	0.21J	0.24J	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA	NA

MW-40-15

	3/22/05	6/30/05	9/28/05	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07
PCE	1U	1U	0.26J	0.23J	1U	1U	1U	1U
TCE	1U	1U	0.26J	0.21J	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.1J	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-06

	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07
PCE	0.21U	9.1	2.1	2.2	1U	3.4	2.3	1.8
TCE	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-32

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/25/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07
PCE	58	73	110	4	2.1	1.7	1.5	2.0	19	10	5.1	34	39	50	47
TCE	28	36	48	1.9	0.84J	1.6	0.94J	1.9	9.6	6.1	2.6	16	20	23	22
DCE	31	40	54	150	130	160	120	150E	82	150	160	46	44	30	25
VC	0.5U	0.5U	0.5U	0.5U	0.5U	9.6	9.5	8.8	5.7	0.5U	1.8	1.7	1.8	1.2	0.97
Ethene	1.7	0.8J	1.2U	0.98J	1.1J	0.84J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

IW-19

	2/28/07
PCE	1U
TCE	0.67J
DCE	2.5
VC	0.5U
Ethene	1.2U

MW-40-36

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/24/05	11/30/05	1/6/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07
PCE	110	300	310	360	310	200	190	160	150	160	140	160	150	87	44
TCE	13	28	25	34	28	16	14	16	13	16	15	18	24	30	85
DCE	11	22	18	49	29	14	13	24	17	22	20	18	20	26	18
VC	0.5U	0.5U	0.5U	10	0.5U	0.5U	0.5U	0.5U	0.23J	0.6	0.41J	0.42J	0.6	0.95	0.65
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-07

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/28/05	1/6/06	3/23/06	7/11/06	9/21/06	1/9/07	4/4/07
PCE	48	62	55	68	86	63	110	81E	90	110	25	100	94	83	49
TCE	0.76J	1.0J	0.89J	1.5	1.7	1.3	1.7	2.0	2.4	3.7	0.85J	3.2	3.1	2.7	1.8
DCE	1U	1U	1U	0.26J	1U	0.24J	0.23J	0.28J	0.34J	0.41J	1U	0.31J	0.43J	0.34J	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-37

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/25/05	11/30/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	4/4/07
PCE	250	330	190	75	140	170	370	120E	390	440	100	120	1.3	2.1	1.1
TCE	12	12	63	16	72	56	53	38	29	48	28	46	16	0.94J	4.9
DCE	5.0	4.9	110	280	170	100	79	50E	48	63	35	36	140	140	89
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.2	3.6	4.5	18	18
Ethene	1.5	3.7	4.6	5.7	5.0	4.1	3.5	2.9	2.9	3.0	1.2U	2	2.6	4.1	3.0

MW-40-39

	3/22/05	4/26/05	4/26/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/30/05	1/6/06	3/21/06	7/11/06	9/21/06	1/9/07
PCE	1U	1U	1U	1U	0.34J	0.29J	0.35J	0.42J	0.49J	0.71J	0.72J	1.7	2.4	2.5
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	NA	NA	NA	NA	NA	NA

HP-1

	2/28/07
PCE	1U
TCE	1U
DCE	1U
VC	0.5U
Ethene	1.2U

MW-40-33

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/27/05	10/24/05	11/30/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-19

	3/22/05	6/28/05	9/27/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07
PCE	0.46J	1.4	1.2	1.3	0.67J	0.73J	0.86J	0.67J
TCE	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

HP-5

	2/28/07
PCE	1U
TCE	1U
DCE	1U
VC	0.5U
Ethene	1.2U

HP-4

	2/28/07
PCE	1U
TCE	1U
DCE	1U
VC	0.5U
Ethene	1.2U

MW-40-34

	3/22/05	4/26/05	5/27/05	6/28/05	7/26/05	8/22/05	9/27/05	10/24/05	11/28/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07
PCE	9.1	140	180	5.8	6.8	190	190	37	31	29	22	18	28	22	24
TCE	1U	1.2	1.6	1.3	2.1	5	12	8.1	2.1	1.3	0.64J	0.92J	1.2	1.0	1.2
DCE	1U	1U	0.24J	130	130	20	65	74	7.5	4.7	2.1	2.3	2.8	1.8	1.9
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.1	1.6	0.59	0.55	0.67	0.53	0.66
Ethene	1.2U	1.2U	1.2U	1.1J	0.8J	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

Figure 2

CHEMICAL OF CONCERN RESULTS (MARCH 2005 THROUGH APRIL 2007) SHALLOW–INTERVAL MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 07122602.DWG
DCN: FWSD–RAC–07–1226
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV: REVISION 0
DRAWN BY: MD
DATE: 5/1/07

P:\3210–RAC IV\CTO–0010\DWG\071226\07122602.DWG
PLOT/UPDATE: MAY 16 2007 09:49:46

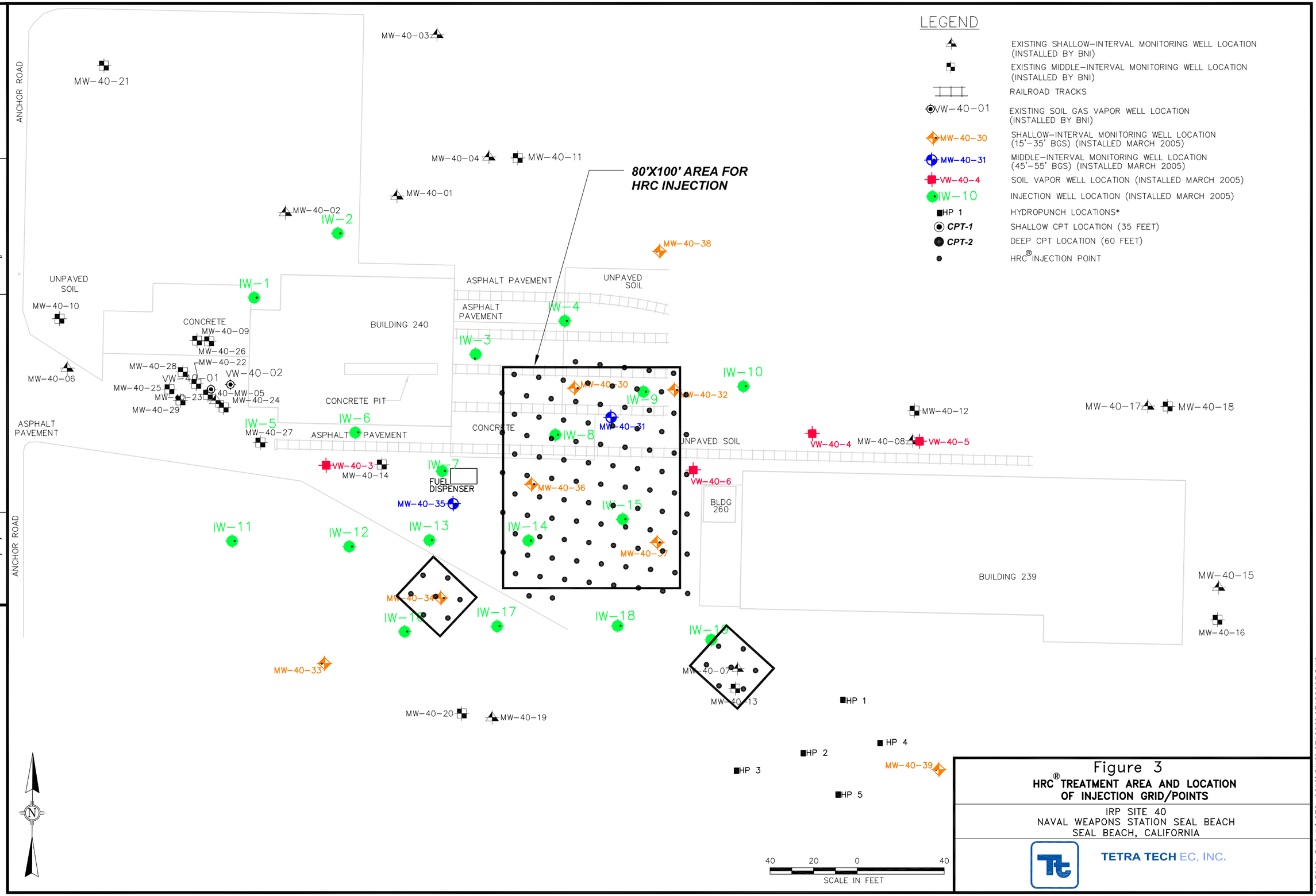


Figure 3
HRC® TREATMENT AREA AND LOCATION OF INJECTION GRID/POINTS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 07122603.DWG
DCN: ECSD-RACIV-07-1226
CTO: #0010
APPROVED BY: HH
CHECKED BY: HH
REV: REVISION 0
DRAWN BY: MD
DATE: 05/16/07

P:\3210-RAC IV\CTO-0010\DWG\071226\07122603.DWG
PLOT/UPDATE: MAY 16 2007 11:08:05

TETRA TECH EC, INC.

SUMMARY OF FIELD ACTIVITIES AND DATA FOR ENHANCED IN-SITU BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS FOR MAY 2007 – JULY 2007

INSTALLATION RESTORATION PROGRAM SITE 40 NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CA

Date: August 10, 2007

Prepared by: Hamlet Hamparsumian and Mark E. Losi, Tetra Tech EC, Inc. (TtEC)

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INTRODUCTION

This summary report provides a brief review of site activities conducted during the period of May 2007 through July 2007 in association with groundwater remediation activities (enhanced in-situ bioremediation [EISB]) at Installation Restoration Program (IRP) Site 40 at Naval Weapons Station Seal Beach, Seal Beach, California. This report includes presentation and assessment of relevant data collected during this period. Also contained herein is a summary of the general status of the project.

The initial sodium lactate injections ceased on December 16, 2005. It was generally concluded that the sodium lactate was effective in stimulating biological reduction of chlorinated volatile organic compounds (CVOCs) in areas where delivery was achieved. However, delivery of sodium lactate proved difficult in some areas of the site due to subsurface heterogeneity. With regulator approval, Hydrogen Release Compound® (HRC®) was applied to the central area of the site during the week beginning April 16, after the April 2007 sampling event had been completed. HRC® is a slow-release form of lactate that was injected in a tight grid, and is expected to migrate via diffusion and dispersion into areas where delivery of soluble sodium lactate has proved difficult. The data set discussed herein provides for initial assessment of the effectiveness of the HRC® injection.

SUMMARY OF FIELD ACTIVITIES

The field activities for this period included groundwater, soil gas, and surface emissions monitoring in various wells. Monitoring activities, along with the dates they were conducted, are listed in Table 1.

MONITORING EVALUATION

Groundwater and soil gas sampling and analytical data as well as groundwater level measurements are briefly discussed below. For the regularly scheduled monitoring event (July 2007), chemicals of concern (COCs) along with a focused suite of microbial and geochemical parameters were measured in regularly (quarterly) monitored wells (middle interval wells MW-40-14, -22, -31, and -35; and shallow-interval wells MW-40-07, -8, -30, -32, -34, -36, and -37). This event also included a suite of wells that are monitored

semiannually to assess monitored natural attenuation (middle-interval wells MW-40-10, -11, -13, -16, -18, and -20; and shallow-interval wells MW-40-02, -06, -08, -15, -17, -19, -33, -38, and -39).

Only one of the semiannually monitored wells had COC concentrations that slightly exceeded the cleanup goals: MW-40-02 (dichloroethene [DCE] at 6.6 micrograms per liter [μg/L]), and there was no clear evidence of plume expansion or migration. The focus of the following discussions is therefore on the quarterly monitored wells in which contamination is or had been prevalent. Additional groundwater monitoring was also conducted in May 2007 and June 2007 prior to the July 2007 event to preliminarily assess the migration/effects of the injected HRC® (Table 1). Groundwater monitoring well data for COCs collected from the beginning of the project (March 2005) through July 2007 are included on Figures 1 and 2 (middle-interval and shallow-interval monitoring wells, respectively), and geochemical and microbiological data are presented in Tables 2 and 3, respectively.

Initial HRC® Assessment and COC Evaluation

This subsection provides a summary of data collected during May 2007 and June 2007 to preliminarily assess HRC® migration and its effects, followed by key observations regarding COCs measured in groundwater during the July 2007 event.

1) Key observations for additional wells sampled to preliminarily assess HRC® migration, including injection wells IW-08, -09, -18, and -19, and groundwater monitoring wells MW-40-07, -30, -32, -34, -36, and -37 are summarized below. Each of these wells is located in the area expected to be influenced by the HRC®. The migration of HRC® to these wells is assessed by measuring chemical oxygen demand (COD), as has been conducted over the duration of the project to measure lactate presence. Decreased dissolved oxygen (DO) and oxidation reduction potentials (ORP) provide an indication of microbial metabolism of the HRC® (effectiveness is generating reducing conditions). COD and DO/ORP data for these wells are included in Tables 2 and 3, respectively.

    - The May 2007 and June 2007 COD measurements revealed substantial increases in wells IW-8 (24,158 milligrams per liter [mg/L] and 15,100 mg/L), IW-9 (5,183 mg/L and mg/L 2,320), MW-40-07 (3,303 mg/L and 2,100 mg/L), -34 (4,295 mg/L and 4,660 mg/L), and -36 (857 mg/L and 1,010 mg/L). During the April 2007 event, COD ranged from 12.3 mg/L to 88.2 mg/L in these wells (it is noted that IW-08 was not assessed). This indicates significant HRC® migration to these areas.
    - COD levels in the other wells (IW-18, -19, MW-40-30, -32, and -37) were consistent with prior measurements indicating that migration of HRC® in these areas was less favorable at that time.
    - Based on the May 2007 and June 2007 readings, DO concentrations in each of these wells were less than 0.5 mg/L and ORP values were all negative. ORP values in these wells had all been measured in the positive range, with the exception of IW-19, during the April 2007 sampling event (measurements were not taken in IW-8 and IW-18). Overall, the May 2007 and June 2007 data indicate a shift to strongly reducing conditions supportive of reductive dechlorination.

2) Key observations regarding COC trends for quarterly monitored middle-interval monitoring wells, including MW-40-14, -22, -31, and -35 (see Figure 1) are summarized below:

    - Tetrachloroethene (PCE) concentrations were below the detection limit (1 μg/L) in each of the quarterly monitored middle-interval monitoring wells.

- TCE levels were below the Maximum Contaminant Level (MCL) (5 μg/L) in the middle-interval monitoring wells and ranged from non-detect (<1 μg/L) to 0.95J μg/L (MW-40-14).
- DCE concentrations were below the MCL (6 μg/L) in each of the middle-interval monitoring wells, ranging from non-detect (<1 μg/L) to 2.1 μg/L (MW-40-35).
- Vinyl chloride (VC) is present above the MCL (0.5 μg/L) in one monitored middle-interval monitoring well, MW-40-14 (2.8 μg/L). Results show that VC remained below the MCL in MW-40-31 and -35 over this period. The VC concentration continued to decrease in well MW-40-22 and is now below the detection limit of 0.5 μg/L.
- Results continue to indicate that a reductive dechlorination process has been effective in these areas, and all contaminants are below or very near the MCLs.

3) Key observations for quarterly monitored shallow-interval wells, including MW-40-07, -08, -30, -32. -34, -36, and -37 (see Figure 2) are summarized below:

- The PCE concentrations are below the MCL (5 μg/L) in all wells except MW-40-07 (11 μg/L), -08 (6.1 μg/L), -30 (66 μg/L), and -32 (10 μg/L).
- Notable reductions in PCE have been observed following the HRC® injection in wells that previously had been problematic, including MW-40-07 (from 49 μg/L to 11 μg/L), -30 (from 91 μg/L to 66 μg/L), MW-40-32 (from 47 μg/L to 10 μg/L), MW-40-34 (from 24 μg/L to 4.5 μg/L), and MW-40-36 (from 44 μg/L to 1 μg/L). Notable increases in one or more daughter products in MW-40-07, -34, and -36 indicate that reductive dechlorination is occurring at these locations.
- Only three of monitoring wells sampled during the July 2007 event (MW-40-07, -30, and -32) had TCE concentrations greater than the MCL. In MW-40-30, a minor decrease in the TCE concentration from 42 μg/L to 34 μg/L was observed. TCE in MW-40-32 also decreased (22 μg/L in April 2007 and 13 μg/L in July 2007), and decreased in MW-40-36 from 85 μg/L in April 2007 to 2.0 μg/L in July 2007. The TCE concentration increased in MW-40-07 from 1.8 μg/L in April 2007 to 6.7 μg/L in July 2007, which corresponded with a decrease in PCE level, indicating degradation of PCE.
- DCE has been noted in many wells, indicating the breakdown of PCE and TCE. DCE remains above the MCL (6 μg/L) in six of the quarterly monitored wells, including -07 (36 μg/L), -30 (45 μg/L), -32 (26 μg/L), -34 (14 μg/L), -36 (35 μg/L), and -37 (64 μg/L). Notable increases in DCE concentrations occurred in MW-40-07 (<1 μg/L to 36 μg/L), -34 (1.9 μg/L to 14 μg/L), and -36 (18 μg/L to 35 μg/L). Each of these increases is accompanied by decreases in PCE and/or TCE. DCE levels are still expected to fluctuate, especially in cases where PCE and/or TCE are still present and undergoing degradation in wells affected by the recent HRC® injection.
- VC was detected above the MCL (0.5 μg/L) in MW-40-32 (1.6 μg/L), -36 (9.6 μg/L), and -37 (24 μg/L). Elevated levels in MW-40-36 and -37 indicate significant breakdown of DCE in these wells. As with DCE, VC levels are expected to fluctuate in wells where parent compounds are still present and undergoing degradation.
- Ethene continues to be detected in well MW-40-37, and has now been detected in MW-40-36, indicating that complete dechlorination is occurring at these locations.

- Overall, major reductions in volatile organic compound (VOC) concentrations have been noted in essentially all wells over the course of the project. The HRC® appears to have had an effect in previously problematic wells -07, -32, -34, and -36. The detection of VC in wells -32, -34 (past events), -36, and -37; and ethene in -36, -37, indicated that the process will likely proceed to completion in the central portion of the site.

Lactate Presence and Microbiological/Geochemical Parameters

As noted previously, COD is an indicator of sodium lactate presence in groundwater. COD data for the July 2007 event are presented in Table 2. As noted above, lactate injection ceased on December 16, 2005, and HRC® was injected during the week of April 16, 2007. In addition, sodium lactate solution was injected into pilot test wells MW-40-25 and -28 (approximately 2,000 gallons into each well) during June 2007. COD values in monitoring wells assessed during the April 2007 event (prior to the HRC injection) ranged from 12.3 mg/L (MW-40-34) to 53.7 mg/L (MW-40-36), with the exception of middle interval wells MW-40-31 (109 mg/L) and MW-40-35 (4,240 mg/L), which still contained residual lactate from the original injections.

COD levels measured during the July 2007 event were, in many cases, substantially elevated over those measured in prior events. In particular, COD in monitoring wells MW-40-07, -20, -22, -34, and -36 ranged from 794 to 13,700 mg/L. Significant COD was also observed in MW-40-31 (880 mg/L) and -35 (5,410 mg/L), both of which represent increases from the April 2007 event. A less pronounced increase was noted in MW-40-32, in which COD increased from 37.6 (April 2007) to 78.8 (July 2007). MW-40-07, -31, -32, -34, -35, and -36 are in or near (downgradient of) the area of the HRC® injection, which likely explains the increase in COD in these wells. The increase in MW-40-22 is attributed to injection of sodium lactate into the nearby pilot test monitoring wells that was performed in June 2007. In addition, volatile fatty acids (VFAs), which indicate the breakdown of lactate released from the HRC (and hence, microbial activity), were detected in wells MW-40-31, -32, -34, -35, and -36. VFAs were only detected in MW-40-35 during the prior event. These data support the initial effectiveness of the HRC® injection in dispersing substrate within the central portion of the site. Each of these wells either has very low COC levels (MW-40-20, -22, -31, and -35) or showed recent response to the treatment (MW-40-07, -32, -34, -36).

Data from the July 2007 event reflecting concentrations of *Dehalococcoides* spp. (DHC) organisms and total biomass (a measure of total viable bacteria) in monitoring wells are included in Table 2. DHC levels in the monitoring well samples ranged from 3.34×10^2 cells/L (MW-40-30) to 4.94×10^7 cells/L (MW-40-32), and total biomass concentrations ranged from 4.48×10^7 cells/L (MW-40-30) to 9.84×10^9 cells/L (MW-40-37). In general, these concentrations are consistent with the prior event; however, orders of magnitude increases in DHC levels were observed in MW-40-32 and -36, where increases in COD and VFAs were also observed. Total biomass also increased by an order of magnitude in MW-40-32 and -37, and a relatively high concentration (1.41×10^9 cells/L) was observed in MW-40-13, which is downgradient from MW-40-07. These data, in conjunction with decreasing contaminant levels suggest that treatment is occurring at these locations. However, it is noted that DHC and total biomass decreased in samples from MW-40-30, where COD levels remained low, and contaminant degradation has been less effective relative to most other areas within the site. In general, however, DHC and biomass levels are considered to be moderate to high, and these data continue to suggest that microbial presence and diversity are favorable for reductive dechlorination at this site.

Geochemical data for the July 2007 sampling event, including electron acceptors (DO, nitrate/nitrite, sulfate), alkalinity, chloride, and ORP, are presented in Table 3. The data continue to indicate a reduced environment in areas where COCs are present (and site wide, as well), based on nitrate/nitrite and DO depletion. ORP, which is a measurement of the degree the system is reduced, ranged from -471 millivolts (mV) (MW-40-02) to 125 mV (MW-40-33), and was less than zero mV in 17 of the 25 wells in which it

was measured. Importantly, ORP values were negative for key wells in or near the HRC® injection area (MW-40-07, -30, -31, -32, -34, -35, 36, and -37). Positive ORP values had been measured in these wells prior to the HRC® injection, which appears to indicate a shift to more strongly reducing conditions resulting from the HRC® injection. It is generally believed that ORP levels of less than zero mV are required for reductive dechlorination to occur. These data, in conjunction with COD and VFA data which suggests increased lactate presence, indicate that the HRC® is having the desired effect.

Soil Gas Data. Methane gas surface emissions monitoring was performed on July 13, 2007. Methane gas emissions were not detected within Buildings 239 and 240 and surrounding areas during this monitoring event.

Soil gas monitoring was conducted on July 13, 2007. The results of probe monitoring indicated that the 31 probes tested in the field had methane gas present at concentrations ranging from as low as 0.2 percent and up to 87.4 percent in air during the July 2007 monitoring event. The highest methane concentrations were detected in the soil gas probe in the injection well IW-13. Hydrogen sulfide was detected in 13 of 31 probes ranging from 1 parts per million (ppm) to as high as 48 ppm. The highest hydrogen sulfide concentration detected in MW-40-36.

Groundwater Levels. Groundwater level measurements were conducted on July 12, 2007. Groundwater elevations within the site ranged from 1.09 feet above mean sea level (msl) in MW-40-13 to 1.95 feet above msl in IW-2. In general, water level measurements collected in July 2007 did not indicate a significant change in groundwater level within the monitoring area in comparison with the elevations measured during the previous monitoring events.

SUMMARY AND CONCLUSIONS

In summary, COC concentrations and a focused suite of microbial and geochemical parameters were measured in various monitoring wells. At this time, only VC slightly exceeds the California MCL or target cleanup goals in one middle-interval well, MW-40-14, detected at 2.8 μg/L. COCs are below MCLs in all other middle-interval wells. With respect to the shallow-interval wells, substantial decreases in COC concentrations were observed (to varying degrees) in key wells MW-40-30, -32, -34, and MW-40-36, where treatment had been inconsistent or negligible in the past. Concurrent increases in COD levels were observed in MW-40-32, -34, and MW-40-36, indicating that the HRC® has had a positive effect in these areas. In addition, MW-40-37, which also had not responded well initially to the lactate injections, continues to show clear evidence of reductive dechlorination. Finally, COD has increased in MW-40-07, accompanied by a decrease in PCE and concurrent increases in TCE and DCE, indicating the onset of reductive dechlorination in this area. Geochemical and microbiological data indicate that conditions have begun to respond to the HRC® injection, and are favorable for reductive dechlorination in areas where sodium lactate migration had previously not been optimal. Thus, at this juncture, it appears that the addition of HRC® as an optimization measure has been effective.

FOLLOW-ON ACTIVITIES

Upcoming field activities include the following:

- Conduct quarterly groundwater monitoring around mid-October 2007.
- Conduct periodic sampling in early September of monitoring wells within the HRC® injection footprint and analyze for COD, DO, and ORP.

TABLES

Table 1 Summary of Monitoring Activities Conducted May 2007 through July 2007

Table 2 COD, VFA, DHC, and PLFA Data Collected May 2007 through July 2007

Table 3 Anions, Alkalinity, DO, and ORP Data Collected May 2007 through July 2007

FIGURES

Figure 1 Chemical of Concern Results (March 2005 through July 2007) Middle-Interval Monitoring Wells

Figure 2 Chemical of Concern Results (March 2005 through July 2007) Shallow-Interval Monitoring Wells

TABLES

TABLE 1

SUMMARY OF MONITORING ACTIVITIES CONDUCTED MAY 2007 THROUGH JULY 2007

Date	Event	Wells Sampled[1]	Analytes[2]/Parameters	Notes
5/16/07	Additional groundwater monitoring	IW-08, -09, -18, -19, MW-40-07, -30, -32, -34, -36, and -37	COD, DO, and ORP	Laboratory and field parameters
6/14/07	Additional groundwater monitoring	IW-08, -09, -18, -19, MW-40-07, -30, -32, -34, -36, and -37	COD, DO, and ORP	Laboratory and field parameters
7/9/07	Soil vapor sampling	VW-40-01, -02, -03, -04, -06, MW-40-34, IW-1, -3, and -7.	VOCs and fixed gases	Laboratory analysis
7/10/07-7/12/07	Scheduled monthly groundwater monitoring	MW-40-02, -06 through -08, -10, -11, -13, -14 through -20, -22, -30 through -39	VOCs, dissolved gases, cations, DNA, PLFAs, VFAs, COD, anions, alkalinity, water levels, TDS, and additional geochemical parameters	Laboratory and field parameters
7/12/07	Groundwater level measurements	MW-40-01, -02, -06, 07, 08, -10, -11, -13, -14, -15, -17, -19, -20, -22, -30 through 39, and IW-1 through IW-17.	Not Applicable	Groundwater level measurements
7/13/07	Soil vapor/gas probe monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, and IW-1 through IW-4 and IW-6 through IW-17.	Methane, oxygen, carbon dioxide, hydrogen sulfide, and carbon monoxide concentrations	Field measurements
7/13/07	Surface emissions monitoring	Not applicable	Methane gas concentrations	Around Building 240 and western portion of Building 239, and areas surrounding the above buildings

Notes:

[1]Refer to Figure 1 for well locations.
[2]Not all analytes run on all wells.

COD – chemical oxygen demand
DNA –
DO – dissolved oxygen
ORP – oxidation reduction potential
PLFA – phospholipid fatty acids
TDS – total dissolved solids
VFA – volatile fatty acid
VOC – volatile organic compound

TABLE 2

COD, VFA, DHC, AND PLFA DATA COLLECTED MAY 2007 THROUGH JULY 2007

Location	Date	COD (mg/L)	Acetic Acid (mg/L)	Propionic Acid (mg/L)	Butyric Acid (mg/L)	DHC (cells/L)		Total PLFA Biomass (cells/L)
IW-08	5/16/2007	24158	NA	NA	NA	NA		NA
IW-09	5/16/2007	5183	NA	NA	NA	NA		NA
IW-18	5/16/2007	48.5	NA	NA	NA	NA		NA
IW-19	5/16/2007	52.7	NA	NA	NA	NA		NA
MW-40-07	5/16/2007	3303	NA	NA	NA	NA		NA
MW-40-30	5/16/2007	36	NA	NA	NA	NA		NA
MW-40-32	5/16/2007	17.2	NA	NA	NA	NA		NA
MW-40-34	5/16/2007	4295	NA	NA	NA	NA		NA
MW-40-36	5/16/2007	859	NA	NA	NA	NA		NA
MW-40-37	5/16/2007	15.1	NA	NA	NA	NA		NA
IW-08	6/14/2007	15100	NA	NA	NA	NA		NA
IW-09	6/14/2007	2320	NA	NA	NA	NA		NA
IW-18	6/14/2007	27.0	NA	NA	NA	NA		NA
IW-19	6/14/2007	20.8	NA	NA	NA	NA		NA
MW-40-07	6/14/2007	2100	NA	NA	NA	NA		NA
MW-40-30	6/14/2007	10.5	NA	NA	NA	NA		NA
MW-40-32	6/14/2007	43.5	NA	NA	NA	NA		NA
MW-40-34	6/14/2007	4660	NA	NA	NA	NA		NA
MW-40-36	6/14/2007	1010	NA	NA	NA	NA		NA
MW-40-37	6/14/2007	18.7	NA	NA	NA	NA		NA
MW-40-02	7/10/2007	13700	NA	NA	NA	NA		NA
MW-40-06	7/10/2007	NA	NA	NA	NA	NA		NA
MW-40-07	7/10/2007	2230	NA	NA	NA	NA		NA
MW-40-08	7/12/2007	NA	NA	NA	NA	NA		NA
MW-40-10	7/10/2007	NA	NA	NA	NA	NA		NA
MW-40-11	7/10/2007	NA	NA	NA	NA	NA		NA
MW-40-13	7/11/2007	52.3	1.5	<1	<1	1.52E+06		1.41E+09
MW-40-14	7/10/2007	13.5	NA	NA	NA	NA		NA
MW-40-15	7/12/2007	10.0 U	NA	NA	NA	NA		NA
MW-40-16	7/12/2007	44.1	NA	NA	NA	NA		NA
MW-40-17	7/12/2007	13.5	NA	NA	NA	NA		NA
MW-40-18	7/12/2007	23.7	NA	NA	NA	NA		NA
MW-40-19	7/10/2007	7.36 J	NA	NA	NA	NA		NA
MW-40-20	7/10/2007	897	NA	NA	NA	NA		NA
MW-40-22	7/10/2007	2270	NA	NA	NA	NA		NA
MW-40-30	7/11/2007	9.40 J	<1	<1	<1	3.34E+02	J	4.48E+07
MW-40-31	7/11/2007	880	127.9	550.8	<1	2.32E+04		6.51E+08
MW-40-32	7/11/2007	78.8	25.7	7.2	<1	4.94E+07		8.52E+07
MW-40-33	7/10/2007	11.4	NA	NA	NA	NA		NA
MW-40-34	7/11/2007	4960	285.9	886.4	1210.0	2.25E+04		1.84E+09
MW-40-35	7/11/2007	5410	508.0	224.4	24.1	1.35E+04		1.74E+09
MW-40-36	7/11/2007	794	280.5	810.7	113.2	1.51E+06		2.36E+09
MW-40-37	7/11/2007	38.0	<1	<1	<1	5.44E+06		9.84E+09
MW-40-38	7/10/2007	NA	NA	NA	NA	NA		NA
MW-40-39	7/10/2007	10.0 U	NA	NA	NA	NA		NA

TABLE 2

COD, VFA, DHC, AND PLFA DATA COLLECTED MAY 2007 THROUGH JULY 2007

Notes:

cells/L – cells per liter
COD – chemical oxygen demand
DHC – *Dehalococcoides* spp.
mg/L – milligrams per liter
NA – not analyzed
PLFA – phospholipid fatty acids
VFA – volatile fatty acid

TABLE 3

ANIONS, ALKALINITY, DO, AND ORP DATA COLLECTED MAY 2007 THROUGH JULY 2007

Location		Chloride (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	DO (mg/L)	ORP (mV)
IW-08	5/16/2007	NA	NA	NA	NA	NA	0.23	-121
IW-09	5/16/2007	NA	NA	NA	NA	NA	0.27	-92
IW-18	5/16/2007	NA	NA	NA	NA	NA	0.29	-13
IW-19	5/16/2007	NA	NA	NA	NA	NA	0.26	-5
MW-40-07	5/16/2007	NA	NA	NA	NA	NA	0.16	-103
MW-40-30	5/16/2007	NA	NA	NA	NA	NA	0.12	-9
MW-40-32	5/16/2007	NA	NA	NA	NA	NA	0.13	-35
MW-40-34	5/16/2007	NA	NA	NA	NA	NA	0.19	-37
MW-40-36	5/16/2007	NA	NA	NA	NA	NA	0.19	-140
MW-40-37	5/16/2007	NA	NA	NA	NA	NA	0.18	-191
IW-08	6/14/2007	NA	NA	NA	NA	NA	0.14	-123
IW-09	6/14/2007	NA	NA	NA	NA	NA	0.05	-95
IW-18	6/14/2007	NA	NA	NA	NA	NA	0.26	-61
IW-19	6/14/2007	NA	NA	NA	NA	NA	0.23	-135
MW-40-07	6/14/2007	NA	NA	NA	NA	NA	0.05	-195
MW-40-30	6/14/2007	NA	NA	NA	NA	NA	0.05	16
MW-40-32	6/14/2007	NA	NA	NA	NA	NA	0.29	-177
MW-40-34	6/14/2007	NA	NA	NA	NA	NA	0.11	-21
MW-40-36	6/14/2007	NA	NA	NA	NA	NA	0.08	-134
MW-40-37	6/14/2007	NA	NA	NA	NA	NA	0.09	-274
MW-40-02	7/10/2007	NA	NA	NA	NA	NA	0.11	-471
MW-40-06	7/10/2007	NA	NA	NA	NA	NA	0.38	116
MW-40-07	7/10/2007	448	0.100 U	0.0710 J	1.47	625	0.1	-91
MW-40-08	7/12/2007	NA	NA	NA	NA	NA	0.17	67
MW-40-10	7/10/2007	NA	NA	NA	NA	NA	0.3	91
MW-40-11	7/10/2007	NA	NA	NA	NA	NA	0.11	-90
MW-40-13	7/11/2007	NA	NA	NA	NA	NA	0.09	-166
MW-40-14	7/10/2007	NA	NA	NA	NA	NA	0.11	-26
MW-40-15	7/12/2007	NA	NA	NA	NA	NA	1.03	21
MW-40-16	7/12/2007	NA	NA	NA	NA	NA	0.18	1
MW-40-17	7/12/2007	NA	NA	NA	NA	NA	0.15	58
MW-40-18	7/12/2007	NA	NA	NA	NA	NA	0.14	37
MW-40-19	7/10/2007	NA	NA	NA	NA	NA	0.24	-13
MW-40-20	7/10/2007	NA	NA	NA	NA	NA	0.24	-95
MW-40-22	7/10/2007	NA	NA	NA	NA	NA	0.08	-87
MW-40-30	7/11/2007	155	0.100 U	0.100 U	140	440	0.1	-62
MW-40-31	7/11/2007	557	0.100 U	0.100 U	1.64	3750	0.08	-174
MW-40-32	7/11/2007	116	0.100 U	0.100 U	4.96	750	0.11	-157
MW-40-33	7/10/2007	NA	NA	NA	NA	NA	0.17	125
MW-40-34	7/11/2007	NA	NA	NA	NA	NA	0.09	-123
MW-40-35	7/11/2007	NA	NA	NA	NA	NA	0.09	-164
MW-40-36	7/11/2007	268	0.100 U	.0840 J	1.20	630	0.08	-135
MW-40-37	7/11/2007	437	0.100 U	.0964 J	185	565	0.09	-243
MW-40-38	7/10/2007	NA	NA	NA	NA	NA	0.15	-85
MW-40-39	7/10/2007	NA	NA	NA	NA	NA	0.22	-25

Notes:

DO – dissolved oxygen

mg/L – milligram per liter

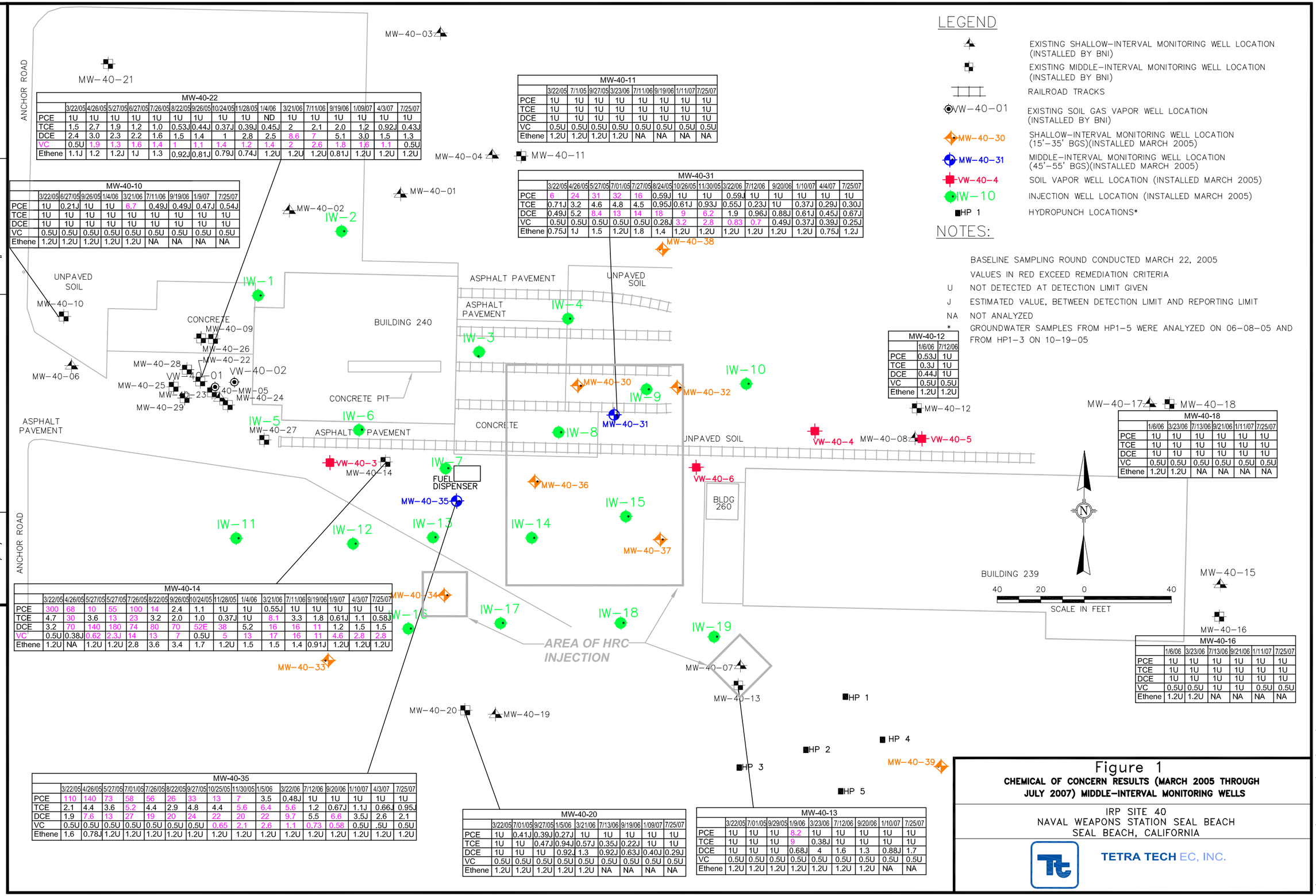
mV – millivolt

NA – not analyzed

ORP – oxidation reduction potential

FIGURES

DRAWING NO: 000101.DWG
DCN: ECSD-2201-0010-0001
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV:
DRAWN BY: MD
DATE: 8/10/07



LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 HYDROPUNCH LOCATIONS*

NOTES:

BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA
U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

MW-40-22

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/09/07	4/3/07	7/25/07
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	ND	1U	1U	1U	1U	1U	1U
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J	0.37J	0.39J	0.45J	2	2.1	2.0	1.2	0.92J	0.43J
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4	1	2.8	2.5	8.6	7	5.1	3.0	1.5	1.3
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1	1.4	1.2	1.4	2	2.6	1.8	1.6	1.1	0.5U
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J	0.79J	0.74J	1.2U	1.2U	1.2U	0.81J	1.2U	1.2U	1.2U

MW-40-11

	3/22/05	7/1/05	9/27/05	3/23/06	7/11/06	9/19/06	1/11/07	7/25/07
PCE	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-10

	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07
PCE	1U	0.21J	1U	1U	6.7	0.49J	0.49J	0.47J	0.54J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-31

	3/22/05	4/26/05	5/27/05	7/01/05	7/27/05	8/24/05	10/26/05	11/30/05	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07
PCE	6	24	31	32	16	0.59J	1U	1U	0.59J	1U	1U	1U	1U	1U
TCE	0.71J	3.2	4.6	4.8	4.5	0.95J	0.61J	0.93J	0.55J	0.23J	1U	0.37J	0.29J	0.30J
DCE	0.49J	5.2	8.4	13	14	18	9	6.2	1.9	0.96J	0.88J	0.61J	0.45J	0.67J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.28J	3.2	2.8	0.83	0.7	0.49J	0.37J	0.39J	0.25J
Ethene	0.75J	1J	1.5	1.2U	1.8	1.4	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.75J	1.2J

MW-40-12

	1/6/06	7/12/06
PCE	0.53J	1U
TCE	0.3J	1U
DCE	0.44J	1U
VC	0.5U	0.5U
Ethene	1.2U	1.2U

MW-40-18

	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07
PCE	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	NA	NA	NA	NA

MW-40-16

	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07
PCE	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	1U	1U	0.5U	0.5U
Ethene	1.2U	1.2U	NA	NA	NA	NA

MW-40-14

	3/22/05	4/26/05	5/27/05	5/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	4/3/07	7/25/07
PCE	300	68	10	55	100	14	2.4	1.1	1U	1U	0.55J	1U	1U	1U	1U	1U
TCE	4.7	30	3.6	13	23	3.2	2.0	1.0	0.37J	1U	8.1	3.3	1.8	0.61J	1.1	0.58J
DCE	3.2	70	140	180	74	80	70	52E	38	5.2	16	16	11	1.2	1.5	1.5
VC	0.5U	0.38J	0.62	2.3J	14	13	7	0.5U	5	13	17	16	11	4.6	2.8	2.8
Ethene	1.2U	NA	1.2U	1.2U	2.8	3.6	3.4	1.7	1.2U	1.5	1.5	1.4	0.91J	1.2U	1.2U	1.2U

MW-40-35

	3/22/05	4/26/05	5/27/05	7/01/05	7/26/05	8/22/05	9/27/05	10/25/05	11/30/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07
PCE	110	140	73	58	56	26	33	13	7	3.5	0.48J	1U	1U	1U	1U	1U
TCE	2.1	4.4	3.6	5.2	4.4	2.9	4.8	4.4	5.6	6.4	5.6	1.2	0.67J	1.1J	0.66J	0.95J
DCE	1.9	7.6	13	27	19	20	24	22	20	22	9.7	5.5	6.6	3.5J	2.6	2.1
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.65	2.1	2.6	1.1	0.73	0.58	0.5U	.5U	0.5U
Ethene	1.6	0.78J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-20

	3/22/05	7/01/05	9/27/05	1/5/06	3/21/06	7/13/06	9/19/06	1/09/07	7/25/07
PCE	1U	0.41J	0.39J	0.27J	1U	1U	1U	1U	1U
TCE	1U	1U	0.47J	0.94J	0.57J	0.35J	0.22J	1U	1U
DCE	1U	1U	1U	0.92J	1.3	0.92J	0.63J	0.40J	0.29J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-13

	3/22/05	7/01/05	9/29/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	7/25/07
PCE	1U	1U	1U	8.2	1U	1U	1U	1U	1U
TCE	1U	1U	1U	9	0.38J	1U	1U	1U	1U
DCE	1U	1U	1U	0.68J	4	1.6	1.3	0.88J	1.7
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA

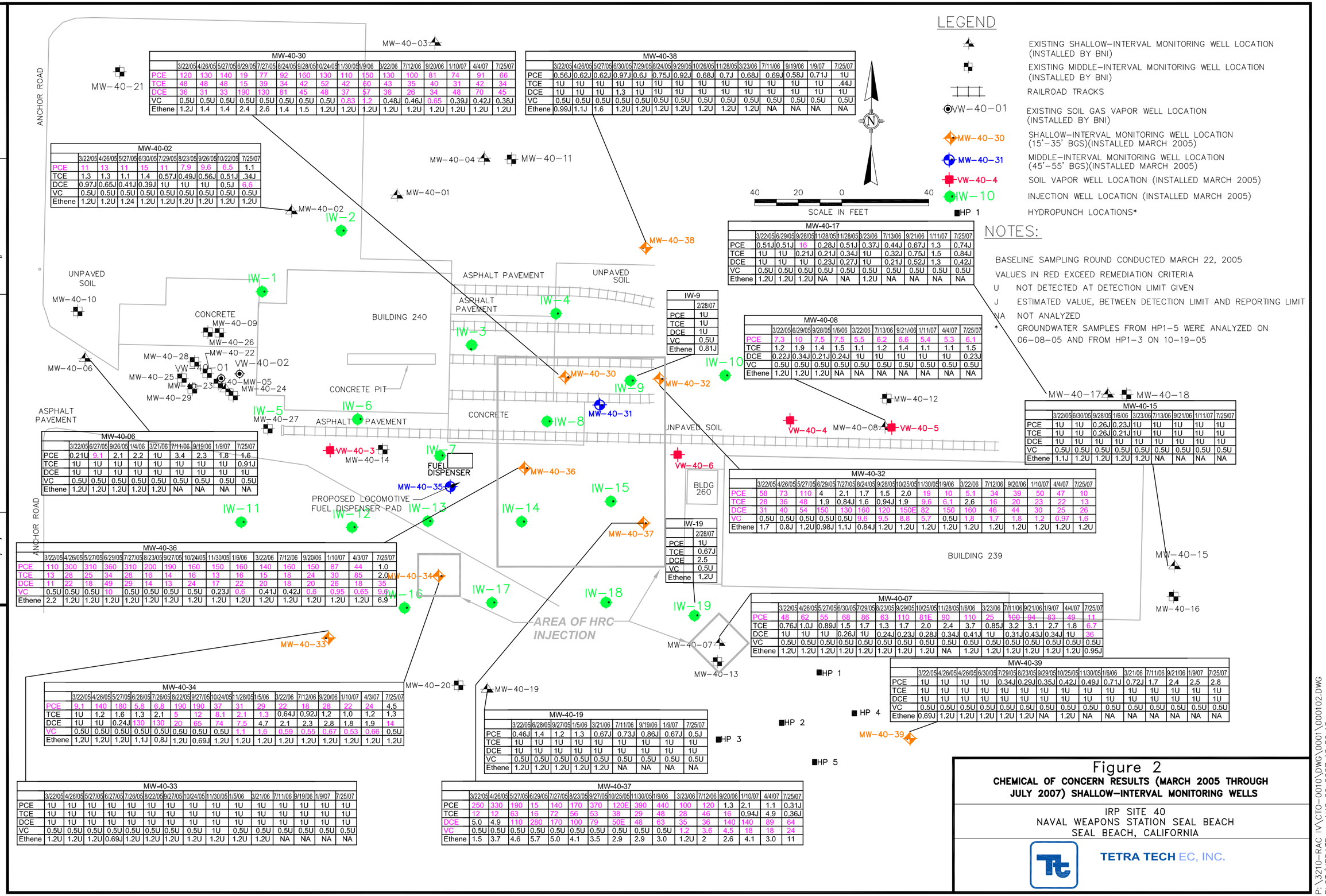
Figure 1

CHEMICAL OF CONCERN RESULTS (MARCH 2005 THROUGH JULY 2007) MIDDLE-INTERVAL MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

P:\3210-RAC IV\CTO-0010\DWG\0001\000101.DWG
PLOT/UPDATE: AUG 09 2007 15:52:24



MW-40-30	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/24/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07
PCE	120	130	140	19	77	92	160	130	110	150	130	100	81	74	91	66
TCE	48	48	48	15	39	34	42	52	42	60	43	35	40	31	42	34
DCE	36	31	33	190	130	81	45	48	37	57	36	26	34	48	70	45
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.83	1.2	0.48J	0.46J	0.65	0.39J	0.42J	0.38J
Ethene	1.2J	1.4	1.4	2.4	2.6	1.4	1.5	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-38	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/24/05	9/29/05	10/26/05	11/28/05	3/23/06	7/11/06	9/19/06	1/9/07	7/25/07
PCE	0.56J	0.62J	0.62J	0.97J	0.6J	0.75J	0.92J	0.68J	0.7J	0.68J	0.69J	0.58J	0.71J	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	.44J
DCE	1U	1U	1U	1.3	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.99J	1.1J	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-02	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/26/05	10/22/05	7/25/07
PCE	11	13	11	15	11	7.9	9.6	6.5	1.1
TCE	1.3	1.3	1.1	1.4	0.57J	0.49J	0.56J	0.51J	.34J
DCE	0.97J	0.65J	0.41J	0.39J	1U	1U	1U	0.5J	6.6
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.24	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-17	3/22/05	6/29/05	9/28/05	11/28/05	11/28/05	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07
PCE	0.51J	0.51J	16	0.28J	0.51J	0.37J	0.44J	0.67J	1.3	0.74J
TCE	1U	1U	0.21J	0.21J	0.34J	1U	0.32J	0.75J	1.5	0.84J
DCE	1U	1U	1U	0.23J	0.27J	1U	0.21J	0.52J	1.3	0.42J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	1.2U	NA	NA	NA	NA

IW-9	2/28/07
PCE	1U
TCE	1U
DCE	1U
VC	0.5U
Ethene	0.81J

MW-40-08	3/22/05	6/29/05	9/28/05	1/6/06	3/22/06	7/13/06	9/21/06	1/11/07	4/4/07	7/25/07
PCE	7.3	10	7.5	7.5	5.5	6.2	6.6	5.4	5.3	6.1
TCE	1.2	1.9	1.4	1.5	1.1	1.2	1.4	1.1	1.1	1.5
DCE	0.22J	0.34J	0.21J	0.24J	1U	1U	1U	1U	1U	0.23J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA	NA	NA

MW-40-15	3/22/05	6/30/05	9/28/05	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07
PCE	1U	1U	0.26J	0.23J	1U	1U	1U	1U	1U
TCE	1U	1U	0.26J	0.21J	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.1J	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-06	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07
PCE	0.21U	9.1	2.1	2.2	1U	3.4	2.3	1.8	1.6
TCE	1U	1U	1U	1U	1U	1U	1U	1U	0.91J
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-32	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/25/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07
PCE	58	73	110	4	2.1	1.7	1.5	2.0	19	10	5.1	34	39	50	47	10
TCE	28	36	48	1.9	0.84J	1.6	0.94J	1.9	9.6	6.1	2.6	16	20	23	22	13
DCE	31	40	54	150	130	160	120	150E	82	150	160	46	44	30	25	26
VC	0.5U	0.5U	0.5U	0.5U	0.5U	9.6	9.5	8.8	5.7	0.5U	1.8	1.7	1.8	1.2	0.97	1.6
Ethene	1.7	0.8J	1.2U	0.98J	1.1J	0.84J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

IW-19	2/28/07
PCE	1U
TCE	0.67J
DCE	2.5
VC	0.5U
Ethene	1.2U

MW-40-36	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/24/05	11/30/05	1/6/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07
PCE	110	300	310	360	310	200	190	160	150	160	140	160	150	87	44	1.0
TCE	13	28	25	34	28	16	14	16	13	16	15	18	24	30	85	2.0
DCE	11	22	18	49	29	14	13	24	17	22	20	18	20	26	18	35
VC	0.5U	0.5U	0.5U	10	0.5U	0.5U	0.5U	0.5U	0.23J	0.6	0.41J	0.42J	0.6	0.95	0.65	9.6
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	6.9

MW-40-07	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/28/05	1/6/06	3/23/06	7/11/06	9/21/06	1/9/07	4/4/07	7/25/07
PCE	48	62	55	68	86	63	110	81E	90	110	25	100	94	83	49	11
TCE	0.76J	1.0J	0.89J	1.5	1.7	1.3	1.7	2.0	2.4	3.7	0.85J	3.2	3.1	2.7	1.8	6.7
DCE	1U	1U	1U	0.26J	1U	0.24J	0.23J	0.28J	0.34J	0.41J	1U	0.31J	0.43J	0.34J	1U	36
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.95J

MW-40-39	3/22/05	4/26/05	4/26/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/30/05	1/6/06	3/21/06	7/11/06	9/21/06	1/9/07	7/25/07
PCE	1U	1U	1U	1U	0.34J	0.29J	0.35J	0.42J	0.49J	0.71J	0.72J	1.7	2.4	2.5	2.8
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	NA	NA	NA	NA	NA	NA	NA

MW-40-34	3/22/05	4/26/05	5/27/05	6/28/05	7/26/05	8/22/05	9/27/05	10/24/05	11/28/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07
PCE	9.1	140	180	5.8	6.8	190	190	37	31	29	22	18	28	22	24	4.5
TCE	1U	1.2	1.6	1.3	2.1	5	12	8.1	2.1	1.3	0.64J	0.92J	1.2	1.0	1.2	1.3
DCE	1U	1U	0.24J	130	130	20	65	74	7.5	4.7	2.1	2.3	2.8	1.8	1.9	14
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.1	1.6	0.59	0.55	0.67	0.53	0.66	0.5U
Ethene	1.2U	1.2U	1.2U	1.1J	0.8J	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-19	3/22/05	6/28/05	9/27/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07
PCE	0.46J	1.4	1.2	1.3	0.67J	0.73J	0.86J	0.67J	0.5J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-33	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/27/05	10/24/05	11/30/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-37	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/25/05	11/30/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07
PCE	250	330	190	15	140	170	370	120E	390	440	100	120	1.3	2.1	1.1	0.31J
TCE	12	12	63	16	72	56	53	38	29	48	28	46	16	0.94J	4.9	0.36J
DCE	5.0	4.9	110	280	170	100	79	50E	48	63	35	36	140	140	89	64
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.2	3.6	4.5	18	18	24
Ethene	1.5	3.7	4.6	5.7	5.0	4.1	3.5	2.9	2.9	3.0	1.2U	2	2.6	4.1	3.0	11

Figure 2

CHEMICAL OF CONCERN RESULTS (MARCH 2005 THROUGH JULY 2007) SHALLOW-INTERVAL MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 000102.DWG
DCN: ECSD-2201-0010-0001
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV:
DRAWN BY: MD
DATE: 08/10/07

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PLOT/UPDATE: AUG 09 2007 15:56:13

TETRA TECH EC, INC.

SUMMARY OF FIELD ACTIVITIES AND DATA FOR OCTOBER 2007 ENHANCED IN-SITU BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS

INSTALLATION RESTORATION PROGRAM SITE 40 NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CA

Date: November 27, 2007

Prepared by: Hamlet Hamparsumian and Mark E. Losi, Tetra Tech EC, Inc. (TtEC)

Distribution:

Navy	**Agencies**
Si T. Le	Patricia Hannon (Water Board)
Pei-Fen Tamashiro	Katherine Leibel (DTSC)

INTRODUCTION

This summary report provides a brief review of site activities conducted during October 2007 in association with groundwater remediation activities (enhanced in-situ bioremediation [EISB]) at Installation Restoration Program (IRP) Site 40 at Naval Weapons Station Seal Beach, Seal Beach, California. This report includes presentation and assessment of relevant data collected during this period. Also contained herein is a summary of the general status of the project.

Initial sodium lactate injections ceased on December 16, 2005. It was generally concluded that the sodium lactate was effective in stimulating biological reduction of chlorinated volatile organic compounds (CVOCs) in areas where delivery was achieved. However, delivery of sodium lactate proved difficult in some areas of the site due to subsurface heterogeneity. With regulator approval, Hydrogen Release Compound® (HRC®) was applied to the central area of the site during the week beginning April 16, 2007, after the April 2007 sampling event had been completed. HRC® is a slow-release form of lactate that was injected in a tight grid, and is expected to migrate via diffusion and dispersion into areas where delivery of soluble sodium lactate has proved difficult. The data set discussed herein provides for assessment of the effectiveness of HRC® approximately 5 months after injection.

SUMMARY OF FIELD ACTIVITIES

The field activities for this period included groundwater, soil gas, and surface emissions monitoring in various wells. Monitoring activities, along with the dates they were conducted, are listed in Table 1.

MONITORING EVALUATION

Groundwater and soil gas sampling and analytical data as well as groundwater level measurements are briefly discussed below. For the regularly scheduled monitoring event (October 2007), chemicals of concern (COCs) along with a focused suite of microbial and geochemical parameters were measured in regularly (quarterly) monitored wells (middle interval wells MW-40-14, -22, -31, and -35; and shallow-interval wells MW-40-07, -8, -30, -32, -34, -36, and -37). The focus of the following discussions is on the quarterly monitored wells in which contamination is or had been prevalent. Groundwater monitoring well

data for COCs collected from the beginning of the project (March 2005) through October 2007 are included on Figures 1 and 2 (middle-interval and shallow-interval monitoring wells, respectively), microbiological data from the October 2007 event are presented in Table 2, and dissolved oxygen (DO) and oxidation reduction potential (ORP) data for the wells are presented in Table 3.

On-Going HRC® Assessment and COC Evaluation

This subsection provides a summary of data collected during October 2007 to assess HRC® migration and its effects, followed by and in comparison with key observations regarding COCs measured in groundwater during the July 2007 event.

1) Evaluation of on-going HRC® migration included assessing groundwater monitoring wells MW-40-07, -30, -32, -34, -36, and -37. Each of these wells is located in the area expected to be influenced by the HRC®. The migration of HRC® to these wells is assessed by measuring chemical oxygen demand (COD), as has been conducted over the duration of the project to measure lactate presence. Additionally, metabolic acids, including acetic acid, propionic acid, and butyric acid, are breakdown products of HRC®, and their presence indicates microbial activity as microbes degrade the HRC®. Decreased DO and ORP provide additional indication of microbial metabolism of the HRC® (effectiveness in generating reducing conditions). COD and metabolic acids, and DO/ORP data for these wells are included in Tables 2 and 3, respectively.

    - The October 2007 COD measurements revealed continued elevated levels in wells MW-40-07 (1,990 milligrams per liter [mg/L]), MW-40-34 (3,090 mg/L), and MW-40-36 (2,720 mg/L). During the April 2007 event (prior to the HRC® injection), COD ranged from 12.3 mg/L to 53.7 mg/L in these wells. In addition, metabolic acids were detected at high levels in MW-40-34 and MW-40-36 (metabolic acids were not measured in MW-40-07). This indicates significant HRC® migration to, and persistence in, these areas.
    - COD levels in wells MW-40-30 and MW-40-37 were consistent with prior measurements indicating that migration of HRC® in these areas was less favorable at this time. However, COD in MW-40-32 rose from 78.8 (July event) to 118 mg/L, and metabolic acids were detected in this well. This indicates migration and metabolism of HRC® in this area.
    - Based on the October 2007 readings, DO concentrations in all the wells that were sampled were less than 0.5 mg/L and ORP values were negative with the exception of MW-40-30 (42 millivolts [mV]). ORP values in these wells had all been measured in the positive range during the April 2007 sampling event (prior to the HRC injection), but were negative during the July event. Overall, the October 2007 data indicate maintenance of strong reducing conditions supportive of reductive dechlorination, with the exception of the area around well MW-40-30.

2) Key observations regarding COC trends for quarterly monitored middle-interval monitoring wells, including MW-40-14, -22, -31, and -35 (see Figure 1) are summarized below:

    - Tetrachloroethene (PCE) concentrations remained below the detection limit (1 microgram per liter [μg/L]) in each of the quarterly monitored middle-interval monitoring wells.
    - Trichloroethene (TCE) levels were below the Maximum Contaminant Level (MCL) (5 μg/L) in the middle-interval monitoring wells and ranged from non-detect (<1 μg/L) to 2.4 μg/L (MW-40-14).

- Dichloroethene (DCE) concentrations were below the MCL (6 μg/L) in all of the middle-interval monitoring wells except MW-40-14, ranging from non-detect (<1 μg/L) to 3.3 μg/L (MW-40-35). The concentration in well MW-40-14 was 11 μg/L.
- Vinyl chloride (VC) is present above the MCL (0.5 μg/L) in one middle-interval monitoring well, MW-40-14 (3.8 μg/L). Results show that VC remained below the MCL in MW-40-22, -31, and -35 over this period.
- Results continue to indicate that the reductive dechlorination process has been effective in these areas, and all contaminants are below MCLs with the exception of DCE and VC in MW-40-14, with DCE fluctuating near the MCL.

3) Key observations for quarterly monitored shallow-interval wells, including MW-40-07, -08, -30, -32. -34, -36, and -37 (see Figure 2) are summarized below:

- The PCE concentrations are below the MCL (5 μg/L) in all wells except MW-40-30 (60 μg/L) and MW-40-08 (7.0 μg/L).
- Continued reductions in PCE over levels measured in July 2007 have been observed following the HRC® injection in wells that previously had been problematic, including MW-40-07 (from 11 μg/L to 1.4J μg/L), MW-40-32 (from 10 μg/L to <1 μg/L), and MW-40-34 (from 4.5 μg/L to <1 μg/L). PCE levels remained relatively stable in MW-40-30 (60 μg/L vs. 66 μg/L detected in July) and MW-40-36 (2.8J μg/L vs. 1 μg/L detected in July). Notable increases in one or more daughter products in MW-40-07 and MW-40-34 indicate that reductive dechlorination continues to occur at these locations.
- Only one of monitoring wells sampled during the October 2007 event (MW-40-30) had a TCE concentration (30 μg/L) greater than the MCL. In MW-40-30, a continued minor decrease in the TCE concentration (from 34 μg/L to 30 μg/L) was observed. TCE in MW-40-32 decreased to below the MCL (from 13 μg/L in July 2007 to 1.4 μg/L in October 2007), as was also the case in well MW-40-07 (from 6.7 μg/L in July 2007 to <1 μg/L in October 2007).
- DCE has been noted in many wells, indicating the breakdown of PCE and TCE. DCE remains above the MCL (6 μg/L) in six of the quarterly monitored wells, including MW-40-07 (54 μg/L), MW-40-30 (34 μg/L), MW-40-32 (10 μg/L), MW-40-34 (19 μg/L), MW-40-36 (19 μg/L), and MW-40-37 (69 μg/L). A notable increase in DCE concentration occurred in MW-40-07 (from 36 μg/L in July 2007 to 54 μg/L in October 2007), accompanied by a decrease in PCE and TCE. DCE levels are still expected to fluctuate, especially in cases where PCE and/or TCE are still present and undergoing degradation in wells affected by the recent HRC® injection.
- VC was detected above the MCL (0.5 μg/L) in MW-40-32 (9.5 μg/L), MW-40-36 (7.2 μg/L), MW-40-34 (2.2J μg/L), and MW-40-37 (18 μg/L). Elevated levels in MW-40-36, MW-40-37, and MW-40-32 indicate significant breakdown of DCE in these wells. As with DCE, VC levels are expected to fluctuate in wells where parent compounds are still present and undergoing degradation.
- Although detected during previous events, ethene was not detected in well MW-40-37. Ethene has now been detected in MW-40-32, however, indicating that complete dechlorination is occurring.
- Overall, major reductions in volatile organic compound (VOC) concentrations have been noted in essentially all wells over the course of the project. The HRC® appears to have

had a clear effect in previously problematic wells MW-40-07, MW-40-32, MW-40-34, and MW-40-36, which are located in the central area of the site. The detection of VC and ethene in most wells within the central portion of the site (current and/or past events), indicates that the process will likely proceed to completion in this area.

Lactate Presence and Microbiological/Geochemical Parameters

As noted previously, COD is an indicator of sodium lactate presence in groundwater. COD data for the October 2007 event are presented in Table 2. As noted above, lactate injection ceased on December 16, 2005, and HRC® was injected during the week of April 16, 2007. COD values in monitoring wells assessed during the April 2007 event (prior to the HRC injection) ranged from 12.3 mg/L (MW-40-34) to 53.7 mg/L (MW-40-36), with the exception of middle interval wells MW-40-31 (109 mg/L) and MW-40-35 (4,240 mg/L), which still contained residual lactate from the original injections.

As discussed above, COD levels measured during the October 2007 event remained, in many cases, substantially elevated over those measured in prior events. In particular, COD in monitoring wells MW-40-07, MW-40-36, and MW-40-34 ranged from 1,990 mg/L to 3,090 mg/L. Significant COD was also observed in MW-40-31 (380 mg/L) and MW-40-35 (2,460 mg/L). A slight increase in COD was noted in MW-40-32, from 78.8 (July 2007) to 118 (October 2007). MW-40-07, MW-40-31, MW-40-32, MW-40-34, MW-40-35, and MW-40-36 are in the area of the HRC® injection. In addition, volatile fatty acids (VFAs), which indicate the breakdown of lactate released from the HRC® (and hence, microbial activity), were detected in wells MW-40-31, MW-40-32, MW-40-34, MW-40-35, and MW-40-36. Immediately before the HRC® injection, VFAs had only been detected in MW-40-35. These data support the initial effectiveness of the HRC® injection in dispersing substrate within the central portion of the site. Each of these wells either has very low COC levels (MW-40-31, and MW-40-35) or has shown recent response to the treatment (MW-40-07, MW-40-32, MW-40-34, and MW-40-36). It is noted that elevated COD was not detected in central area wells MW-40-30 and MW-40-37. In MW-40-37, PCE and TCE have been degraded to levels below their MCLs and DCE and VC are now present and appear to be degrading. However in MW-40-30, relatively little degradation has been observed.

Data from the October 2007 event reflecting concentrations of *Dehalococcoides* spp. (DHC) organisms and total biomass (a measure of total viable bacteria) in monitoring wells are included in Table 2. DHC levels in the monitoring well samples ranged from 2.00×10^5 cells/L (MW-40-34) to 2.09×10^8 cells/L (MW-40-32), and total biomass concentrations ranged from 1.25×10^8 cells/L (MW-40-32) to 6.46×10^9 cells/L (MW-40-34). In general, total biomass counts were similar to those measured during the July 2007 event. However DHC levels were elevated over those measured during the prior event (2.00×10^5 cells/L to 2.09×10^8 vs. 3.34×10^2 cells/L to 4.94×10^7 cells/L, respectively) by one or more orders of magnitude in all wells except MW-40-37. This increase may be attributable to accelerated growth and proliferation due to the HRC injection. These data in conjunction with decreasing contaminant levels suggest that treatment is occurring at most locations. However, it is noted that while DHC and total biomass increased in samples from MW-40-30 compared to the prior event, COD levels remained low in this well, and contaminant degradation has been less effective relative to most other areas within the site. In general, however, DHC and biomass levels are considered to be high, and these data continue to suggest that microbial presence and diversity are favorable for reductive dechlorination at this site.

Geochemical data for the July 2007 sampling event included only DO and ORP for this round, and are presented in Table 3. The data continue to indicate a reduced environment in areas where COCs are present, based on DO depletion and ORP measurements. ORP, which is a measurement of the degree the system is reduced, ranged from -227 mV (MW-40-07) to 42 mV (MW-40-30), and was negative in 10 of the 11 wells in which it was measured. Importantly, ORP values were negative for key wells in or near the HRC® injection area (MW-40-07, MW-40-31, MW-40-32, MW-40-34, MW-40-35, MW-40-36, and MW-40-37). It may be of note that the only positive ORP value was measured in MW-40-30, where

contaminant degradation has been minimal. It is generally believed that ORP levels of less than zero mV are required for reductive dechlorination to occur. These data, in conjunction with COD and VFA data, which suggests increased lactate presence, generally continue to indicate that the HRC® is having the desired effect.

Soil Gas Data. Methane gas surface emissions monitoring was performed on October 17, 2007. Methane gas emissions were not detected within Buildings 239 and 240 and surrounding areas during this monitoring event.

Soil gas monitoring of probes was conducted on October 17, 2007. The results of probe monitoring indicated that the 30 probes tested in the field had methane gas present at concentrations ranging from as low as 0.8 percent and up to 80.4 percent in air during the October 2007 monitoring event. The highest methane concentrations were detected in the soil gas probe in the injection well IW-4. Hydrogen sulfide was detected in 12 of 31 probes ranging from 1 parts per million (ppm) to as high as 35 ppm. The highest hydrogen sulfide concentration was detected in MW-40-36.

In addition, soil gas samples were collected in one liter Tedlar bags from vapor monitoring wells (VW-40-01, -02, -03, -04, and -06) and select number of soil gas monitoring probes installed in groundwater monitoring well MW-40-34 and injection wells IW-1, IW-3, and IW-4. VC was detected ranging from 67 μg/L in VW-40-04 to as high as 18,400 μg/cubic meter (μg/m^3) in the soil gas probe installed in injection well IW-3. Trans-1,2-dichloroethene was detected only in 7 out of 10 samples ranging from 110 μg/m^3 in VW-40-03 to 4,700 μg/m^3 in VW-40-02. Cis-1,2-dichloroetene was detected in all sampled wells ranging from 190J μg/m^3 in VW-40-04 to 12,200 μg/m^3 in IW-1. TCE was detected in 9 out of the 10 probes, ranging from 360J μg/m^3 in IW-1 to 16,300 μg/m^3 in VW-40-03. PCE was detected in 6 out of 10 samples, ranging from 2,100 μg/m^3 in VW-40-04 to 21,400 μg/m^3 in MW-40-34. Methane gas concentration in samples collected from the soil gas monitoring probes and vapor monitoring wells ranged from 17.1 percent in VW-40-04 to 86.4 percent in a sample collected from IW-3.

Groundwater Levels. Groundwater level measurements were conducted on October 16, 2007. Groundwater elevations within the site ranged from 0.36 feet above mean sea level (msl) in MW-40-02 to 1.97 feet above msl in IW-16. In general, water level measurements collected in October 2007 did not indicate a significant change in groundwater level within the monitoring area in comparison with the elevations measured during the previous monitoring events.

SUMMARY AND CONCLUSIONS

In summary, COC concentrations and a focused suite of microbial and geochemical parameters were measured in various monitoring wells. At this time, only DCE and VC slightly exceed the California MCL or target cleanup goals in one middle-interval well, MW-40-14, detected at 11 μg/L and 3.8 μg/L, respectively. COCs are below MCLs in all other middle-interval wells. With respect to the shallow-interval wells, relatively stable (low level) or decreasing COC concentrations were observed (to varying degrees) in key wells MW-40-32, MW-40-34, and MW-40-36, where treatment had been inconsistent or negligible in the past. Elevated COD levels were again observed in MW-40-32, MW-40-34, and MW-40-36, indicating that the HRC® has had a positive effect in these areas. In addition, MW-40-37, which also had not responded well initially to the lactate injections, continues to show clear evidence of reductive dechlorination. Finally, COD remains elevated in MW-40-07, accompanied by decreases in PCE and TCE and concurrent increases in DCE, indicating continued reductive dechlorination in this area. Geochemical and microbiological data indicate that conditions have been influenced by the HRC® injection, and are favorable for reductive dechlorination in areas where sodium lactate migration had previously not been optimal. Thus, at this juncture, it continues to appear that the addition of HRC® as an optimization

measure has been effective in all areas except for the slower response associated with the area around MW-40-30.

FOLLOW-ON ACTIVITIES

Upcoming field activities include the following:

- Conduct quarterly groundwater monitoring around January 2008.

TABLES

Table 1 Summary of Monitoring Activities Conducted During October 2007

Table 2 COD, VFA, DHC, and PLFA Data – October 2007

Table 3 DO and ORP Data – October 2007

FIGURES

Figure 1 Chemical of Concern Results (March 2005 through October 2007) Middle-Interval Monitoring Wells

Figure 2 Chemical of Concern Results (March 2005 through October 2007) Shallow-Interval Monitoring Wells

TABLES

TABLE 1

SUMMARY OF MONITORING ACTIVITIES CONDUCTED DURING OCTOBER 2007

Date	Event	Wells Sampled[1]	Analytes[2]/Parameters	Notes
10/11/07	Soil vapor sampling	VW-40-01, -02, -03, -04, -06, MW-40-34, IW-1, -3, and -7.	VOCs and fixed gases	
10/15/07-10/16/07	Scheduled groundwater monitoring	Groundwater: MW-40-07, -08, -14, -22, -30 through -32, and -34 through -37.	VOCs, dissolved gases, cations, DNA, water levels, COD, and additional geochemical parameters	Laboratory and field parameters
10/16/07	Groundwater level measurements	MW-40-01, -02, -06, 07, 08, -10, -11, -13, -14, -15, -17, -19, -20, -22, -30 through 39, and IW-1 through IW-17.	Not Applicable	Groundwater level measurements
10/17/07	Surface emissions monitoring	Not applicable	Methane gas concentrations	Inside Building 240 and western portion of Building 239, and areas surrounding the above buildings
10/17/07	Soil vapor/gas probe monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, and IW-1 through IW-4 and IW-6 through IW-17.	Methane, oxygen, carbon dioxide, VOCs, and carbon monoxide	

Notes:

[1]Refer to Figure 1 for well locations.
[2]Not all analytes run on all wells.

Abbreviations and Acronyms:

COD – chemical oxygen demand
DNA – deoxyribonucleic acid
VOC – volatile organic compound

TABLE 2

COD, VFA, DHC, AND PLFA DATA - OCTOBER 2007

Location	COD (mg/L)	Acetic Acid (mg/L)	Propionic Acid (mg/L)	Butyric Acid (mg/L)	DHC (cells/L)	Total PLFA Biomass (cells/L)
MW-40-22	51.5	NA	NA	NA	NA	NA
MW-40-14	19.1	NA	NA	NA	NA	NA
MW-40-34	3090	414.5	904.7	661.6	2.00E+05	6.46E+09
MW-40-35	2460	1441.0	570.2	51.0	1.92E+06	5.77E+09
MW-40-36	2720	392.0	1139.0	372.3	1.02E+07	2.31E+09
MW-40-37	15.1	<1	<1	<1	9.25E+05	5.60E+08
MW-40-30	10 U	<1	<1	<1	2.36E+05	1.24E+09
MW-40-31	380	88.5	97.9	3.7	4.61E+05	2.17E+09
MW-40-32	118	46.1	48.0	<1	2.09E+08	1.25E+08
MW-40-07	1990	NA	NA	NA	NA	NA

Abbreviations and Acronyms:
cells/L – cells per liter
COD – chemical oxygen demand
DHC – *Dehalococcoides* spp.
mg/L – milligrams per liter
NA – not analyzed
PLFA – phospholipid fatty acids
VFA – volatile fatty acid

TABLE 3

DO AND ORP DATA - OCTOBER 2007

Location	DO (mg/L)	ORP (mV)
MW-40-22	0.25	-201
MW-40-14	0.29	-141
MW-40-34	0.18	-179
MW-40-35	0.15	-215
MW-40-36	0.18	-173
MW-40-37	0.19	-188
MW-40-30	0.19	42
MW-40-31	0.15	-164
MW-40-32	0.20	-223
MW-40-08	0.19	-75
MW-40-08 (FD)	0.19	-75
MW-40-07	0.19	-227

Abbreviations and Acronyms

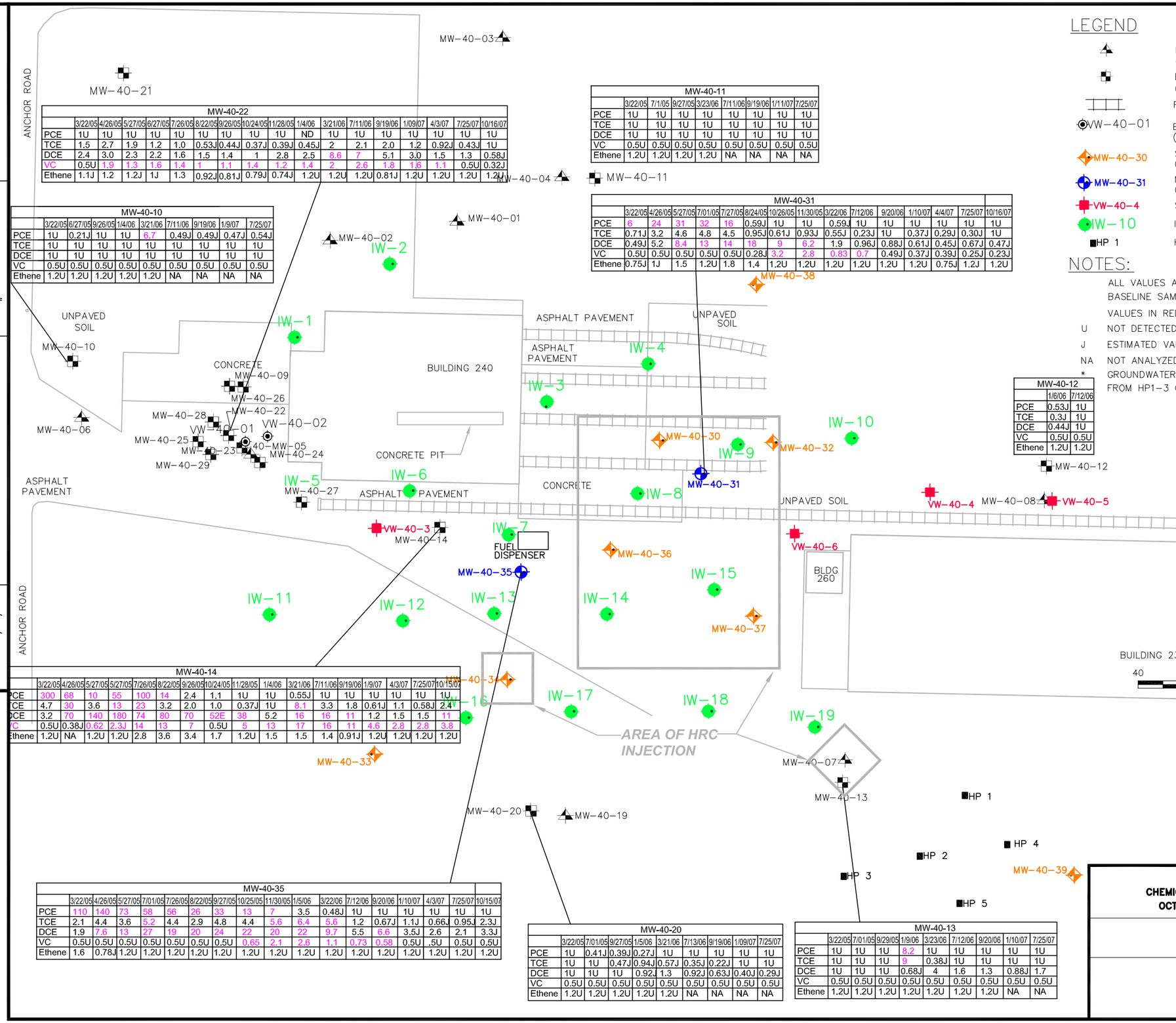
DO – dissolved oxygen

mg/L – milligrams per liter

mV – millivolts

ORP – oxidation reduction potential

FIGURES



LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 — SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (μg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

MW-40-22

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/09/07	4/3/07	7/25/07	10/16/07
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	ND	1U	1U	1U	1U	1U	1U	1U
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J	0.37J	0.39J	0.45J	2	2.1	2.0	1.2	0.92J	0.43J	1U
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4	1	2.8	2.5	8.6	7	5.1	3.0	1.5	1.3	0.58J
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1	1.4	1.2	1.4	2	2.6	1.8	1.6	1.1	0.5U	0.32J
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J	0.79J	0.74J	1.2U	1.2U	1.2U	0.81J	1.2U	1.2U	1.2U	1.2U

MW-40-11

	3/22/05	7/1/05	9/27/05	3/23/06	7/11/06	9/19/06	1/11/07	7/25/07
PCE	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-10

	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07
PCE	1U	0.21J	1U	1U	6.7	0.49J	0.49J	0.47J	0.54J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-31

	3/22/05	4/26/05	5/27/05	7/01/05	7/27/05	8/24/05	10/26/05	11/30/05	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07
PCE	6	24	31	32	16	0.59J	1U	1U	0.59J	1U	1U	1U	1U	1U	1U
TCE	0.71J	3.2	4.6	4.8	4.5	0.95J	0.61J	0.93J	0.55J	0.23J	1U	0.37J	0.29J	0.30J	1U
DCE	0.49J	5.2	8.4	13	14	18	9	6.2	1.9	0.96J	0.88J	0.61J	0.45J	0.67J	0.47J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.28J	3.2	2.8	0.83	0.7	0.49J	0.37J	0.39J	0.25J	0.23J
Ethene	0.75J	1J	1.5	1.2U	1.8	1.4	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.75J	1.2J	1.2U

MW-40-12

	1/6/06	7/12/06
PCE	0.53J	1U
TCE	0.3J	1U
DCE	0.44J	1U
VC	0.5U	0.5U
Ethene	1.2U	1.2U

MW-40-18

	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07
PCE	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	NA	NA	NA	NA

MW-40-16

	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07
PCE	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	1U	1U	0.5U	0.5U
Ethene	1.2U	1.2U	NA	NA	NA	NA

MW-40-14

	3/22/05	4/26/05	5/27/05	5/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	4/3/07	7/25/07	10/15/07
PCE	300	68	10	55	100	14	2.4	1.1	1U	1U	0.55J	1U	1U	1U	1U	1U	1U
TCE	4.7	30	3.6	13	23	3.2	2.0	1.0	0.37J	1U	8.1	3.3	1.8	0.61J	1.1	0.58J	2.4
DCE	3.2	70	140	180	74	80	70	52E	38	5.2	16	16	11	1.2	1.5	1.5	11
VC	0.5U	0.38J	0.62	2.3J	14	13	7	0.5U	5	13	17	16	11	4.6	2.8	2.8	3.8
Ethene	1.2U	NA	1.2U	1.2U	2.8	3.6	3.4	1.7	1.2U	1.5	1.5	1.4	0.91J	1.2U	1.2U	1.2U	1.2U

MW-40-35

	3/22/05	4/26/05	5/27/05	7/01/05	7/26/05	8/22/05	9/27/05	10/25/05	11/30/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07
PCE	110	140	73	58	56	26	33	13	7	3.5	0.48J	1U	1U	1U	1U	1U	1U
TCE	2.1	4.4	3.6	5.2	4.4	2.9	4.8	4.4	5.6	6.4	5.6	1.2	0.67J	1.1J	0.66J	0.95J	2.3J
DCE	1.9	7.6	13	27	19	20	24	22	20	22	9.7	5.5	6.6	3.5J	2.6	2.1	3.3J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.65	2.1	2.6	1.1	0.73	0.58	0.5U	.5U	0.5U	0.5U
Ethene	1.6	0.78J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-20

	3/22/05	7/01/05	9/27/05	1/5/06	3/21/06	7/13/06	9/19/06	1/09/07	7/25/07
PCE	1U	0.41J	0.39J	0.27J	1U	1U	1U	1U	1U
TCE	1U	1U	0.47J	0.94J	0.57J	0.35J	0.22J	1U	1U
DCE	1U	1U	1U	0.92J	1.3	0.92J	0.63J	0.40J	0.29J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-13

	3/22/05	7/01/05	9/29/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	7/25/07
PCE	1U	1U	1U	8.2	1U	1U	1U	1U	1U
TCE	1U	1U	1U	9	0.38J	1U	1U	1U	1U
DCE	1U	1U	1U	0.68J	4	1.6	1.3	0.88J	1.7
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA

Figure 1

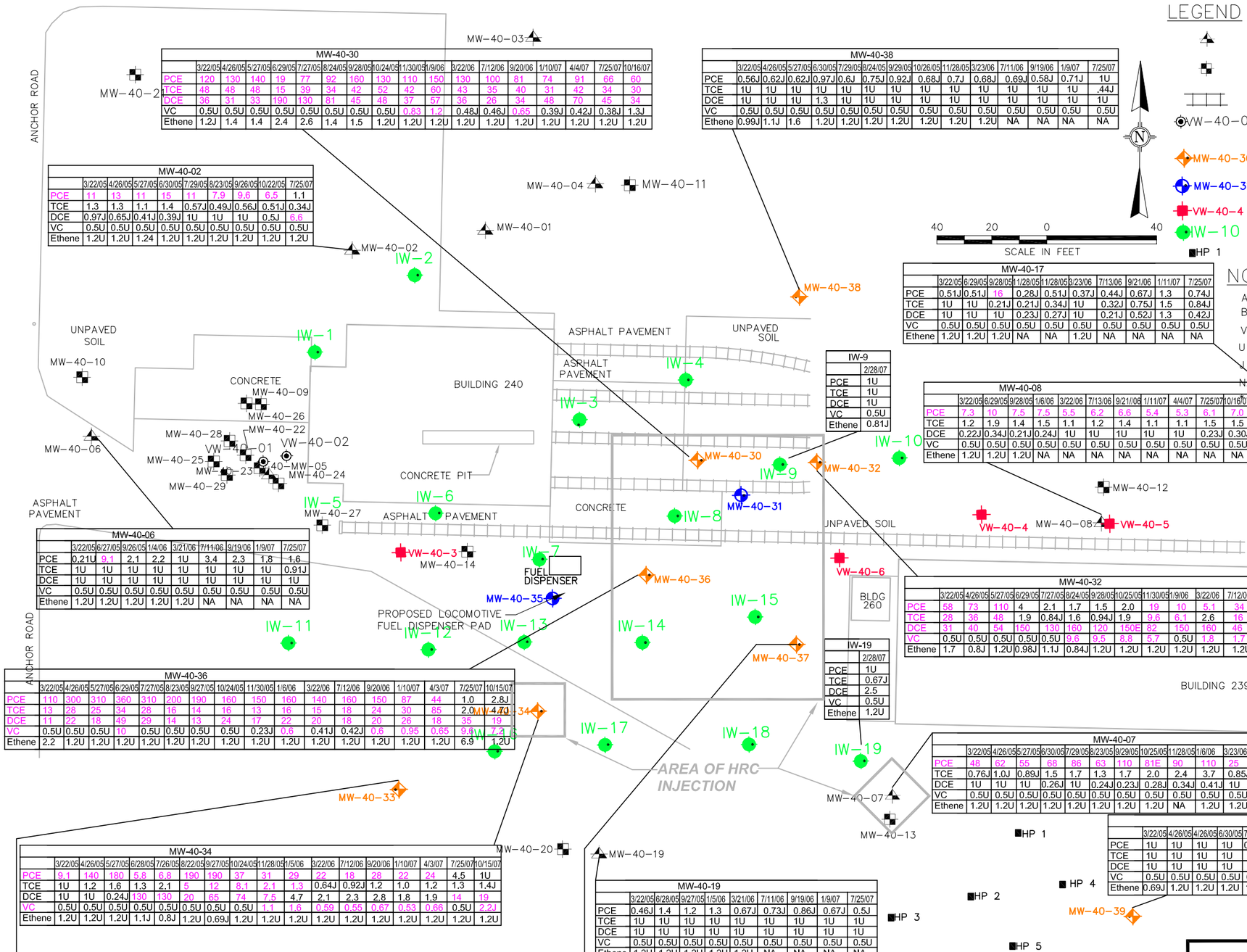
CHEMICAL OF CONCERN RESULTS (MARCH 2005 THROUGH OCTOBER 2007) MIDDLE-INTERVAL MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 08015301.DWG
DCN: ECSD-2201-0008-0153
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV:
DRAWN BY: MD
DATE: 11/02/07

P:\3210-RAC IV\CTO-0010\DWG\080153\08015301.DWG
PLOT/UPDATE: NOV 26 2007 14:06:47



LEGEND

- EXISTING SHALLOW–INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE–INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW–40–01 EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW–40–30 SHALLOW–INTERVAL MONITORING WELL LOCATION (15'–35' BGS)(INSTALLED MARCH 2005)
- MW–40–31 MIDDLE–INTERVAL MONITORING WELL LOCATION (45'–55' BGS)(INSTALLED MARCH 2005)
- VW–40–4 SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW–10 INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 HYDROPUNCH LOCATIONS*

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (µg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
GROUNDWATER SAMPLES FROM HP1–5 WERE ANALYZED ON 06–08–05 AND FROM HP1–3 ON 10–19–05

MW-40-30

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/24/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07
PCE	120	130	140	19	77	92	160	130	110	150	130	100	81	74	91	66	60
TCE	48	48	48	15	39	34	42	52	42	60	43	35	40	31	42	34	30
DCE	36	31	33	190	130	81	45	48	37	57	36	26	34	48	70	45	34
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.83	1.2	0.48J	0.46J	0.65	0.39J	0.42J	0.38J	1.3J
Ethene	1.2J	1.4	1.4	2.4	2.6	1.4	1.5	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-38

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/24/05	9/29/05	10/26/05	11/28/05	3/23/06	7/11/06	9/19/06	1/9/07	7/25/07
PCE	0.56J	0.62J	0.62J	0.97J	0.6J	0.75J	0.92J	0.68J	0.7J	0.68J	0.69J	0.58J	0.71J	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	.44J
DCE	1U	1U	1U	1.3	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.99J	1.1J	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-02

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/26/05	10/22/05	7/25/07
PCE	11	13	11	15	11	7.9	9.6	6.5	1.1
TCE	1.3	1.3	1.1	1.4	0.57J	0.49J	0.56J	0.51J	0.34J
DCE	0.97J	0.65J	0.41J	0.39J	1U	1U	1U	0.5J	6.6
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.24	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-17

	3/22/05	6/29/05	9/28/05	11/28/05	11/28/05	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07
PCE	0.51J	0.51J	16	0.28J	0.51J	0.37J	0.44J	0.67J	1.3	0.74J
TCE	1U	1U	0.21J	0.21J	0.34J	1U	0.32J	0.75J	1.5	0.84J
DCE	1U	1U	1U	0.23J	0.27J	1U	0.21J	0.52J	1.3	0.42J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	1.2U	NA	NA	NA	NA

IW-9

	2/28/07
PCE	1U
TCE	1U
DCE	1U
VC	0.5U
Ethene	0.81J

MW-40-08

	3/22/05	6/29/05	9/28/05	1/6/06	3/22/06	7/13/06	9/21/06	1/11/07	4/4/07	7/25/07	10/16/07
PCE	7.3	10	7.5	7.5	5.5	6.2	6.6	5.4	5.3	6.1	7.0
TCE	1.2	1.9	1.4	1.5	1.1	1.2	1.4	1.1	1.1	1.5	1.5
DCE	0.22J	0.34J	0.21J	0.24J	1U	1U	1U	1U	1U	0.23J	0.30J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA	NA	NA	NA

MW-40-15

	3/22/05	6/30/05	9/28/05	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07
PCE	1U	1U	0.26J	0.23J	1U	1U	1U	1U	1U
TCE	1U	1U	0.26J	0.21J	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.1J	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-06

	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07
PCE	0.21U	9.1	2.1	2.2	1U	3.4	2.3	1.8	1.6
TCE	1U	1U	1U	1U	1U	1U	1U	1U	0.91J
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-32

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/25/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07
PCE	58	73	110	4	2.1	1.7	1.5	2.0	19	10	5.1	34	39	50	47	10	1U
TCE	28	36	48	1.9	0.84J	1.6	0.94J	1.9	9.6	6.1	2.6	16	20	23	22	13	1.4
DCE	31	40	54	150	130	160	120	150E	82	150	160	46	44	30	25	26	10
VC	0.5U	0.5U	0.5U	0.5U	0.5U	9.6	9.5	8.8	5.7	0.5U	1.8	1.7	1.8	1.2	0.97	1.6	9.5
Ethene	1.7	0.8J	1.2U	0.98J	1.1J	0.84J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	4.9

IW-19

	2/28/07
PCE	1U
TCE	0.67J
DCE	2.5
VC	0.5U
Ethene	1.2U

MW-40-36

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/24/05	11/30/05	1/6/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07
PCE	110	300	310	360	310	200	190	160	150	160	140	160	150	87	44	1.0	2.8J
TCE	13	28	25	34	28	16	14	16	13	16	15	18	24	30	85	2.0	4.7J
DCE	11	22	18	49	29	14	13	24	17	22	20	18	20	26	18	35	19
VC	0.5U	0.5U	0.5U	10	0.5U	0.5U	0.5U	0.5U	0.23J	0.6	0.41J	0.42J	0.6	0.95	0.65	9.6	7.2
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	6.9	1.2U

MW-40-07

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/28/05	1/6/06	3/23/06	7/11/06	9/21/06	1/9/07	4/4/07	7/25/07	10/16/07
PCE	48	62	55	68	86	63	110	81E	90	110	25	100	94	83	49	11	1.4J
TCE	0.76J	1.0J	0.89J	1.5	1.7	1.3	1.7	2.0	2.4	3.7	0.85J	3.2	3.1	2.7	1.8	6.7	1U
DCE	1U	1U	1U	0.26J	1U	0.24J	0.23J	0.28J	0.34J	0.41J	1U	0.31J	0.43J	0.34J	1U	36	54
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.95J	1.2U

MW-40-39

	3/22/05	4/26/05	4/26/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/30/05	1/6/06	3/21/06	7/11/06	9/21/06	1/9/07	7/25/07
PCE	1U	1U	1U	1U	0.34J	0.29J	0.35J	0.42J	0.49J	0.71J	0.72J	1.7	2.4	2.5	2.8
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	NA	NA	NA	NA	NA	NA	NA

MW-40-34

	3/22/05	4/26/05	5/27/05	6/28/05	7/26/05	8/22/05	9/27/05	10/24/05	11/28/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07
PCE	9.1	140	180	5.8	6.8	190	190	37	31	29	22	18	28	22	24	4.5	1U
TCE	1U	1.2	1.6	1.3	2.1	5	12	8.1	2.1	1.3	0.64J	0.92J	1.2	1.0	1.2	1.3	1.4J
DCE	1U	1U	0.24J	130	130	20	65	74	7.5	4.7	2.1	2.3	2.8	1.8	1.9	14	19
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.1	1.6	0.59	0.55	0.67	0.53	0.66	0.5U	2.2J
Ethene	1.2U	1.2U	1.2U	1.1J	0.8J	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-19

	3/22/05	6/28/05	9/27/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07
PCE	0.46J	1.4	1.2	1.3	0.67J	0.73J	0.86J	0.67J	0.5J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-33

	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/27/05	10/24/05	11/30/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

MW-40-37

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/25/05	11/30/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/15/07
PCE	250	330	190	15	140	170	370	120E	390	440	100	120	1.3	2.1	1.1	0.31J	1.8J
TCE	12	12	63	16	72	56	53	38	29	48	28	46	16	0.94J	4.9	0.36J	3.1J
DCE	5.0	4.9	110	280	170	100	79	50E	48	63	35	36	140	140	89	64	69
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.2	3.6	4.5	18	18	24	18
Ethene	1.5	3.7	4.6	5.7	5.0	4.1	3.5	2.9	2.9	3.0	1.2U	2	2.6	4.1	3.0	11	1.2U

Figure 2

CHEMICAL OF CONCERN RESULTS (MARCH 2005 THROUGH OCTOBER 2007) SHALLOW–INTERVAL MONITORING WELLS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 08015302.DWG
DCN: ECSD–2201–0008–0153 CTO: #0010
APPROVED BY: HH
CHECKED BY: ML REV:
DRAWN BY: MD DATE: 11/02/07

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PLOT/UPDATE: NOV 26 2007 14:09:34

TETRA TECH EC, INC.

SUMMARY OF FIELD ACTIVITIES AND DATA FOR JANUARY 2008 MONITORING EVENT ENHANCED IN-SITU BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS

INSTALLATION RESTORATION PROGRAM SITE 40 NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CA

Date: February 26, 2008

Prepared by: Hamlet Hamparsumian and Mark E. Losi, Tetra Tech EC, Inc. (TtEC)

Distribution:

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INTRODUCTION

This summary report provides a brief review of site activities conducted during January 2008 in association with groundwater remediation activities (enhanced in-situ bioremediation [EISB]) at Installation Restoration Program (IRP) Site 40 at Naval Weapons Station Seal Beach, Seal Beach, California. This report includes presentation and assessment of relevant data collected during this period. A summary of the general status of the project and recommendations based on the conclusions are also provided.

Initial sodium lactate injections ceased on December 16, 2005. The injection of sodium lactate was effective in stimulating biological reduction of chlorinated volatile organic compounds in areas where delivery was achieved. However, delivery of sodium lactate proved difficult in some areas of the site due to subsurface heterogeneity. With regulator approval, Hydrogen Release Compound® (HRC®) was applied to the central area of the site during the week beginning April 16, 2007, after the April 2007 sampling event had been completed. HRC® is a slow-release form of lactate that was injected in a tight grid. HRC® migrates via diffusion and dispersion and was expected to do so in the areas where delivery of soluble sodium lactate has proved difficult. The data set discussed herein allows for the assessment of the effectiveness of HRC® approximately 9 months after injection.

SUMMARY OF FIELD ACTIVITIES

The field activities for this period included groundwater, soil gas, and surface emissions monitoring in various wells. Monitoring activities, along with the dates they were conducted, are listed in Table 1.

MONITORING EVALUATION

Groundwater and soil gas sampling and analytical data as well as groundwater level measurements are briefly discussed below. For the regularly scheduled monitoring event (January 2008), chemicals of concern (COCs) along with a focused suite of microbial and geochemical parameters were measured

regularly (semiannually) in monitored wells MW-40-02, -06, -07, -08, -10, -11, -13 through -20, -22, and -30 through -39.

Data Presentation

In prior reports, well data for COCs collected from the beginning of the project (March 2005) through the most current event were presented on two figures – one showing the wells screened in the shallow zone, and one showing the wells screened in the mid-shallow zone. However it is now apparent that for many of the wells in both zones, all COC levels have been below their respective Maximum Contaminant Levels (MCLs) for over a year. Accordingly, for this report, all COC data (including the January 2008 data) for these wells are presented on Figure 1. Since the January 2008 data confirm that COCs are not present in these wells and have not been for over a year, the data collected from these wells during the January 2008 event are reported (Figure 1, Tables 2 and Table 3), but do not warrant further discussion.

Rather, the focus of the discussions is on shallow and mid-shallow wells in which one or more COC is still present in excess of the respective MCL. Thus, all data from all monitoring wells that meet this criterion are presented on Figure 2. In addition, chemical oxygen demand (COD), volatile fatty acids (VFAs), and microbiological data from the January 2008 event are presented in Table 2, and dissolved oxygen (DO) and oxidation reduction potential (ORP) data for the wells are presented in Table 3. These data are presented in light of the recent HRC® injection and form the basis of the following discussions.

On-Going Evaluation of HRC® Migration and COC Concentrations

This subsection provides a summary of data collected during January 2008 to assess HRC® migration and its effects, followed by key observations regarding COCs measured in groundwater during the January 2008 event.

1) Evaluation of on-going HRC® migration included assessment of shallow interval groundwater monitoring wells MW-40-07, -30, -32, -34, -36, and -37 (Refer to Figure 2). Each of these wells is still impacted by one or more COCs at levels exceeding the respective MCL, and each is located in the area expected to be influenced by the HRC®. The migration of HRC® to these wells is assessed by measuring COD, as has been done over the duration of the project to measure lactate presence. Additionally, metabolic acids, including acetic acid, propionic acid, and butyric acid, are breakdown products of HRC®, and their presence indicates microbial activity as microbes degrade the HRC®. COD and VFA data are presented in Table 2.

    - The January 2008 COD measurements revealed continued, significantly elevated levels in wells MW-40-07 (1,150 milligrams per liter [mg/L]), MW-40-32 (735 mg/L), MW-40-34 (2,810 mg/L), and MW-40-36 (2,360 mg/L). During the April 2007 event (prior to the HRC® injection), COD had ranged from 12.3 mg/L to 53.7 mg/L in these wells. In addition, metabolic acids were detected in MW-40-07, -30, -32, -34, and -36. This indicates significant HRC® migration to, and persistence in, these areas.
    - COD levels in wells MW-40-30 (67.2 mg/L) and MW-40-37 (40.9 mg/L), which had showed minimal response to the HRC® treatment, were elevated over October 2007 measurements (ND [less than 10 mg/L] and 15.1 mg/L, respectively). In addition, VFAs were detected in MW-40-30. This indicates that migration and possibly metabolism of HRC® in these areas are likely.

2) Key observations regarding COC trends for middle-interval monitoring wells are as follows:

    - All COCs have been below MCLs in all middle-interval monitoring wells for over a year (Figure 1) except for MW-40-14 (Figure 2).

- MW-40-14 still has residual 1,2-dichloroethene (DCE) (20 microgram per liter [μg/L]) and vinyl chloride (VC) (4.0 μg/L) at levels above respective MCLs (6.0 and 0.5 μg/L).

3) Key observations for shallow-interval wells are summarized below:

- All COCs have been below MCLs in all shallow-interval monitoring wells for over a year (Figure 1) except for MW-40-02, -07, -08, -30, -32, -34, -36, and -37 (Figure 2).
- Tetrachloroethene (PCE) has been reduced to below its MCL (5 μg/L) in all wells except MW-40-08 (6.8 μg/L).
- Trichloroethene (TCE) has been reduced to below its MCL (5 μg/L) in all wells.
- DCE is present at levels exceeding its MCL (6 μg/L) in MW-40-07 (47 μg/L), -30 (110 μg/L), -32 (12 μg/L), -34 (8.5 μg/L), -36 (17 μg/L), and -37 (94 μg/L).
- VC is present at levels exceeding its MCL (0.5 μg/L) in MW-40-30 (12 μg/L), -32 (5.6 μg/L), -34 (2.6 μg/L), -36 (6.5 μg/L), and -37 (18 μg/L).
- Ethene was detected in MW-40-30 (1.8 μg/L), -32 (0.99J μg/L), -36 (2.9 μg/L), and -37 (6.5 μg/L).
- Clearly, the HRC® has had positive effects in the central area of the site, most notably in wells MW-40-07, -30, -32, -34, and -36.

Microbiological and Geochemical Parameters

Data from the January 2008 event reflecting concentrations of *Dehalococcoides* spp. (DHC) organisms, which are critical to the reductive dechlorination process, and total biomass (a measure of total viable bacteria) in key monitoring wells are included in Table 2. Decreased DO and ORP provide additional indication of microbial metabolism of the HRC® (effectiveness in generating reducing conditions). Microbiological results and DO/ORP data for these wells are included in Tables 2 and 3, respectively. As noted above, only data from wells where COCs have been detected at levels exceeding respective MCLs within the past year are discussed (refer to Figure 2; note that MW-40-02 and -08 are not analyzed for microbiological and geochemical parameters).

1) Key observations regarding microbiological parameters for relevant semiannually monitored wells are as follows:

- Total biomass counts for January, 2008, ranged from $3.8x10^8$ to $2.5x10^9$ cells/L, and were similar to those measured during the October 2007 event ($1.3x10^8$ to $6.5x10^9$ cells/L).
- However, DHC levels ranged from $6.8x10^3$ to $4.3x10^7$ cells/L, and were generally an order of magnitude lower than levels measured in October, 2007 ($2.0x10^5$ to $2.1x10^8$ cells/L). DHC counts were notably low in MW-40-07 ($6.8x10^3$ cells/L) and -37 ($1.9x10^4$ cells/L), where COC degradation appears to have stabilized.
- While total biomass levels remain high, the decrease in DHC organisms may be attributable to the declining COC levels. DHC organisms require chloroethenes for respiration, and growth/proliferation can be expected to decline as COCs reach levels of approximately 50 μg/L (total chloroethenes).

The analysis used to quantify DHC detects deoxyribonucleic acid (DNA) sequences specific to DHC organisms. These sequences show the presence of DHC but do not reflect whether or not the organisms are actively growing (i.e., the results may reflect some “dead” cells). To investigate further, on February 7, 2008, samples from wells MW-40-07, -30, -32, and -37 were collected and analyzed for DHC

ribonucleic acid (RNA) (as opposed to DNA). This is a relatively new analytical technique and is less likely to include dead cells because the RNA is only produced by actively growing cells. Results are as follows:

Results of RNA analysis for DHC and functional enzymes.

Well Number	Parameters	Result cells/L	DHC Result (for comparison) cells/L
MW-40-07	*Dehalococcoides* spp. TCE R-Dase[1] BAV1 VC R-Dase[1] VC R-Dase[1]	Non-detect (ND) ($<8.33x10^2$) ND ($<8.33x10^2$) ND ($<8.33x10^2$) ND ($<8.33x10^2$)	$6.81x10^3$
MW-40-30	*Dehalococcoides* spp. TCE R-Dase[1] BAV1 VC R-Dase[1] VC R-Dase[1]	$8.20\ x10^5$ ND ($<4.55x10^2$) $2.52x10^5$ ND ($<4.55\ x10^2$)	$2.25x10^7$
MW-40-32	*Dehalococcoides* spp. TCE R-Dase[1] BAV1 VC R-Dase[1] VC R-Dase[1]	$2.12x10^6$ $1.26x10^3$ $2.75x10^5$ $7.62x10^6$	$4.33x10^7$
MW-40-37	*Dehalococcoides* spp. TCE R-Dase[1] BAV1 VC R-Dase[1] VC R-Dase[1]	$1.94x10^6$ ND ($<2.86\ x10^2$) ND ($<2.86\ x10^2$) $6.27x10^4$	$1.94x10^4$

[1]Functional enzymes involved in breakdown of chloroethenes

As the above table shows, no RNA was detected in samples from MW-40-07, which had the lowest DNA based DHC counts, indicating that dechlorinating activity is likely minimal in this area. However, in MW-40-32, RNA indicative of active DHC organisms and functional enzymes was detected at relatively high levels, indicating that dechlorination may still be actively occurring at this location. In addition, DHC RNA was detected in samples from MW-40-30 and -37, along with one of the three functional enzymes. This also indicates active reductive dechlorination in these areas (possibly not as strongly as in MW-40-37). Thus, although chloroethene levels are generally low and DHC counts decreased from the prior event, the RNA analysis suggests that dechlorination is still actively occurring at three of the four selected locations.

2) Key observations regarding relevant geochemical parameters are as follows:

- Based on the January 2008 readings, DO concentrations in relevant wells (refer to Figure 2) were less than 0.5 mg/L.
- ORP values were strongly negative, ranging from -156 millivolts (mV) to -275 mV. ORP values in these wells had all been measured in the positive range during the April 2007 sampling event (prior to the HRC® injection), but have been overwhelmingly negative since then. The January 2008 data indicate maintenance of strong reducing conditions supportive of reductive dechlorination in all critical areas.

- Continued maintenance of ORP levels of less than 0 mV in the area where contamination is present is optimal for reductive dechlorination.
- These data, in conjunction with COD and VFA data, which suggest increased lactate presence, continue to indicate that the HRC® is having the desired effect.

Soil Gas Data. Methane gas surface emissions monitoring was performed on January 8, 2008. Methane gas emissions were not detected within Buildings 239 and 240 and surrounding areas during this monitoring event.

Soil gas monitoring of probes was conducted on January 8, 2008. The results of probe monitoring indicated that the 29 probes tested in the field had methane gas present at concentrations ranging from 19.3 to 86.8 percent in air during the January 2008 monitoring event. The highest methane concentrations were detected in the soil gas probe in the injection well IW-17. Hydrogen sulfide was detected in 11 of 29 probes ranging from 1 to 15 parts per million. The highest hydrogen sulfide concentrations were detected in the soil gas probe in MW-40-35 and in the soil gas probe in injection well IW-8.

In addition, soil gas samples were collected in one liter Tedlar bags from vapor monitoring wells (VW-40-01, -02, -03, -04, and -06) and select number of soil gas monitoring probes installed in groundwater monitoring well MW-40-34 and injection wells IW-1, IW-3, and IW-4. VC was detected at concentrations ranging from 380 μg/cubic meter (μg/m^3) in VW-40-04 to 3,500 μg/m^3 in the soil gas probe installed in injection well IW-3. DCE was detected only in one of nine samples at a concentration of 37J μg/m^3 in the soil gas probe installed in injection well IW-7. TCE was detected in all nine probes at concentrations ranging from 50J μg/m^3 in IW-1 to 2,300 μg/m^3 in VW-40-03. PCE was detected in six out of nine samples at concentrations ranging from 420 μg/m^3 in IW-7 to 2,700 μg/m^3 in MW-40-34. Methane gas concentrations in samples collected from the soil gas monitoring probes and vapor monitoring wells ranged from 52.6 percent in VW-40-04 to 75.3 percent in IW-3. Concentrations of COCs and methane in soil gas have decreased since the last monitoring and sampling event.

Groundwater Levels. Groundwater level measurements were conducted on January 18, 2008. Groundwater elevations within the site ranged from 0.37 feet above mean sea level (msl) in MW-40-08 to 2.23 feet above msl in MW-40-02. In general, water level measurements collected in January 2008 did not indicate a significant change in groundwater level within the monitoring area in comparison with the elevations measured during the previous monitoring events.

CONCLUSIONS

In general, the total chloroethenes (CE) concentrations have been substantially reduced in all wells. However, because further decreases were not evident, it is possible that the site may be approaching the limits of bioremediation in most areas (total CE levels of 50 μg/L or greater are generally required to support vigorous growth of DHC). The Remedial Design/Work Plan for EISB (Section 6 and Figure 6-2) stipulates that when COC concentrations have been asymptotic for two quarters, and are less than 10 times the respective MCLs, monitoring frequency is reduced to yearly, and the focus is shifted toward assessing monitored natural attenuation (MNA). All wells currently containing COCs at levels exceeding an MCL appear to be asymptotic (i.e., concentration fluctuations were observed, but clear decreases were not noted) over the last two events (Figure 2). In addition, the concentration criterion (less than 10 times the MCL) is met for all wells with the exception of MW-40-30 (DCE=110 μg/L and VC=12 μg/L), MW-40-32 (DCE=12 μg/L and VC=5.6 μg/L), MW-40-36 (DCE=18 μg/L and VC=6.4 μg/L), and MW-40-37 (DCE=94 μg/L and VC=20 μg/L), where either DCE or VC concentrations are still more than 10 times their respective MCLs. In addition, it is reasonable to expect some continued benefits of bioremediation as indicated by the COD, DO, and ORP data suggesting a favorable environment for reductive dechlorination; RNA data suggesting DHC activity (MW-40-30, -32, and -37); and trends in some of the

wells where initial lactate delivery was efficient and all COCs were reduced below the MCLs (MW-40-14, -31, and 35).

RECOMMENDATONS

Accordingly, we recommend the following:

1) Continue monitoring MW-40-30, -32, -36, and -37 on a quarterly basis until the criteria for shifting to reduced monitoring frequency for MNA (asymptotic for two quarters, and less than 10 times the MCLs) are confirmed.

2) Monitoring all other wells on an annual basis for MNA assessment.

3) After one more quarter of monitoring, assess the possibility of a final attempt to augment DHC populations in areas where activity is low but contaminants still exceed the criteria for shifting to reduced monitoring frequency. As noted above, the effectiveness of reductive dechlorination appears to be decreasing (as is expected at the observed chloroethene levels); however, there is reason to believe that some continued benefits may be realized over time. One more quarter of monitoring should be sufficient to confirm the trend, and to determine whether additional efforts to augment DHC populations are warranted. If DHC augmentation is warranted, this would likely be attempted through addition of fresh cultures of KB-1 (available through SiREM Laboratories), which was used previously. Alternatively, it may be possible to recirculate DHC-laden water from areas where DHC populations appear active to areas where DHC populations are inactive. Recirculation should be done using water from wells that have no COC contamination. Wells that might be used for recirculation must be first tested for COCs and DHC. Finally, it is noted that growth and spread of the introduced DHC may be limited at wells with low COC concentrations. However, dechlorination to below MCLs by introduced DHC cultures has been observed in areas where COC concentrations were low at this site, and has also been observed elsewhere with similar conditions.

TABLES

Table 1 Summary of Monitoring Activities Conducted During January 2008

Table 2 COD, VFA, DHC, and PLFA Data Collected During January 2008

Table 3 Anions, Alkalinity, DO, and ORP Data Collected During January 2008

FIGURES

Figure 1 Shallow and Mid-Shallow Monitoring Wells Proposed for Annual Monitoring

Figure 2 Shallow and Mid-Shallow Monitoring Wells Proposed for Quarterly Monitoring

TABLES

TABLE 1

SUMMARY OF MONITORING ACTIVITIES CONDUCTED DURING JANUARY 2008

Date	Event	Wells Sampled[1]	Analytes[2]/Parameters	Notes
1/15/08-1/17/08	Scheduled groundwater monitoring	Groundwater: MW-40-02, -06, -07, -08, -10, -11, -13, -14 through -20, -22, and -30 through -39.	VOCs, dissolved gases, cations, DNA, water levels, COD, and additional geochemical parameters	Laboratory and field parameters
1/17/08	Surface emissions monitoring	Not applicable	Methane gas concentrations	Inside Building 240 and western portion of Building 239, and areas surrounding the above buildings
1/18/08	Groundwater level measurement	MW-40-01, -02, -06, 07, 08, -10, -11, -13, -14, -15, -17, -19, -20, -22, -30 through 39, and IW-1 through IW-17.	Not applicable	Groundwater level measurements
1/18/08	Soil vapor/gas probe monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, and IW-1 through IW-4 and IW-6 through IW-17.	Methane, oxygen, carbon dioxide, VOCs, and carbon monoxide	Field testing
1/22/08	Soil vapor sampling	VW-40-01, -02, -03, -04, -06, MW-40-34, IW-1, -3, and -7.	VOCs and fixed gases	Laboratory analysis

Notes:

[1]Refer to Figures 1 and 2 for well locations.
[2]Not all analytes run on all wells.

COD – chemical oxygen demand
DNA – deoxyribonucleic acid
VOC – volatile organic compound

TABLE 2

COD, VFA, DHC, AND PLFA DATA COLLECTED DURING JANUARY 2008

Location	COD (mg/L)	Acetic Acid (mg/L)	Propionic Acid (mg/L)	Butyric Acid (mg/L)	DHC (cells/L)	Total PLFA Biomass (cells/L)
MW-40-06	NA	NA	NA	NA	NA	NA
MW-40-07	1150	144.2	997.2	73	6.81E+03	1.16E+09
MW-40-08	40.9	NA	NA	NA	NA	NA
MW-40-10	NA	NA	NA	NA	NA	NA
MW-40-11	NA	NA	NA	NA	NA	NA
MW-40-13	49.3	NA	NA	NA	NA	NA
MW-40-14	45.2	<1	<1	<1	6.48E+04	3.79E+08
MW-40-15	14.7	NA	NA	NA	NA	NA
MW-40-16	51.8	NA	NA	NA	NA	NA
MW-40-17	25.0	NA	NA	NA	NA	NA
MW-40-18	35.3	NA	NA	NA	NA	NA
MW-40-19	55.4	NA	NA	NA	NA	NA
MW-40-20	65.7	NA	NA	NA	NA	NA
MW-40-22	73.9	NA	NA	NA	NA	NA
MW-40-30	67.2	17.9	1.3	<1	2.25E+07	2.50E+09
MW-40-31	296	33.5	104.2	<1	2.44E+03	1.77E+09
MW-40-32	735	171.1	455.7	4.0	4.33E+07	5.58E+08
MW-40-33	26.7	NA	NA	NA	NA	NA
MW-40-34	2810	453.8	763.6	648.3	7.98E+04	1.92E+09
MW-40-35	3630	2,192	852.7	107.5	1.28E+05	3.38E+09
MW-40-36	2360	319.9	1,086	422	1.54E+06	1.84E+09
MW-40-37	40.9	<1	<1	<1	1.94E+04	5.37E+08
MW-40-38	NA	NA	NA	NA	NA	NA
MW-40-39	24.6	NA	NA	NA	NA	NA

Notes:

Pyruvic acid and formic acid were not detected; lactic acid was detected in MW-40-31 and MW-40-35 during the January event at 52.9 mg/L and 609.8 mg/L, respectively.

cells/L – cells per liter
COD – chemical oxygen demand
DHC – *Dehalococcoides* spp.
mg/L – milligrams per liter
NA – not analyzed
PLFA – phospholipid fatty acid
VFA – volatile fatty acid

TABLE 3

ANIONS, ALKALINITY, DO, AND ORP DATA COLLECTED DURING JANUARY 2008

Location	Chloride (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	DO (mg/L)	ORP (mV)
MW-40-06	NA	NA	NA	NA	NA	0.65	-120
MW-40-07	394	0.5 U	0.0971 J	1.97	1070	0.18	-202
MW-40-08	NA	NA	NA	NA	NA	0.28	-51
MW-40-10	NA	NA	NA	NA	NA	0.80	-15
MW-40-11	NA	NA	NA	NA	NA	0.24	-144
MW-40-13	NA	NA	NA	NA	NA	0.11	-212
MW-40-14	NA	NA	NA	NA	NA	0.59	-155
MW-40-15	NA	NA	NA	NA	NA	0.61	4
MW-40-16	NA	NA	NA	NA	NA	0.48	-93
MW-40-17	NA	NA	NA	NA	NA	0.43	1
MW-40-18	NA	NA	NA	NA	NA	0.38	-129
MW-40-19	NA	NA	NA	NA	NA	0.23	-204
MW-40-20	NA	NA	NA	NA	NA	0.29	-162
MW-40-22	NA	NA	NA	NA	NA	0.58	-208
MW-40-30	155	0.2 U	0.175	27.5	800	0.10	-275
MW-40-31	479	0.1 U	0.165	1.39	3850	0.16	-220
MW-40-32	131	0.2 U	0.140	2.73	1350	0.25	-202
MW-40-33	NA	NA	NA	NA	NA	0.93	28
MW-40-34	NA	NA	NA	NA	NA	0.18	-176
MW-40-35	NA	NA	NA	NA	NA	0.15	-194
MW-40-36	246	0.2 U	0.156	1.51	910	0.13	-167
MW-40-37	423	0.2 U	0.0999 J	170	670	0.20	-156
MW-40-38	NA	NA	NA	NA	NA	0.75	-86
MW-40-39	NA	NA	NA	NA	NA	0.79	32

Notes:

DO – dissolved oxygen

mg/L – milligrams per liter

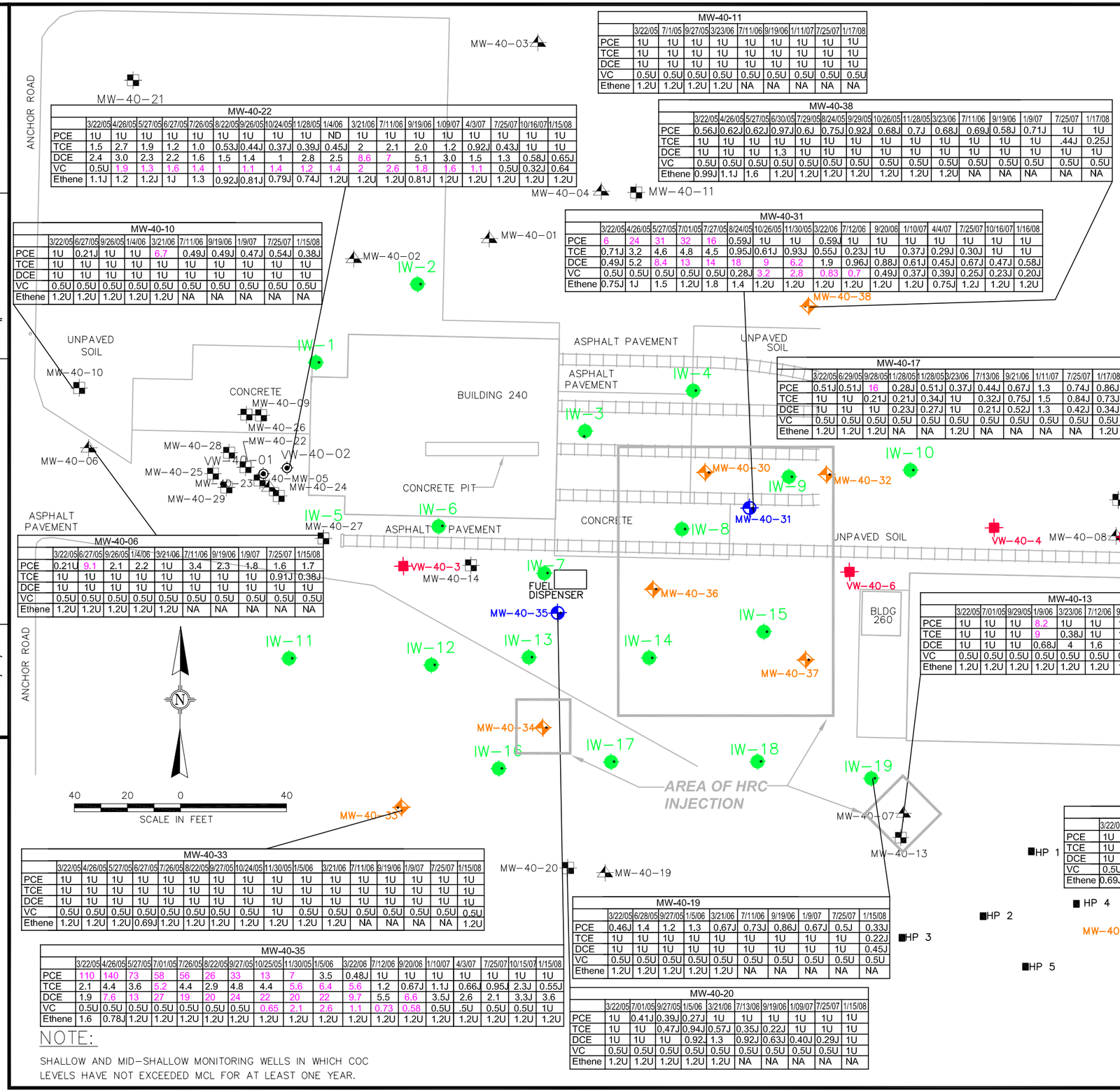
mV – millivolt

NA – not analyzed

ORP – oxidation/reduction potential

FIGURES

DRAWING NO: 08069201.DWG
DCN: ECSD-2201-0008-0692
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV:
DRAWN BY: MD
DATE: 02/14/08



MW-40-11	3/22/05	7/1/05	9/27/05	3/23/06	7/11/06	9/19/06	1/11/07	7/25/07	1/17/08
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-22	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/09/07	4/3/07	7/25/07	10/16/07	1/15/08
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	ND	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J	0.37J	0.39J	0.45J	2	2.1	2.0	1.2	0.92J	0.43J	1U	1U
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4	1	2.8	2.5	8.6	7	5.1	3.0	1.5	1.3	0.58J	0.65J
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1	1.4	1.2	1.4	2	2.6	1.8	1.6	1.1	0.5U	0.32J	0.64
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J	0.79J	0.74J	1.2U	1.2U	1.2U	0.81J	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-38	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/24/05	9/29/05	10/26/05	11/28/05	3/23/06	7/11/06	9/19/06	1/9/07	7/25/07	1/17/08
PCE	0.56J	0.62J	0.62J	0.97J	0.6J	0.75J	0.92J	0.68J	0.7J	0.68J	0.69J	0.58J	0.71J	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	.44J	0.25J
DCE	1U	1U	1U	1.3	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.99J	1.1J	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-10	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	1U	0.21J	1U	1U	6.7	0.49J	0.49J	0.47J	0.54J	0.38J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-31	3/22/05	4/26/05	5/27/05	7/01/05	7/27/05	8/24/05	10/26/05	11/30/05	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/16/08
PCE	6	24	31	32	16	0.59J	1U	1U	0.59J	1U	1U	1U	1U	1U	1U	1U
TCE	0.71J	3.2	4.6	4.8	4.5	0.95J	0.61J	0.93J	0.55J	0.23J	1U	0.37J	0.29J	0.30J	1U	1U
DCE	0.49J	5.2	8.4	13	14	18	9	6.2	1.9	0.96J	0.88J	0.61J	0.45J	0.67J	0.47J	0.58J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.28J	3.2	2.8	0.83	0.7	0.49J	0.37J	0.39J	0.25J	0.23J	0.20J
Ethene	0.75J	1J	1.5	1.2U	1.8	1.4	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.75J	1.2J	1.2U	1.2U

MW-40-17	3/22/05	6/29/05	9/28/05	11/28/05	11/28/05	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
PCE	0.51J	0.51J	16	0.28J	0.51J	0.37J	0.44J	0.67J	1.3	0.74J	0.86J
TCE	1U	1U	0.21J	0.21J	0.34J	1U	0.32J	0.75J	1.5	0.84J	0.73J
DCE	1U	1U	1U	0.23J	0.27J	1U	0.21J	0.52J	1.3	0.42J	0.34J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	1.2U	NA	NA	NA	NA	1.2U

MW-40-18	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
PCE	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U
Ethene	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-06	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	0.21U	9.1	2.1	2.2	1U	3.4	2.3	1.8	1.6	1.7
TCE	1U	1U	1U	1U	1U	1U	1U	1U	0.91J	0.38J
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-13	3/22/05	7/01/05	9/29/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	7/25/07	1/15/08
PCE	1U	1U	1U	8.2	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	9	0.38J	1U	1U	1U	1U	1U
DCE	1U	1U	1U	0.68J	4	1.6	1.3	0.88J	1.7	0.40J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-15	3/22/05	6/30/05	9/28/05	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
	1U	1U	0.26J	0.23J	1U	1U	1U	1U	1U	1U
	1U	1U	0.26J	0.21J	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.1J	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-16	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
PCE	1U	1U	1U	1U	1U	1U	ND
TCE	1U	1U	1U	1U	1U	1U	ND
DCE	1U	1U	1U	1U	1U	1U	ND
VC	0.5U	0.5U	1U	1U	0.5U	0.5U	ND
Ethene	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-39	3/22/05	4/26/05	4/26/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/30/05	1/6/06	3/21/06	7/11/06	9/21/06	1/9/07	7/25/07	1/15/08
PCE	1U	1U	1U	1U	0.34J	0.29J	0.35J	0.42J	0.49J	0.71J	0.72J	1.7	2.4	2.5	2.8	1.3
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	NA	NA	NA	NA	NA	NA	NA	NA

MW-40-33	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/27/05	10/24/05	11/30/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	1.2U

MW-40-35	3/22/05	4/26/05	5/27/05	7/01/05	7/26/05	8/22/05	9/27/05	10/25/05	11/30/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/15/08
PCE	110	140	73	58	56	26	33	13	7	3.5	0.48J	1U	1U	1U	1U	1U	1U	1U
TCE	2.1	4.4	3.6	5.2	4.4	2.9	4.8	4.4	5.6	6.4	5.6	1.2	0.67J	1.1J	0.66J	0.95J	2.3J	0.55J
DCE	1.9	7.6	13	27	19	20	24	22	20	22	9.7	5.5	6.6	3.5J	2.6	2.1	3.3J	3.6
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.65	2.1	2.6	1.1	0.73	0.58	0.5U	.5U	0.5U	0.5U	1U
Ethene	1.6	0.78J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-19	3/22/05	6/28/05	9/27/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	0.46J	1.4	1.2	1.3	0.67J	0.73J	0.86J	0.67J	0.5J	0.33J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	0.22J
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	0.45J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-20	3/22/05	7/01/05	9/27/05	1/5/06	3/21/06	7/13/06	9/19/06	1/09/07	7/25/07	1/15/08
PCE	1U	0.41J	0.39J	0.27J	1U	1U	1U	1U	1U	1U
TCE	1U	1U	0.47J	0.94J	0.57J	0.35J	0.22J	1U	1U	1U
DCE	1U	1U	1U	0.92J	1.3	0.92J	0.63J	0.40J	0.29J	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 — SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (μg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

NOTE:

SHALLOW AND MID-SHALLOW MONITORING WELLS IN WHICH COC LEVELS HAVE NOT EXCEEDED MCL FOR AT LEAST ONE YEAR.

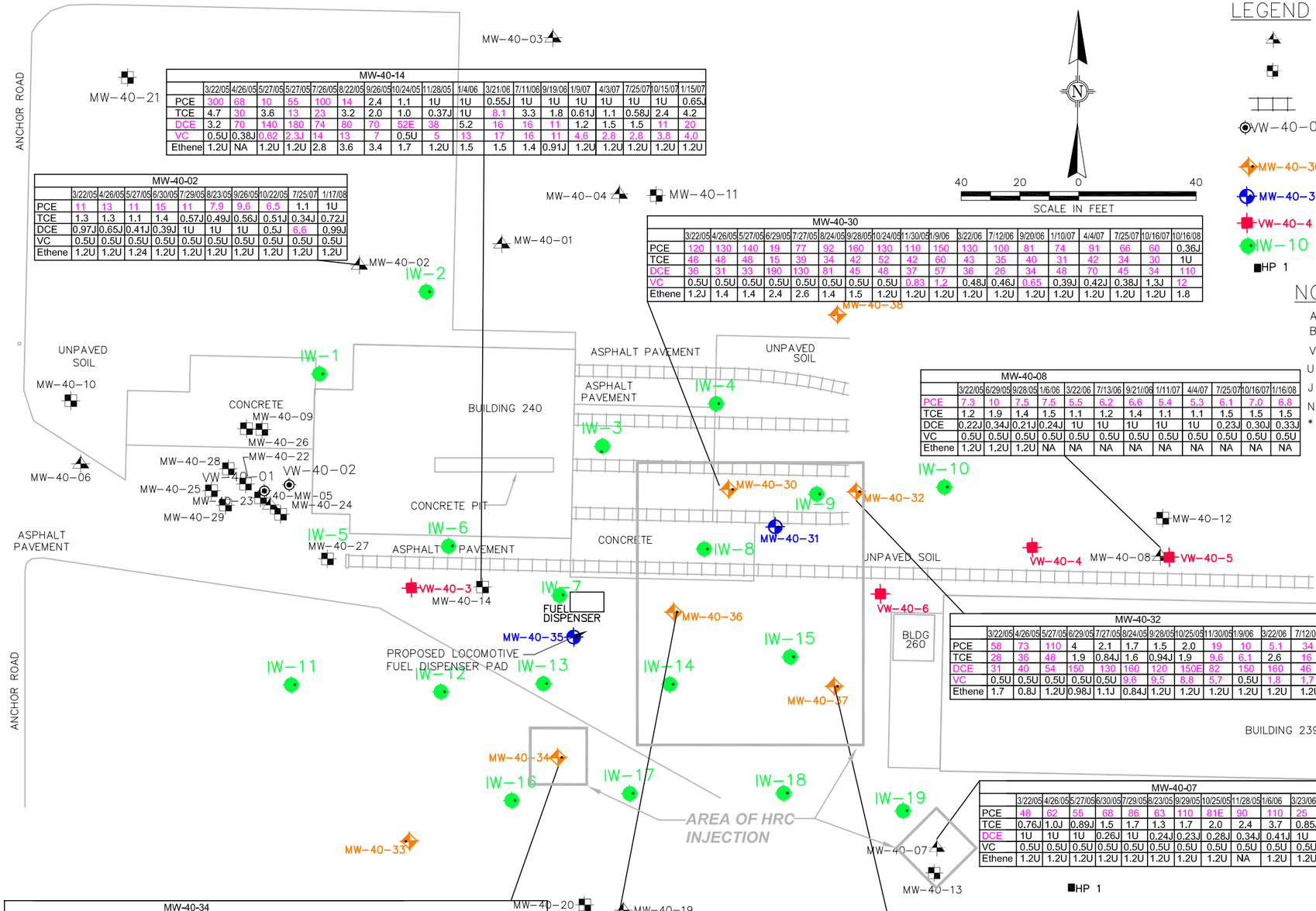
Figure 1

SHALLOW AND MID SHALLOW MONITORING WELLS PROPOSED FOR ANNUAL MONITORING

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

P:\3210-RAC IV\CTO-0010\DWG\080692\08069201.DWG
PLOT/UPDATE: FEB 25 2008 13:50:25



LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 — SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (μg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

MW-40-14

	3/22/05	4/26/05	5/27/05	5/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	4/3/07	7/25/07	10/15/07	1/15/07
PCE	300	68	10	55	100	14	2.4	1.1	1U	1U	0.55J	1U	1U	1U	1U	1U	1U	0.65J
TCE	4.7	30	3.6	13	23	3.2	2.0	1.0	0.37J	1U	8.1	3.3	1.8	0.61J	1.1	0.58J	2.4	4.2
DCE	3.2	70	140	180	74	80	70	52E	38	5.2	16	16	11	1.2	1.5	1.5	11	20
VC	0.5U	0.38J	0.62	2.3J	14	13	7	0.5U	5	13	17	16	11	4.6	2.8	2.8	3.8	4.0
Ethene	1.2U	NA	1.2U	1.2U	2.8	3.6	3.4	1.7	1.2U	1.5	1.5	1.4	0.91J	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-02

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/26/05	10/22/05	7/25/07	1/17/08
PCE	11	13	11	15	11	7.9	9.6	6.5	1.1	1U
TCE	1.3	1.3	1.1	1.4	0.57J	0.49J	0.56J	0.51J	0.34J	0.72J
DCE	0.97J	0.65J	0.41J	0.39J	1U	1U	1U	0.5J	6.6	0.99J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.24	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-30

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/24/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	10/16/08
PCE	120	130	140	19	77	92	160	130	110	150	130	100	81	74	91	66	60	0.36J
TCE	48	48	48	15	39	34	42	52	42	60	43	35	40	31	42	34	30	1U
DCE	36	31	33	190	130	81	45	48	37	57	36	26	34	48	70	45	34	110
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.83	1.2	0.48J	0.46J	0.65	0.39J	0.42J	0.38J	1.3J	12
Ethene	1.2J	1.4	1.4	2.4	2.6	1.4	1.5	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.8

MW-40-08

	3/22/05	6/29/05	9/28/05	1/6/06	3/22/06	7/13/06	9/21/06	1/11/07	4/4/07	7/25/07	10/16/07	1/16/08
PCE	7.3	10	7.5	7.5	5.5	6.2	6.6	5.4	5.3	6.1	7.0	6.8
TCE	1.2	1.9	1.4	1.5	1.1	1.2	1.4	1.1	1.1	1.5	1.5	1.5
DCE	0.22J	0.34J	0.21J	0.24J	1U	1U	1U	1U	1U	0.23J	0.30J	0.33J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA	NA	NA	NA	NA

MW-40-32

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/25/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/16/08
PCE	58	73	110	4	2.1	1.7	1.5	2.0	19	10	5.1	34	39	50	47	10	1U	0.74J
TCE	28	36	48	1.9	0.84J	1.6	0.94J	1.9	9.6	6.1	2.6	16	20	23	22	13	1.4	1.3
DCE	31	40	54	150	130	160	120	150E	82	150	160	46	44	30	25	26	10	12
VC	0.5U	0.5U	0.5U	0.5U	0.5U	9.6	9.5	8.8	5.7	0.5U	1.8	1.7	1.8	1.2	0.97	1.6	9.5	5.6
Ethene	1.7	0.8J	1.2U	0.98J	1.1J	0.84J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	4.9	0.99J

MW-40-07

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/28/05	1/6/06	3/23/06	7/11/06	9/21/06	1/9/07	4/4/07	7/25/07	10/16/07	1/15/08
PCE	48	62	55	68	86	63	110	81E	90	110	25	~~100~~	~~94~~	~~83~~	~~49~~	~~11~~	1.4J	2.8
TCE	0.76J	1.0J	0.89J	1.5	1.7	1.3	1.7	2.0	2.4	3.7	0.85J	3.2	3.1	2.7	1.8	6.7	1U	1.7
DCE	1U	1U	1U	0.26J	1U	0.24J	0.23J	0.28J	0.34J	0.41J	1U	0.31J	0.43J	0.34J	1U	36	54	47
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.95J	1.2U	1.2U

MW-40-34

	3/22/05	4/26/05	5/27/05	6/28/05	7/26/05	8/22/05	9/27/05	10/24/05	11/28/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/16/08
PCE	9.1	140	180	5.8	6.8	190	190	37	31	29	22	18	28	22	24	4.5	1U	1U
TCE	1U	1.2	1.6	1.3	2.1	5	12	8.1	2.1	1.3	0.64J	0.92J	1.2	1.0	1.2	1.3	1.4J	0.65J
DCE	1U	1U	0.24J	130	130	20	65	74	7.5	4.7	2.1	2.3	2.8	1.8	1.9	14	19	8.5
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.1	1.6	0.59	0.55	0.67	0.53	0.66	0.5U	2.2J	2.6
Ethene	1.2U	1.2U	1.2U	1.1J	0.8J	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-36

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/24/05	11/30/05	1/6/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/16/08
PCE	110	300	310	360	310	200	190	160	150	160	140	160	150	87	44	1.0	2.8J	1.1
TCE	13	28	25	34	28	16	14	16	13	16	15	18	24	30	85	2.0	4.7J	2.1
DCE	11	22	18	49	29	14	13	24	17	22	20	18	20	26	18	35	19	17
VC	0.5U	0.5U	0.5U	10	0.5U	0.5U	0.5U	0.5U	0.23J	0.6	0.41J	0.42J	0.6	0.95	0.65	9.6	7.2	6.5
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	6.9	1.2U	2.9

MW-40-37

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/25/05	11/30/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/15/07	1/16/08
PCE	250	330	190	15	140	170	370	120E	390	440	100	120	1.3	2.1	1.1	0.31J	1.8J	0.36J
TCE	12	12	63	16	72	56	53	38	29	48	28	46	16	0.94J	4.9	0.36J	3.1J	1.3
DCE	5.0	4.9	110	280	170	100	79	50E	48	63	35	36	140	140	89	64	69	94
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.2	3.6	4.5	18	18	24	18	18
Ethene	1.5	3.7	4.6	5.7	5.0	4.1	3.5	2.9	2.9	3.0	1.2U	2	2.6	4.1	3.0	11	1.2U	6.5

NOTE:

SHALLOW AND MID-SHALLOW MONITORING WELLS IN WHICH CONCENTRATIONS OF ONE OR MORE COCs HAVE EXCEEDED RESPECTIVE MCL LEVELS DURING RECENT OR LATEST MONITORING EVENTS.

Figure 2

SHALLOW AND MID-SHALLOW MONITORING WELLS PROPOSED FOR QUARTERLY MONITORING

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 08069202.DWG
DCN: ECSD-2201-0008-0692
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV:
DRAWN BY: MD
DATE: 02/14/08

P:\3210-RAC IV\CTO-0010\DWG\080692\08069202.DWG
PLOT/UPDATE: FEB 25 2008 14:16:37

TETRA TECH EC, INC.

SUMMARY OF FIELD ACTIVITIES AND DATA FOR APRIL 2008 MONITORING EVENT ENHANCED IN SITU BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS

INSTALLATION RESTORATION PROGRAM SITE 40 NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CA

Date: July 8, 2008

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INTRODUCTION

This summary report provides an overview of monitoring activities conducted during April 2008 in association with enhanced in situ bioremediation (EISB) of groundwater at Installation Restoration Program (IRP) Site 40 at Naval Weapons Station Seal Beach, Seal Beach, California. This report includes presentation and assessment of relevant data collected during this period. A summary of the general status of the project and recommendations based on the conclusions are also provided.

Chemicals of concern (COCs) in groundwater at IRP Site 40 are tetrachloroethene (PCE), trichloroethene (TCE), 1,2-dichloroethene (DCE), and vinyl chloride (VC).

Major project milestones to date are as follows:

- Initial injections of sodium lactate were conducted from April through December 2005. Injection of sodium lactate was effective in stimulating complete biological reduction of the COCs in areas where delivery was achieved. As a result, COC concentrations were reduced in these areas, in many cases to below maximum contaminant levels (MCLs).

- Bioaugmentation with KB-1, a commercially available dechlorinating culture containing *Dehalococcoides* spp. (DHC) organisms, was conducted during September 2005. Initial DHC counts increased in injection well samples where the culture had been applied; however, microbial data following bioaugmentation were variable, and clear effects of bioaugmentation were difficult to document in monitoring wells. Nevertheless, bioaugmentation is believed to have had a beneficial effect in terms of enhancing DHC presence and activity at this site.

- With regulator approval, Hydrogen Release Compound® (HRC®) was applied to the central area of the site during the the second half of April 2007. Based on the performance monitoring results during the initial sodium lactate injection and subsequent investigations, it was determined that, due to lithologic variations, sodium lactate distribution in the shallower portion of the aquifer in the central area of the site was not optimal. An analysis and evaluation of various technologies for optimizing the bioremediation process were conducted, and HRC injection was selected and implemented. HRC has been effective in enhancing treatment in the central area of the site and several hotspot locations where TCE and PCE were persistent.

SUMMARY OF FIELD ACTIVITIES

The field activities for this period included groundwater and soil gas monitoring in various wells and surface gas emissions monitoring. Monitoring activities, along with the dates they were conducted, are listed in Table 1.

MONITORING EVALUATION

Groundwater and soil gas analytical data, as well as groundwater level measurements, are briefly discussed below. For the regularly scheduled monitoring event (April 2008), COCs and a focused suite of microbial and geochemical parameters were measured in groundwater samples from monitoring wells MW-40-07, -14, -30, -32, -34, -36, and -37. These are key compliance wells located in the central portion of the site where low-level contamination is still present. In addition, groundwater samples were collected from 17 injection wells (see Table 1) to better assess residual COC distributions and determine whether there might be any areas that would benefit from localized treatment.

Presentation of Data

New data collected from monitoring wells MW-40-07, -14, -30, -32, -34, -36, and -37 during the April 2008 event, along with all data collected over the life of the project for these wells, are the main focus of this report. In the past, separate figures had been presented to delineate COC concentrations for shallow and mid-shallow wells. However, at this time, only one mid-shallow interval monitoring well (MW-40-14) still has TCE, DCE, and VC concentrations in excess of their respective MCLs (TCE at 6.0 micrograms per liter [μg/L], DCE at 26 μg/L, and VC at 2.8 μg/L). Data for this well and data for shallow interval wells are presented on Figure 1. Data collected for the above wells, data for injection wells sampled during this event, and the most recent data for monitoring wells not sampled during this event were used for evaluation of groundwater conditions at the site.

Continuing Evaluation of HRC® Migration/Persistence and COCs

This subsection provides a summary of data collected during April 2008 to assess HRC migration and its effects, followed by key observations regarding COC concentrations in the selected groundwater monitoring wells during the April 2008 event.

1) One year has elapsed since the application of HRC. Continuing evaluation of HRC migration primarily included assessment of shallow interval groundwater monitoring wells MW-40-07, -30, -32, -34, -36, and -37 (Refer to Figure 1 for well locations). These monitoring wells are located within the areas where HRC was injected. Each of these wells is still impacted by one or more COCs at levels exceeding their respective MCLs, and each is located in the area expected to be influenced by the HRC. Chemical oxygen demand (COD) has been measured over the duration of the project to evaluate lactate presence and to assess the migration and persistence of HRC to these wells. Additionally, volatile fatty acids (VFAs), including acetic acid, propionic acid, and

butyric acid, are breakdown products of HRC, and their presence indicates microbial activity is occurring as microbes degrade the HRC. COD and VFA data are presented in Table 2.

- The April 2008 COD concentrations were somewhat lower than those measured during the January 2008 event, but they continued to remain elevated in wells MW-40-07 (1,010 milligrams per liter [mg/L]), MW-40-32 (273 mg/L), MW-40-34 (601 mg/L), and MW-40-36 (1,090 mg/L). During the April 2007 event (prior to the HRC injection), COD concentrations ranged from 12.3 to 53.7 mg/L in the above wells. In addition, VFAs were detected in MW-40-32, -34, and -36, although at lower concentrations than those measured during the January 2008 event. Thus, while substrate levels may be declining, the data still indicate that HRC is present and being metabolized in these areas.
- COD concentrations in wells MW-40-30 (12.1 mg/L) and MW-40-37 (14.2 mg/L), which have the highest remaining concentrations of DCE and VC, were lower than the January 2008 concentrations (67.2 and 40.9 mg/L, respectively). In addition, VFAs were not detected in either of the samples collected from these wells in April. VFAs had not been detected in MW-40-37 during the April 2008 event, but they had been detected at low levels in MW-40-30. These data indicate that migration and metabolism of HRC in these areas are still not as significant as in other areas.
- COD concentrations in injection wells ranged from non-detect (less than 10 mg/L) to 610 mg/L in IW-15, which is located within the area where HRC was injected. Interestingly, COD levels remained relatively low in IW-8, -9, and -14 (40, 33.4, and less than 10 mg/L, respectively), which are also located within the area where HRC was injected. This is in agreement with the monitoring well data, which indicated migration of HRC was not uniformly achieved within the injection area. Finally, relatively low COD concentrations detected in other injection wells suggest that the initially injected sodium lactate has for the most part been degraded.

2) COC concentrations for the monitoring wells listed above are presented on Figure 1. Graphs illustrating the trends for each well are included on the figure as well. Key observations regarding COC trends for the monitoring wells are as follows (refer to Figure 1):

Mid-Shallow Interval Well

- MW-40-14, the only mid-shallow interval well in which COCs still exceed respective MCLs, has residual TCE (6.0 μg/L), DCE (26 μg/L), and VC (2.8 μg/L) at concentrations above respective MCLs (5, 6, and 0.5 μg/L). PCE (reported at 4.6 μg/L) did not exceed its MCL (5 μg/L).

Shallow Interval Wells

- PCE was again not detected above its MCL in any of the shallow wells monitored during the April 2008 event.
- TCE has been reduced to below its MCL in all shallow monitoring wells.
- DCE is present at concentrations exceeding its MCL in shallow monitoring wells MW-40-07 (42 μg/L), MW-40-30 (86 μg/L), MW-40-32 (20 μg/L), MW-40-36 (11 μg/L), and MW-40-37 (58 μg/L). These concentrations represent decreases over levels measured during the January 2008 event in all of these wells except for MW-40-32.

- VC is present at concentrations exceeding its MCL in shallow monitoring wells MW-40-07 (5.4 μg/L), MW-40-30 (8.3 μg/L), MW-40-32 (4.8 μg/L), MW-40-34 (1.7 μg/L), MW-40-36 (4.6 μg/L), and MW-40-37 (12 μg/L). These concentrations represent decreases over concentrations reported during the January 2008 event in all of these wells.
- Ethene was reported in MW-40-30 (1.8 μg/L), MW-40-32 (0.88 J μg/L) ("J" indicates an estimated value), MW-40-36 (2.1 μg/L), and MW-40-37 (4.6 μg/L).
- Substantial reductions in COCs have been achieved following the HRC injection in the central area of the site, promoting COC degradation in wells MW-40-07, -30, -32, -34, and -36.

3) General plume extents are contoured on Figures 2 through 5 for PCE, TCE, DCE, and VC, respectively. Plume depictions were generated using the most current concentration for each monitoring point, including the monitoring well and injection well data collected during the April 2008 event. Contour intervals include the MCL for each contaminant, and ten times the MCL where applicable (i.e., for DCE and VC). Key observations regarding plume configurations are provided below. COC data for shallow and mid-shallow intervals are presented on the same figure, and as noted on the figures and in the discussions below, the majority of contamination is present in the shallow interval.

PCE: As shown on Figure 2, PCE is present above its MCL at only two monitoring points, both in the shallow interval. While these data are contoured as plumes, the estimated plume extents are very minimal.

TCE: Figure 3 shows that TCE is present above its MCL in six monitoring points. TCE concentrations slightly exceed the MCL at four of these monitoring points, ranging from 6.0 to 7.3 μg/L in IW-1, IW-7, IW-10, and MW-40-14. The highest TCE concentrations were in samples from IW-18 (22 μg/L) and IW-13 (42 μg/L). MW-40-14 is the only mid-shallow monitoring well with a TCE concentration (6.0 μg/L) that exceeds the MCL for this compound. Hence, TCE contamination is present mostly in the shallow interval. As with PCE, this represents residual pockets of contamination and while plume interpretations are shown, the overall residual concentrations are minimal.

DCE: DCE concentrations were somewhat more widespread (Figure 4). A dilute plume can be interpreted in the south-central portion of the site with a maximum concentration of 32 μg/L (IW-6). The highest remaining DCE concentration was reported in sample MW-40-30 (86 μg/L). As was observed for TCE, the only mid-shallow monitoring point where DCE exceeds its MCL is MW-40-14 (with a concentration of 26 μg/L). Hence, DCE contamination is present mostly in the shallow interval.

VC: Figure 5 depicts a low-level residual VC plume within the central portion of the site. The highest VC concentration was reported in a sample from injection well IW-19 at a concentration of 14 μg/L. A VC concentration of 2.8 μg/L was reported in mid-interval monitoring well MW-40-14 that slightly exceeded its MCL. Therefore, the major portion of residual VC is present in the shallow interval. Figure 5 also depicts the estimated VC plume boundary with concentrations that exceed 10 times the VC MCL.

A composite of plume extents for all COCs is presented in Figure 6, along with the most recent COD data. This information depicts a low-level residual plume, mostly located in the western portion of the site, where COD levels are relatively low.

Microbiological and Geochemical Parameters

Data from the April 2008 event reflecting concentrations of DHC organisms, which are critical to the reductive dechlorination process, and total biomass (a measure of total viable bacteria) in key monitoring wells are included in Table 2. Suppressed dissolved oxygen (DO) levels and oxidation reduction potential (ORP) provide additional indication of microbial metabolism of the HRC (effectiveness in generating/maintaining reducing conditions). DO and ORP data are included in Table 3. As noted above, only data from key compliance wells (refer to Figure 1) where residual COC concentrations still exceed MCLs are discussed in this status report. Note that monitoring wells MW-40-07 and -14 were not analyzed for microbiological and geochemical parameters.

1) Key observations regarding microbiological parameters for relevant wells are as follows (refer to Table 2):

    - Total biomass counts for April 2008 ranged from 4.57×10^8 to 5.24×10^9 cells per liter (cells/L), and were similar to those measured during the January 2008 event (3.8×10^8 to 2.5×10^9 cells/L).
    - DHC levels ranged from 6.38×10^6 to 1.88×10^8 cells/L, which are generally higher than levels measured in January 2008 (6.8×10^3 to 4.3×10^7 cells/L).
    - Total biomass levels remain high, and while measured at lower concentrations during the prior event, DHC organisms are still present at reasonably high levels. This, along with continual decreases in COC levels, indicates that biodegradation continues to take place, but probably at a slower rate.

2) Key observations regarding relevant geochemical parameters for monitored wells are as follows (refer to Table 3):

    - Based on the April 2008 readings, DO concentrations in the monitoring wells were less than 0.5 mg/L (given limitations associated with this measurement, this essentially represents non-detect).
    - ORP values measured during the April 2008 event were strongly negative, ranging from -117 millivolts (mV) to -202 mV in monitoring wells. ORP values in these wells had all been measured in the positive range during the April 2007 sampling event (prior to the HRC injection), but have been overwhelmingly negative since then.
    - As for the injection wells, DO levels were less than 0.5 mg/L in 11 of the 17 wells sampled during the April 2008 event. DO levels in the remaining six wells ranged from 0.51 to 0.72, which are very low and do not indicate significant DO presence. In addition, all injection well ORP levels were negative (-42 to -188 mV), and were less than -100 mV in 12 of the 17 injection wells).
    - Overall, the April 2008 geochemical data indicate maintenance of strong reducing conditions supportive of reductive dechlorination in all critical areas. However, declining substrate levels (as indicated by the COD data, discussed above) could potentially lead to the system reverting back to more oxidizing conditions (positive ORP levels), which are not supportive of reductive dechlorination. This condition was observed prior to the HRC injection in the central portion of the site where the original sodium lactate had for the most part been biodegraded.
    - The pH readings ranged from 6.10 to 7.36 standard pH units, a range which is generally considered acceptable for bioremediation.

Soil Gas Data. Methane gas surface emissions monitoring was performed on April 11, 2008. Methane gas emissions were not detected within Buildings 239 and 240 and surrounding areas during this monitoring event.

Soil gas monitoring of probes was conducted on April 11, 2008. The results indicated that the 29 probes tested in the field had methane gas present at concentrations from 14.2 to 86.2 percent in air during the April 2008 monitoring event. The highest methane concentrations were detected in the soil gas probe in injection well IW-9. Hydrogen sulfide was detected in 11 of 29 probes with concentrations from 1 to 21 parts per million (ppm). The highest hydrogen sulfide concentrations were detected in the soil gas probe in injection wells IW-8 and IW-9, at 21 and 13 ppm, respectively.

In addition, soil gas samples were collected in 1-liter Tedlar bags from vapor monitoring wells (VW-40-01, -02, -03, -04, and -06), and a select number of soil gas monitoring probes were installed in groundwater monitoring well MW-40-34 and injection wells IW-1, -3, and -4. VC was detected at concentrations from 1,200 micrograms per cubic meter ($\mu g/m^3$) (or 450 parts per billion in volume [ppbv]) in the soil gas probe installed in MW-40-34 to 8,600 $\mu g/m^3$ (or 3,300 ppbv) in soil gas monitoring well VW-40-06. DCE was detected in eight of nine sampled wells ranging in concentration from 960 J $\mu g/m^3$ in the soil gas probe installed in injection well IW-3 to 5,700 $\mu g/m^3$ in soil gas monitoring well VW-40-02. TCE was detected in seven of nine probes at concentrations from 810 J $\mu g/m^3$ in IW-3 to 21,100 $\mu g/m^3$ in VW-40-03. PCE was detected in six of nine samples at concentrations from 430 J $\mu g/m^3$ in IW-3 to 16,500 $\mu g/m^3$ in MW-40-34.

Methane gas concentrations in samples collected in Tedlar bags from the soil gas monitoring probes and vapor monitoring wells and analyzed in the laboratory ranged from 48.1 percent in IW-3 to 71.0 percent in MW-40-34. Concentrations of methane in soil gas have decreased since the last monitoring and sampling event.

Groundwater Levels. Groundwater level measurements were conducted on April 10, 2008. Groundwater elevations within the site ranged from 0.38 feet above mean sea level (msl) in MW-40-08 to 2.30 feet above msl in MW-40-02. In general, water level measurements collected in April 2008 did not indicate a change in groundwater level within the monitoring area in comparison with the elevations measured during the previous monitoring event in January 2008.

SAMPLING FREQUENCY EVALUATION

An evaluation of the monitoring wells was conducted using criteria set forth in the Final Remedial Design Work Plan (TtEC, 2005) based on most current data and trends to determine appropriate monitoring frequency for monitoring wells. Refer to Figure 6-2, Remedial Action and Monitoring Flow Chart, of the Final Remedial Design Work Plan (TtEC, 2005). The criteria indicate that sampling frequency for wells in which COC concentrations are less than 10 times the respective MCLs and are asymptotic for two quarters will be reduced to semiannual basis. Sampling frequency for wells in which the COCs have been below their MCLs for 1 year will be reduced to annual basis. Wells that do not meet either of these criteria will continue to be sampled on a quarterly basis until both of these criteria are met. Data used in the sampling frequency evaluation are presented on Figures 1 and 7. Results of the evaluation are presented in Table 4.

CONCLUSIONS

In general, significant reductions in total chloroethene concentrations have been observed in all compliance monitoring wells. However low-level residual COCs (mostly DCE and VC) are present above respective MCLs in several wells, mainly in the central portion of the site. Injection well data

generally confirmed low-level residual contamination in this area. While continued (although minor) decreases in DCE and VC levels are evident, relatively low substrate levels were observed in these key areas. Finally, reasonably high microbial counts were measured, but while conditions favoring reductive dechlorination continue to be present, COD levels appear to be declining and are low in the critical areas where COCs are still present.

Overall, the data suggest that: 1) EISB has been very effective in reducing COC levels in groundwater, 2) reduction of residual COCs will likely continue to occur, although probably at a reduced rate, and 3) the site is approaching a point where (as planned), monitored natural attenuation (MNA) will likely be sufficient for site groundwater to reach MCLs. However, there is still uncertainty regarding the time frame to reach MCLs and the potential for contaminant rebound to occur (as potentially suggested by increased COC levels in MW-40-14).

It is noted that dechlorinating organisms generally do not thrive (i.e., reproduce) when total chloroethene levels fall below about 50 μg/L, as is the case at this site. Nevertheless, with the presence of sufficient dechlorinating biomass, contaminant reduction to below MCLs is commonly observed (as has been at this site) under enhanced bioremediation. Despite the generally positive results to date, it is likely that the dechlorinating organisms currently present in the subsurface are stressed due to substrate limitations, low chloroethene levels, or both. Thus, it is expected that significant benefits can be derived from a final application of substrate and fresh dechlorinating organisms via bioaugmentation.

RECOMMENDATONS

The following recommendations are based on the above evaluation and analysis of the data:

1) Conduct future monitoring as proposed in Table 4.

2) Collect several grab groundwater samples at various depths from inside the locomotive maintenance shop (Building 240) to assess the potential for further rebound in the vicinity of MW-40-14. Direct-push technology using a cone penetrometer test (CPT) rig will be utilized for collecting the samples. Proposed sampling locations are shown on Figure 8. CPT and groundwater sampling will be conducted in accordance with the procedures described in the Final Work Plan for Collecting Additional Data for Enhanced In Situ Bioremediation System Optimization, Installation Restoration Program Site 40 (Concrete Pit/Gravel Area), Naval Weapons Station Seal Beach, Seal Beach, California (dated April 19, 2006) (Work Plan) and the Addendum Sampling and Analysis Plan included as an appendix to the Work Plan. Based on the review and evaluation of the groundwater sampling results, a determination will be made on whether it is necessary to expand the footprint of the HRC injection to include the area within Building 240, and if necessary, the locations of the HRC injection points within the building will be designated once the CPT results become available.

3) Apply a final round of HRC and conduct bioaugmentation at strategic locations to address residual contamination. To the extent practicable, this is expected to: 1) maximize (increase the rate and extent of) the treatment processes already occurring, 2) reduce the timeframe for MNA to act to meet MCLs, and 3) help guard against future contaminant rebound.

   The HRC application will be conducted using the same methodology as the previous HRC application conducted at the site in April 2007, and as described in the Final Technical Memorandum, Enhanced In Situ Bioremediation Remedial Action Optimization Work Plan (TtEC, 2006). The injection points will be spaced

approximately 10 feet apart and staggered. The proposal target areas for the application of HRC are depicted on Figure 8. The preliminary effectiveness of the HRC injection will be assessed during the subsequent quarterly monitoring event, and if DCE and VC concentrations have not decreased, bioaugmentation will be considered as a final effort to accelerate the cleanup time frame. It is noted that (as mentioned above), contaminants are still present in MW-40-14, which is located downgradient from the Building 240 concrete pit and gravel area (the contaminant source area). In addition, concentrations of the PCE, TCE, and DCE in this well appear to have increased slightly (refer to Figure 1), which may indicate the potential onset of rebound in this area, especially since COC levels in groundwater immediately upgradient (under Building 240) are not known. HRC injection may include increased dosing along the western edge of Building 240 to address potential contamination migrating from beneath the building. A tighter spacing may be used for injection of HRC along Building 240. The location of the HRC injection points along the western edge of Building 240 will be adjusted once the CPT results become available.

REFERENCES

TtEC (Tetra Tech EC, Inc.). 2005. Final Remedial Design/Work Plan, Enhanced In Situ Bioremediation at Installation Restoration Program Site 40 (Concrete Pit/Gravel Area). Naval Weapons Station Seal Beach, Seal Beach, California. DCN: FWSD-RAC-05-0380. February 24.

_____. 2006. Final Technical Memorandum, Enhanced In Situ Bioremediation Remedial Action Optimization Work Plan, at Installation Restoration Program Site 40 (Concrete Pit/Gravel Area). Naval Weapons Station Seal Beach, Seal Beach, California. DCN: ECSD-RACIV-07-0060. November 17.

TABLES

Table 1 Summary of Monitoring Activities Conducted During February and April 2008

Table 2 COD, VFA, DHC, and PLFA Data Collected in February and April 2008

Table 3 Anions, Alkalinity, DO, ORP, and pH Data Collected During April 2008

Table 4 Assessment of Recommended Monitoring Frequency for All Monitoring Wells

FIGURES

Figure 1 COC Concentrations and Trends in Shallow and Mid-Shallow Monitoring Wells Sampled During April 2008

Figure 2 Interpreted Plume Extents for PCE Based on Most Current Data

Figure 3 Interpreted Plume Extents for TCE Based on Most Current Data

Figure 4 Interpreted Plume Extents for DCE Based on Most Current Data

Figure 5 Interpreted Plume Extents for VC Based on Most Current Data

Figure 6 Composite of Interpreted Plume Extents for all COCs Based on Most Current Data

Figure 7 COC Concentrations in Shallow and Mid-Shallow Monitoring Wells Not Sampled During April 2008

Figure 8 Conceptual HRC Application Areas and Groundwater Sampling Locations

TABLES

TABLE 1

SUMMARY OF MONITORING ACTIVITIES CONDUCTED DURING FEBRUARY AND APRIL 2008

Date	Event	Wells Sampled[1]	Analytes[2]/Parameters	Notes
2/7/08	Additional groundwater monitoring for microbial parameters	Groundwater: MW-40-07, -30, -032, and -037	DNA for DHC	Laboratory and field parameters
4/10/08	Soil vapor sampling	VW-40-01, -02, -03, -04, -06, MW-40-34, IW-1, -3, and -7	VOCs and fixed gases	Laboratory analysis
4/10/08	Groundwater level measurement	MW-40-01, -02, -06, 07, 08, -10, -11, -13, -14, -15, -17, -19, -20, -22, -30 through 39, and IW-1 through IW-17	Not applicable	Groundwater level measurements
4/11/08	Soil vapor/gas probe monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, IW-1 through IW-4, and IW-6 through IW-17	Methane, oxygen, carbon dioxide, VOCs, hydrogen sulfide, and carbon monoxide	Field testing
4/11/08	Surface emissions monitoring	Not applicable	Methane gas concentrations	Inside Building 240 and western portion of Building 239, and areas surrounding the above buildings
4/14/08-4/16/08	Groundwater sampling[3]	MW-40-07, -14, -30, -32, -34, -36, -37, IW-1 through -10, -12 through -15, and -17 through -19	VOCs, dissolved gasses, TDS, cations, anions, alkalinity, COD, DNA, PLFAs, VFAs	Laboratory and field parameters

Notes:

[1]Refer to Figure 1 for well locations.
[2]Not all analytes run on all wells.
[3]Data from injection well samples were used to help assess whether a final round of bioaugmentation would be of benefit, and where it could be optimally applied.

COD – chemical oxygen demand
DHC – *Dehalococcoides* spp.
DNA – deoxyribonucleic acid
PLFA – phospholipid fatty acids
TDS – total dissolved solids
VFA – volatile fatty acids
VOC – volatile organic compound

TABLE 2

COD, VFA, DHC, AND PLFA DATA COLLECTED IN FEBRUARY AND APRIL 2008

Location	COD (mg/L)	Acetic Acid (mg/L)	Propionic Acid (mg/L)	Butyric Acid (mg/L)	DHC (cells/L)	Total PLFA Biomass (cells/L)
MW-40-07[1]	NA	NA	NA	NA	<8.33E+02	NA
MW-40-07	1010	NA	NA	NA	NA	NA
MW-40-14	14.2	NA	NA	NA	NA	NA
MW-40-30[1]	NA	NA	NA	NA	8.20E+05	NA
MW-40-30	12.1	1U	1U	1U	3.01E+07	3.84E+09
MW-40-32[1]	NA	NA	NA	NA	2.12E+06	NA
MW-40-32	273	83	112.6	1U	1.88E+08	4.57E+08
MW-40-34	601	185.8	213.4	15.1	7.41E+06	5.24E+09
MW-40-36	1090	261.8	486.3	20.2	1.34E+07	3.56E+09
MW-40-37[1]	NA	NA	NA	NA	1.94E+06	NA
MW-40-37	14.2	1U	1U	1U	6.38E+06	1.36E+09
IW-1	10.0 U	NA	NA	NA	NA	NA
IW-2	33.5	NA	NA	NA	NA	NA
IW-3	31.4	NA	NA	NA	NA	NA
IW-4	20.7	NA	NA	NA	NA	NA
IW-5	77.7	NA	NA	NA	NA	NA
IW-6	10.0 U	NA	NA	NA	NA	NA
IW-7	22.8	NA	NA	NA	NA	NA
IW-8	40.0	NA	NA	NA	NA	NA
IW-9	33.4	NA	NA	NA	NA	NA
IW-10	20.7	NA	NA	NA	NA	NA
IW-12	10.0 U	NA	NA	NA	NA	NA
IW-13	10.0 U	NA	NA	NA	NA	NA
IW-14	10.0 U	NA	NA	NA	NA	NA
IW-15	610	NA	NA	NA	NA	NA
IW-17	24.7	NA	NA	NA	NA	NA
IW-18	16.2	NA	NA	NA	NA	NA
IW-19	20.5	NA	NA	NA	NA	NA

Notes:

Pyruvic acid, lactic acid, and formic acid were not detected.

[1] Samples collected on 02/07/2008

cells/L – cells per liter
COD – chemical oxygen demand
DHC – *Dehalococcoides* spp.
mg/L – milligrams per liter
NA – not analyzed
PLFA – phospholipid fatty acid
VFA – volatile fatty acid

TABLE 3

ANIONS, ALKALINITY, DO, ORP, AND pH DATA COLLECTED DURING APRIL 2008

Location	Chloride (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	DO (mg/L)	ORP (mV)	pH (pH units)
MW-40-07	347	0.200 U	0.104	0.983	1360	0.32	-168	6.36
MW-40-14	NA	NA	NA	NA	NA	0.49	-146	6.30
MW-40-30	170	0.100 U	0.0686 J	123	810	0.49	-142	6.59
MW-40-32	137	0.200 U	0.0892 J	1.16	1190	0.48	-174	6.58
MW-40-34	NA	NA	NA	NA	NA	0.19	-202	6.44
MW-40-36	277	0.100 U	0.0896 J	0.952	970	0.37	-164	6.38
MW-40-37	449	0.100 U	0.108	208	650	0.44	-117	6.79
IW-1	NA	NA	NA	NA	NA	0.51	-139	6.66
IW-2	NA	NA	NA	NA	NA	0.66	-112	6.59
IW-3	NA	NA	NA	NA	NA	0.30	-101	6.92
IW-4	NA	NA	NA	NA	NA	0.15	-68	6.23
IW-5	NA	NA	NA	NA	NA	0.28	-173	7.36
IW-6	NA	NA	NA	NA	NA	0.62	-138	6.39
IW-7	NA	NA	NA	NA	NA	0.33	-75	6.75
IW-8	NA	NA	NA	NA	NA	0.38	-153	6.97
IW-9	NA	NA	NA	NA	NA	0.59	-188	6.73
IW-10	NA	NA	NA	NA	NA	0.28	-42	6.10
IW-12	NA	NA	NA	NA	NA	0.63	-112	6.30
IW-13	NA	NA	NA	NA	NA	0.40	-89	6.20
IW-14	NA	NA	NA	NA	NA	0.30	-112	6.33
IW-15	NA	NA	NA	NA	NA	0.17	-173	6.77
IW-17	NA	NA	NA	NA	NA	0.72	-150	6.88
IW-18	NA	NA	NA	NA	NA	0.43	-53	6.36
IW-19	NA	NA	NA	NA	NA	0.46	-107	6.74

Notes:

DO – dissolved oxygen
mg/L – milligrams per liter
mV – millivolt
NA – not analyzed
ORP – oxidation/reduction potential

TABLE 4

ASSESSMENT OF RECOMMENDED MONITORING FREQUENCY FOR ALL MONITORING WELLS

Well	Exceedance (Based on April 2008 data, unless otherwise noted)	Is COC Asymptotic for Two Quarters?[1, 2]	Is COC < 10 Times MCL?[1]	Is COC < MCL for 1 year?[1]	Comments	Recommendation
MW-40-02	DCE - 6.6 μg/L	Yes	Yes	No	As shown on Figure 7, a DCE concentration of 6.6 mg/L was reported in July 2007; however, the overall trends are still judged to be asymptotic for this well, and quarterly monitoring is not recommended.	Semiannual monitoring
MW-40-06	None	Yes	Yes	Yes	None	Annual monitoring
MW-40-07	DCE - 42 μg/L VC - 5.4 μg/L	Yes	No	No	None	Quarterly monitoring
MW-40-08	PCE - 6.8 μg/L	Yes	Yes	No	Exceedence was measured during January 2008	Semiannual monitoring
MW-40-10	None	Yes	Yes	Yes	None	Annual monitoring
MW-40-11	None	Yes	Yes	Yes	None	Annual monitoring
MW-40-13	None	Yes	Yes	Yes	None	Annual monitoring
MW-40-14	TCE - 6 μg/L DCE - 20 μg/L VC - 4 μg/L	No	Yes	No	Current trend indicates potential rebound	Quarterly monitoring
MW-40-15	None	Yes	Yes	Yes	None	Annual monitoring
MW-40-16	None	Yes	Yes	Yes	None	Annual monitoring
MW-40-17	None	Yes	Yes	Yes	None	Annual monitoring
MW-40-18	None	Yes	Yes	Yes	None	Annual monitoring
MW-40-20	None	Yes	Yes	Yes	None	Annual monitoring
MW-40-22	None	Yes	Yes	Yes	None	Annual monitoring
MW-40-30	DCE - 86 μg/L VC - 8.3 μg/L	No	No	No	None	Quarterly monitoring
MW-40-31	None	Yes	Yes	Yes	None	Annual monitoring

TABLE 4

ASSESSMENT OF RECOMMENDED MONITORING FREQUENCY FOR ALL MONITORING WELLS

Well	Exceedance (Based on April 2008 data, unless otherwise noted)	Is COC Asymptotic for Two Quarters?[1, 2]	Is COC < 10 Times MCL?[1]	Is COC < MCL for 1 year?[1]	Comments	Recommendation
MW-40-32	DCE - 20 μg/L VC - 4.8 μg/L	Yes	Yes	No	Slight increase in DCE concentration measured during the April 2008 event, but overall trend suggests that DCE concentration is essentially asymptotic	Semiannual monitoring
MW-40-33	None	Yes	Yes	Yes	None	Annual monitoring
MW-40-34	VC - 1.7μg/L	Yes	Yes	No	None	Semiannual monitoring
MW-40-35	None	Yes	Yes	Yes	None	Annual monitoring
MW-40-36	DCE - 11 μg/L VC - 4.6 μg/L	Yes	Yes	No	None	Semiannual monitoring
MW-40-37	DCE - 58 μg/L VC - 12 μg/L	Yes	No	No	None	Quarterly monitoring
MW-40-38	None	Yes	Yes	Yes	None	Annual monitoring
MW-40-39	None	Yes	Yes	Yes	None	Annual monitoring

Notes:

Refer to Figures 1 and 7 for concentrations and overall trends.

[1]Criteria as defined in Figure 6-2, Remedial Action and Monitoring Flow Chart, Final Work Plan (TtEC, 2005).

[2]For wells with current exceedences, these determinations were made based on trends presented in Figure 1.

μg/L – micrograms per liter
COC – chemical of concern
DCE – dichloroethene
MCL – maximum contaminant level
mg/L – milligrams per liter
PCE – tetrachloroethene
TCE – trichloroethene
VC – vinyl chloride

FIGURES

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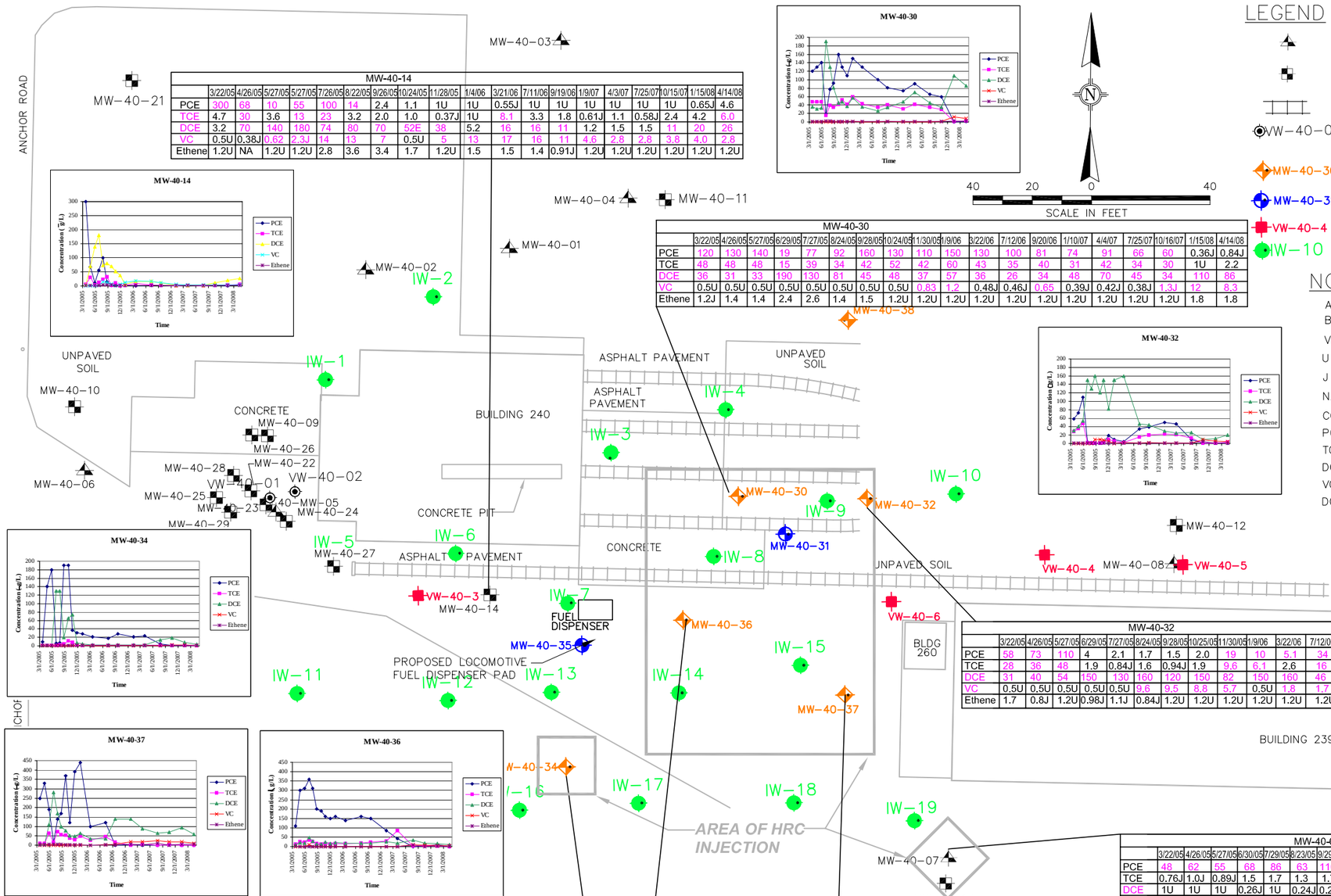
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV:
DRAWN BY: MD
DATE: 04/23/08

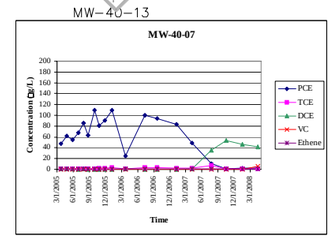


MW-40-14	3/22/05	4/26/05	5/27/05	5/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	4/3/07	7/25/07	10/15/07	1/15/08	4/14/08
PCE	300	68	10	55	100	14	2.4	1.1	1U	1U	0.55J	1U	1U	1U	1U	1U	1U	0.65J	4.6
TCE	4.7	30	3.6	13	23	3.2	2.0	1.0	0.37J	1U	8.1	3.3	1.8	0.61J	1.1	0.58J	2.4	4.2	6.0
DCE	3.2	70	140	180	74	80	70	52E	38	5.2	16	16	11	1.2	1.5	1.5	11	20	26
VC	0.5U	0.38J	0.62	2.3J	14	13	7	0.5U	5	13	17	16	11	4.6	2.8	2.8	3.8	4.0	2.8
Ethene	1.2U	NA	1.2U	1.2U	2.8	3.6	3.4	1.7	1.2U	1.5	1.5	1.4	0.91J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-30	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/24/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/15/08	4/14/08
PCE	120	130	140	19	77	92	160	130	110	150	130	100	81	74	91	66	60	0.36J	0.84J
TCE	48	48	48	15	39	34	42	52	42	60	43	35	40	31	42	34	30	1U	2.2
DCE	36	31	33	190	130	81	45	48	37	57	36	26	34	48	70	45	34	110	86
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.83	1.2	0.48J	0.46J	0.65	0.39J	0.42J	0.38J	1.3J	12	8.3
Ethene	1.2J	1.4	1.4	2.4	2.6	1.4	1.5	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.8	1.8

MW-40-32	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/25/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/16/08	4/14/08
PCE	58	73	110	4	2.1	1.7	1.5	2.0	19	10	5.1	34	39	50	47	10	1U	0.74J	0.60J
TCE	28	36	48	1.9	0.84J	1.6	0.94J	1.9	9.6	6.1	2.6	16	20	23	22	13	1.4	1.3	3.1
DCE	31	40	54	150	130	160	120	150	82	150	160	46	44	30	25	26	10	12	20
VC	0.5U	0.5U	0.5U	0.5U	0.5U	9.6	9.5	8.8	5.7	0.5U	1.8	1.7	1.8	1.2	0.97	1.6	9.5	5.6	4.8
Ethene	1.7	0.8J	1.2U	0.98J	1.1J	0.84J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	4.9	0.99J	0.88J

MW-40-07	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/28/05	1/6/06	3/23/06	7/11/06	9/21/06	1/9/07	4/4/07	7/25/07	10/16/07	1/15/08	4/14/08
PCE	48	62	55	68	86	63	110	81E	90	110	25	100	94	83	49	11	1.4J	2.8	2.6
TCE	0.76J	1.0J	0.89J	1.5	1.7	1.3	1.7	2.0	2.4	3.7	0.85J	3.2	3.1	2.7	1.8	6.7	1U	1.7	1.7
DCE	1U	1U	1U	0.26J	1U	0.24J	0.23J	0.28J	0.34J	0.41J	1U	0.31J	0.43J	0.34J	1U	36	54	47	42
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	5.4
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.95J	1.2U	1.2U	1.2U



MW-40-34	3/22/05	4/26/05	5/27/05	6/28/05	7/26/05	8/22/05	9/27/05	10/24/05	11/28/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/16/08	4/14/08
PCE	9.1	140	180	5.8	6.8	190	190	37	31	29	22	18	28	22	24	4.5	1U	1U	1U
TCE	1U	1.2	1.6	1.3	2.1	5	12	8.1	2.1	1.3	0.64J	0.92J	1.2	1.0	1.2	1.3	1.4J	0.65J	0.25J
DCE	1U	1U	0.24J	130	130	20	65	74	7.5	4.7	2.1	2.3	2.8	1.8	1.9	14	19	8.5	3.0
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.1	1.6	0.59	0.55	0.67	0.53	0.66	0.5U	2.2J	2.6	1.7
Ethene	1.2U	1.2U	1.2U	1.1J	0.8J	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-36	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/24/05	11/30/05	1/6/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/16/08	4/14/08
PCE	110	300	310	360	310	200	190	160	150	160	140	160	150	87	44	1.0	2.8J	1.1	1U
TCE	13	28	25	34	28	16	14	16	13	16	15	18	24	30	85	2.0	4.7J	2.1	0.68J
DCE	11	22	18	49	29	14	13	24	17	22	20	18	20	26	18	35	19	17	11
VC	0.5U	0.5U	0.5U	10	0.5U	0.5U	0.5U	0.5U	0.23J	0.6	0.41J	0.42J	0.6	0.95	0.65	9.6	7.2	6.5	4.6
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	6.9	1.2U	2.9	2.1

MW-40-37	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/25/05	11/30/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/15/07	1/16/08	4/14/08
PCE	250	330	190	15	140	170	370	120E	390	440	100	120	1.3	2.1	1.1	0.31J	1.8J	0.36J	1U
TCE	12	12	63	16	72	56	53	38	29	48	28	46	16	0.94J	4.9	0.36J	3.1J	1.3	1.3
DCE	5.0	4.9	110	280	170	100	79	50E	48	63	35	36	140	140	89	64	69	94	58
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.2	3.6	4.5	18	18	24	18	18	12
Ethene	1.5	3.7	4.6	5.7	5.0	4.1	3.5	2.9	2.9	3.0	1.2U	2	2.6	4.1	3.0	11	1.2U	6.5	4.6

NOTE:

WITH THE EXCEPTION OF MW-40-08 (PCE=6.8 µg/L, 1/16/08), ALL COC CONCENTRATIONS IN OTHER WELLS HAVE BEEN BELOW RESPECTIVE MCLs FOR AT LEAST 1 YEAR.

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 INJECTION WELL LOCATION (INSTALLED MARCH 2005)

40 20 0 40
SCALE IN FEET

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (µg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA.
U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
COC CHEMICAL OF CONCERN
PCE TETRACHLOROETHENE
TCE TRICHLOROETHENE
DCE DICHLOROETHENE
VC VINYL CHLORIDE
DCE VALUES FOR (1)-1,2-DCE REPORTED

Figure 1

COC CONCENTRATIONS AND TRENDS IN SHALLOW AND MID-SHALLOW MONITORING WELLS SAMPLED DURING APRIL, 2008

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

P:\3210-RAC IV\CTO-0010\DWG\080870\08087001.DWG
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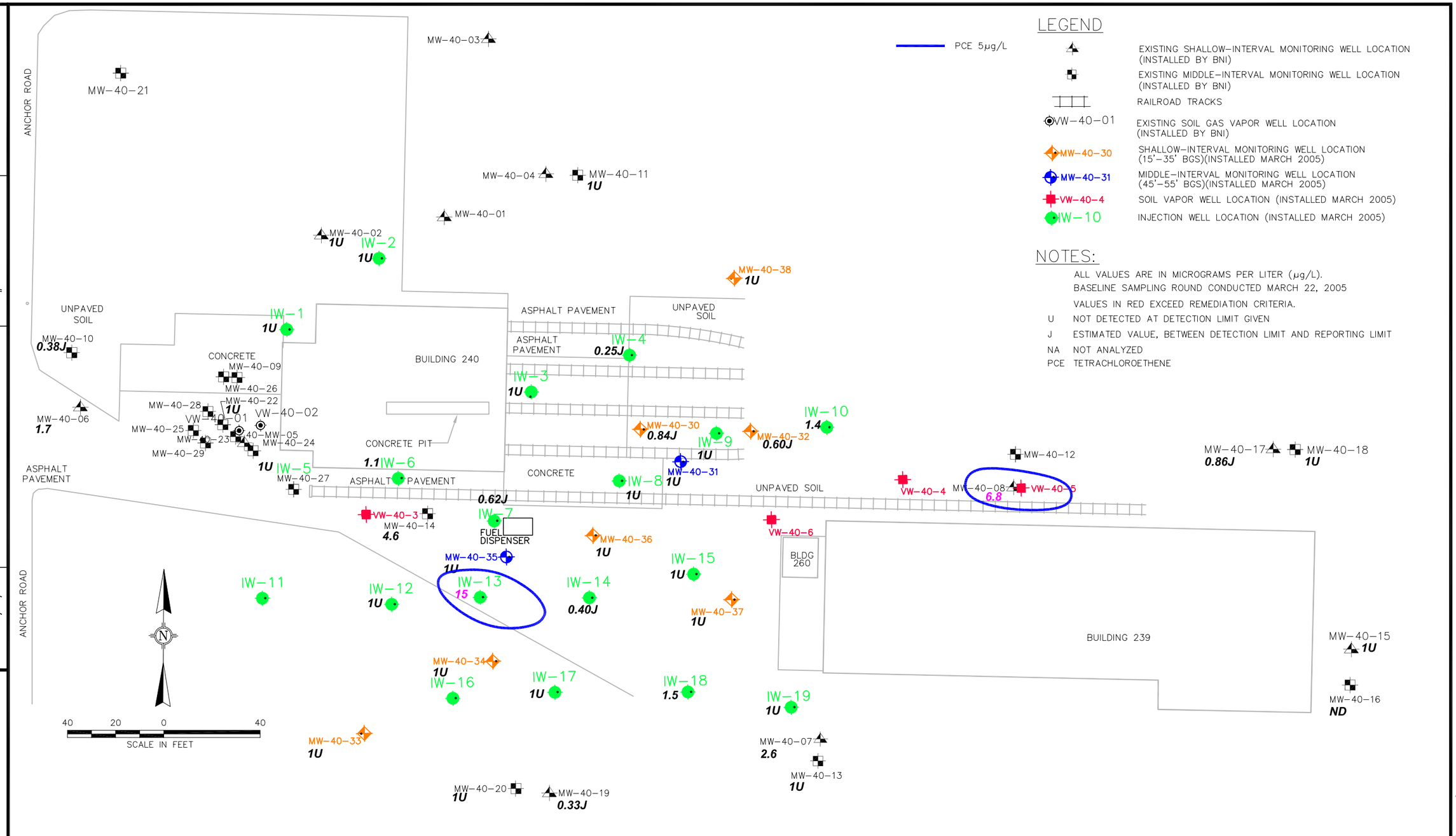

NOTE:

MOST RECENT DATA PRESENTED FOR BOTH SHALLOW AND MID INTERVAL WELLS. INJECTION WELLS ARE ALL SCREENED IN THE SHALLOW INTERVAL. INTERPRETED PLUMES ARE PRESENTED IN SHALLOW LAYER ONLY.

Figure 2

INTERPRETED PLUME EXTENTS FOR PCE BASED ON MOST CURRENT DATA

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 08087002.DWG
DCN: ECSD-2201-0008-0870
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV:
DRAWN BY: MD
DATE: 05/21/08

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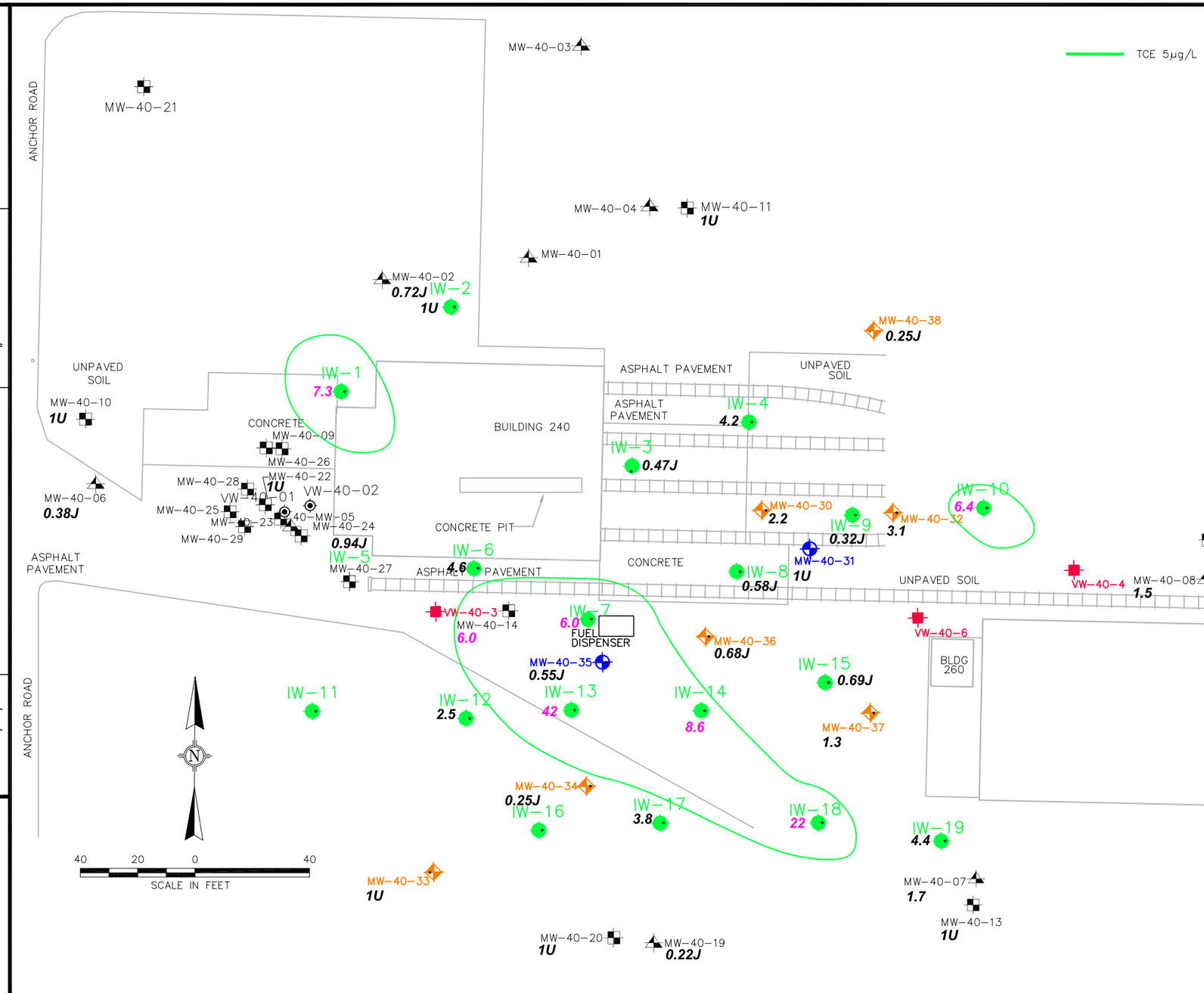

LEGEND

TCE 5µg/L

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 INJECTION WELL LOCATION (INSTALLED MARCH 2005)

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (µg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
TCE TRICHLOROETHENE

NOTE:

MOST RECENT DATA PRESENTED FOR BOTH SHALLOW AND MID INTERVAL WELLS. INJECTION WELLS ARE ALL SCREENED IN THE SHALLOW INTERVAL. INTERPRETED PLUMES ARE PRESENT IN THE SHALLOW LAYER WITH THE EXCEPTION OF THE AREA AROUND MW-40-14.

Figure 3

INTERPRETED PLUME EXTENTS FOR TCE BASED ON MOST CURRENT DATA

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 08087003.DWG
DCN: ECSD-2201-0008-0870
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV:
DRAWN BY: MD
DATE: 05/21/08

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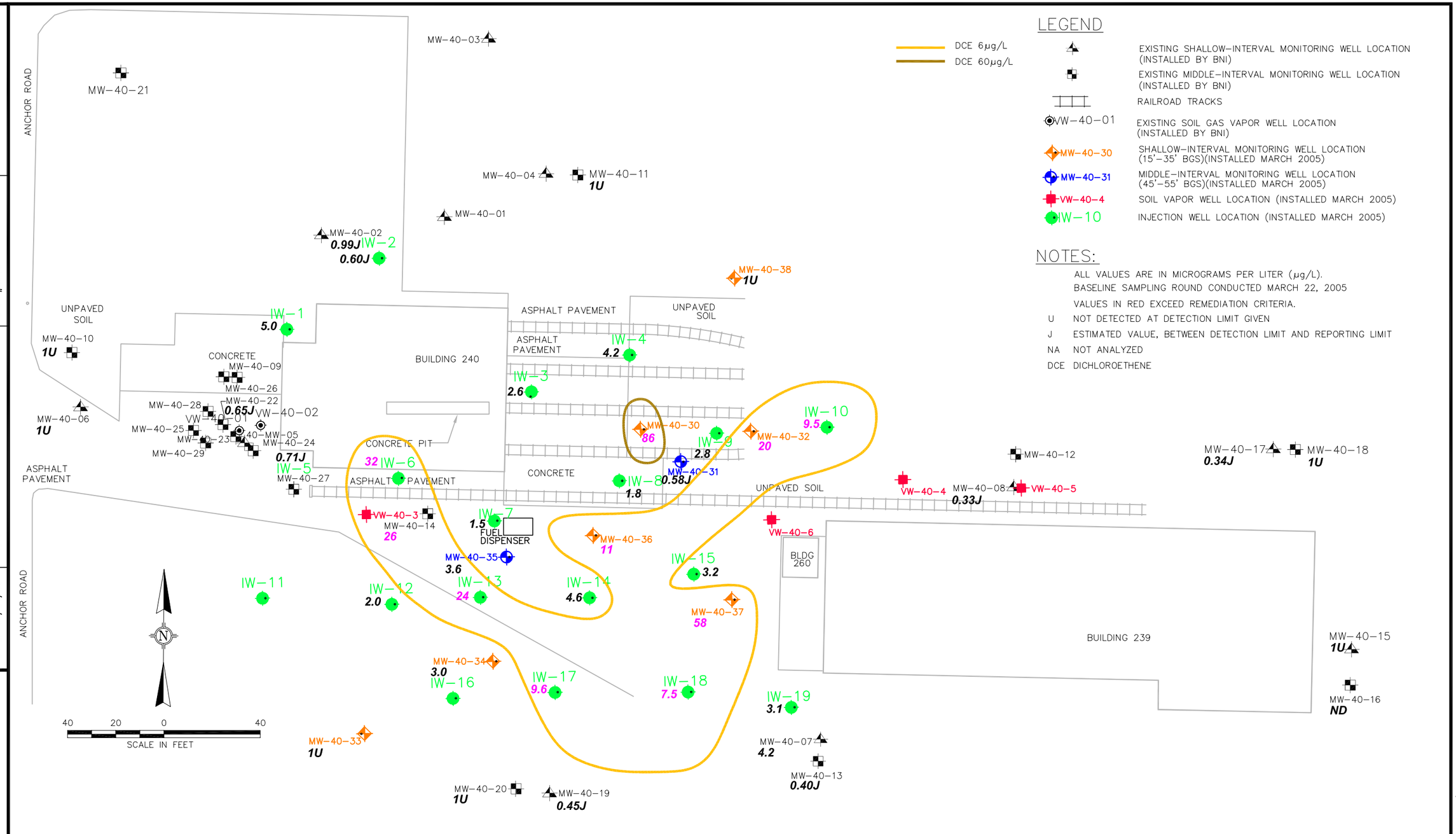

NOTE:

MOST RECENT DATA PRESENTED FOR BOTH SHALLOW AND MID INTERVAL WELLS. INJECTION WELLS ARE ALL SCREENED IN THE SHALLOW INTERVAL. INTERPRETED PLUMES ARE PRESENT IN SHALLOW LAYER WITH THE EXCEPTION OF THE AREA AROUND MW-40-14.

Figure 4

INTERPRETED PLUME EXTENTS FOR DCE BASED ON MOST CURRENT DATA

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 08087004.DWG
DCN: ECSD-2201-0008-0870
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV:
DRAWN BY: MD
DATE: 05/21/08

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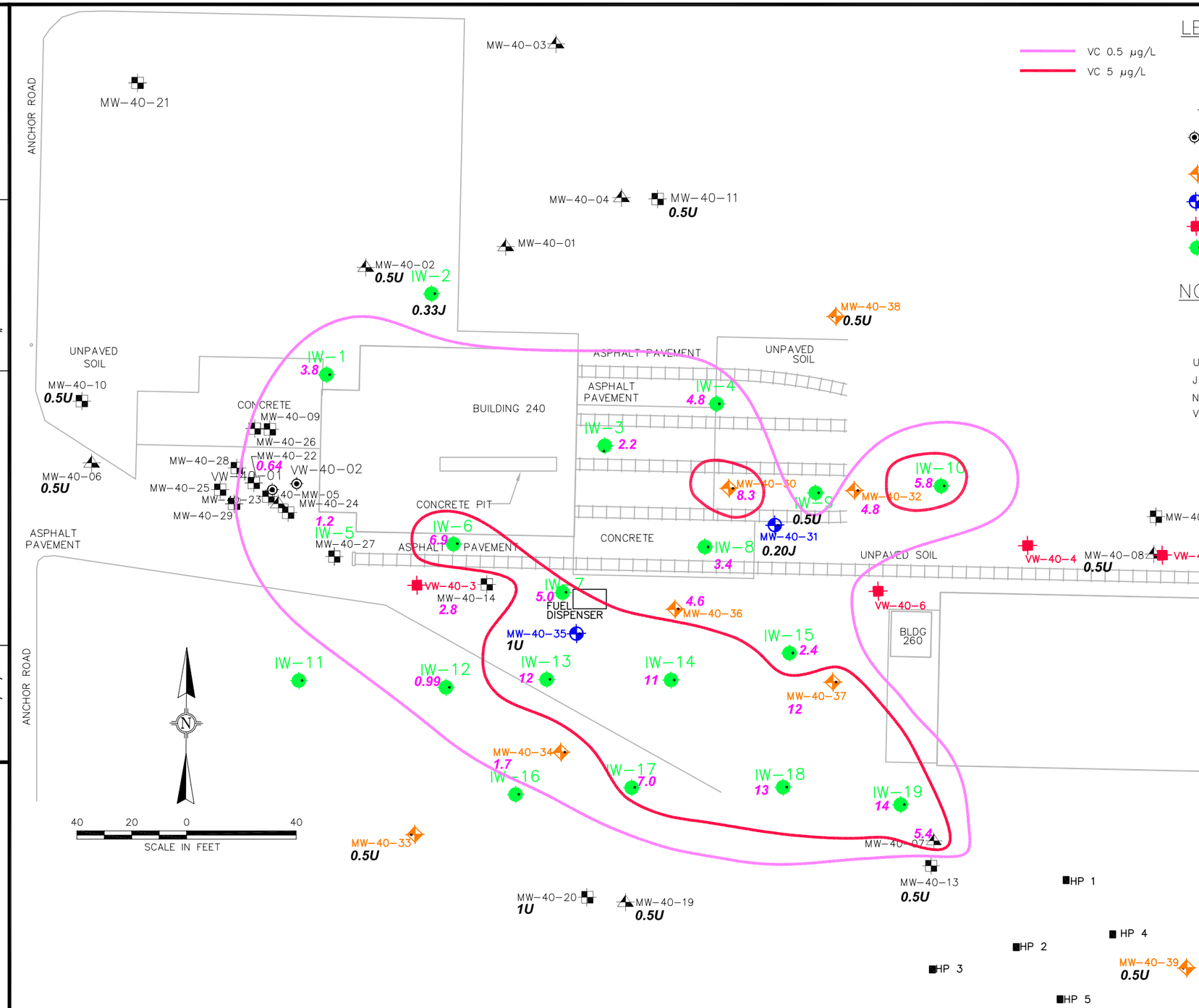

LEGEND

- VC 0.5 µg/L
- VC 5 µg/L
- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 INJECTION WELL LOCATION (INSTALLED MARCH 2005)

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (µg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
VC VINYL CHLORIDE

NOTE:

MOST RECENT DATA PRESENTED FOR BOTH SHALLOW AND MID INTERVAL WELLS. INJECTION WELLS ARE ALL SCREENED IN THE SHALLOW INTERVAL. INTERPRETED PLUMES ARE PRESENT MOSTLY IN SHALLOW LAYER WITH THE EXCEPTION OF THE EASTERN PORTION OF THE PLUME WHERE VERY LOW LEVELS OF RESIDUAL VC ARE PRESENT.

Figure 5

INTERPRETED PLUME EXTENTS FOR VC BASED ON MOST CURRENT DATA

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 08087005.DWG
DCN: ECSD-2201-0008-0870
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV:
DRAWN BY: MD
DATE: 05/21/08

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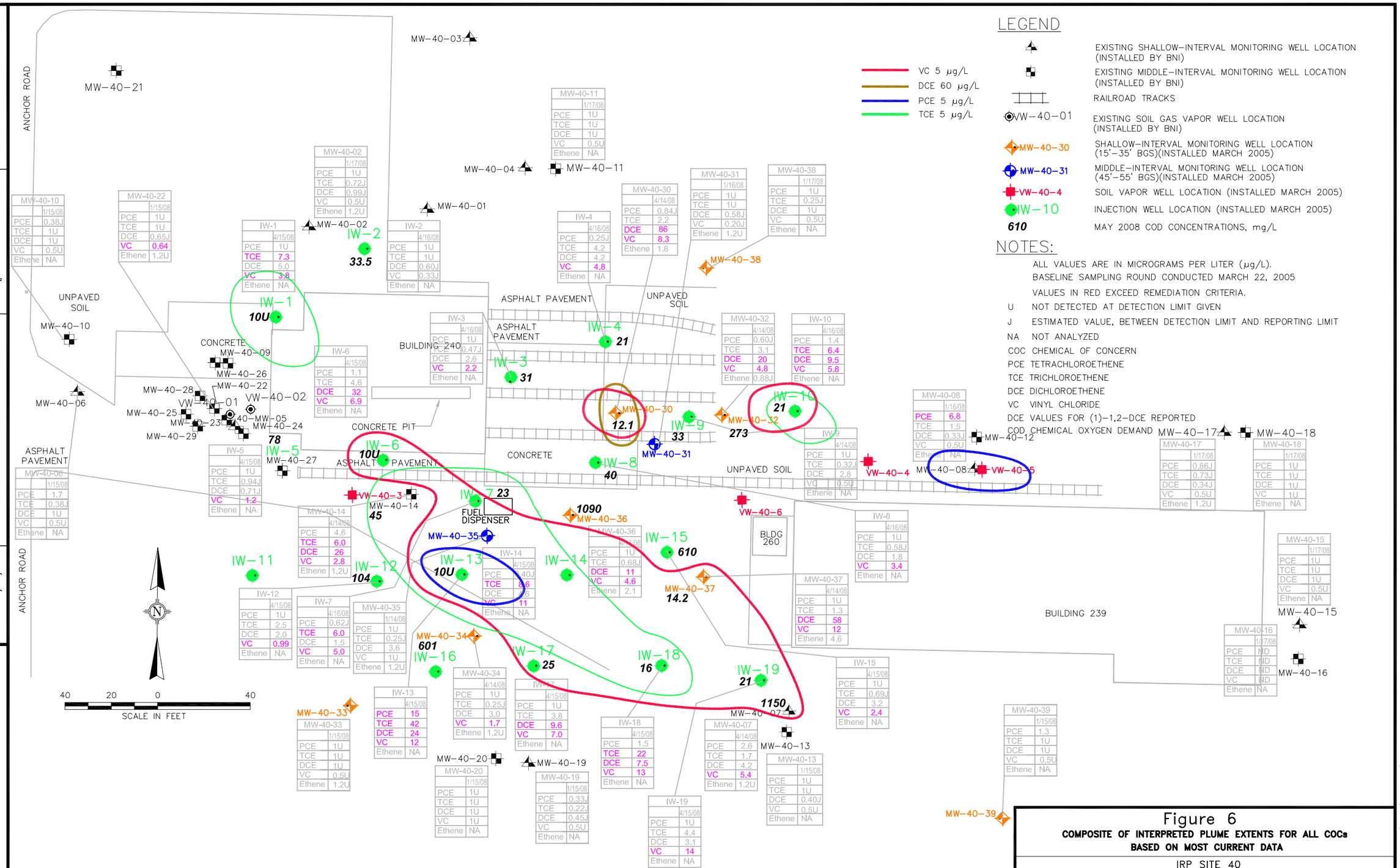
PLOT/UPDATE: JUN 13 2008 10:54:16

DRAWING NO: 08087006.DWG
DCN: ECSD-2201-0008-0870
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV:
DRAWN BY: MD
DATE: 05/21/08



MW-40-10	1/15/08
PCE	0.38J
TCE	1U
DCE	1U
VC	0.5U
Ethene	NA

MW-40-22	1/15/08
PCE	1U
TCE	1U
DCE	0.65J
VC	0.64
Ethene	1.2U

MW-40-02	1/17/08
PCE	1U
TCE	0.72J
DCE	0.99J
VC	0.5U
Ethene	1.2U

MW-40-11	1/17/08
PCE	1U
TCE	1U
DCE	1U
VC	0.5U
Ethene	NA

IW-1	4/15/08
PCE	1U
TCE	7.3
DCE	5.0
VC	3.8
Ethene	NA

IW-2	4/16/08
PCE	1U
TCE	1U
DCE	0.60J
VC	0.33J
Ethene	NA

IW-4	4/16/08
PCE	0.25J
TCE	4.2
DCE	4.2
VC	4.8
Ethene	NA

MW-40-30	4/14/08
PCE	0.84J
TCE	2.2
DCE	86
VC	8.3
Ethene	1.8

MW-40-31	1/16/08
PCE	1U
TCE	1U
DCE	0.58J
VC	0.20J
Ethene	1.2U

MW-40-38	1/17/08
PCE	1U
TCE	0.25J
DCE	1U
VC	0.5U
Ethene	NA

IW-3	4/16/08
PCE	1U
TCE	0.47J
DCE	2.6
VC	2.2
Ethene	NA

IW-6	4/15/08
PCE	1.1
TCE	4.6
DCE	32
VC	6.9
Ethene	NA

MW-40-32	4/14/08
PCE	0.60J
TCE	3.1
DCE	20
VC	4.8
Ethene	0.88J

IW-10	4/16/08
PCE	1.4
TCE	6.4
DCE	9.5
VC	5.8
Ethene	NA

MW-40-08	1/16/08
PCE	6.8
TCE	1.5
DCE	0.33J
VC	0.5U
Ethene	NA

IW-9	4/14/08
PCE	1U
TCE	0.32J
DCE	2.8
VC	0.5U
Ethene	NA

IW-5	4/15/08
PCE	1U
TCE	0.94J
DCE	0.71J
VC	1.2
Ethene	NA

MW-40-06	1/15/08
PCE	1.7
TCE	0.38J
DCE	1U
VC	0.5U
Ethene	NA

MW-40-14	4/14/08
PCE	4.6
TCE	6.0
DCE	26
VC	2.8
Ethene	1.2U

MW-40-36	4/14/08
PCE	1U
TCE	0.68J
DCE	11
VC	4.6
Ethene	2.1

IW-14	4/15/08
PCE	0.40J
TCE	8.6
DCE	6
VC	11
Ethene	NA

IW-8	4/16/08
PCE	1U
TCE	0.58J
DCE	1.8
VC	3.4
Ethene	NA

MW-40-37	4/14/08
PCE	1U
TCE	1.3
DCE	58
VC	12
Ethene	4.6

MW-40-15	1/17/08
PCE	1U
TCE	1U
DCE	1U
VC	0.5U
Ethene	NA

MW-40-16	1/17/08
PCE	ND
TCE	ND
DCE	ND
VC	ND
Ethene	NA

IW-12	4/15/08
PCE	1U
TCE	2.5
DCE	2.0
VC	0.99
Ethene	NA

IW-7	4/16/08
PCE	0.62J
TCE	6.0
DCE	1.5
VC	5.0
Ethene	NA

MW-40-35	1/14/08
PCE	1U
TCE	0.25J
DCE	3.6
VC	1U
Ethene	1.2U

IW-15	4/15/08
PCE	1U
TCE	0.69J
DCE	3.2
VC	2.4
Ethene	NA

MW-40-39	1/15/08
PCE	1.3
TCE	1U
DCE	1U
VC	0.5U
Ethene	NA

MW-40-33	1/15/08
PCE	1U
TCE	1U
DCE	1U
VC	0.5U
Ethene	1.2U

IW-13	4/15/08
PCE	15
TCE	42
DCE	24
VC	12
Ethene	NA

MW-40-34	4/14/08
PCE	1U
TCE	0.25J
DCE	3.0
VC	1.7
Ethene	1.2U

IW-17	4/15/08
PCE	1U
TCE	3.8
DCE	9.6
VC	7.0
Ethene	NA

IW-18	4/15/08
PCE	1.5
TCE	22
DCE	7.5
VC	13
Ethene	NA

MW-40-07	4/14/08
PCE	2.6
TCE	1.7
DCE	4.2
VC	5.4
Ethene	1.2U

MW-40-13	1/15/08
PCE	1U
TCE	1U
DCE	0.40J
VC	0.5U
Ethene	NA

MW-40-20	1/15/08
PCE	1U
TCE	1U
DCE	1U
VC	1U
Ethene	NA

MW-40-19	1/15/08
PCE	0.33J
TCE	0.22J
DCE	0.45J
VC	0.5U
Ethene	NA

IW-19	4/15/08
PCE	1U
TCE	4.4
DCE	3.1
VC	14
Ethene	NA

MW-40-17	1/17/08
PCE	0.86J
TCE	0.73J
DCE	0.34J
VC	0.5U
Ethene	1.2U

MW-40-18	1/17/08
PCE	1U
TCE	1U
DCE	1U
VC	1U
Ethene	NA

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 — SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- 610 — MAY 2008 COD CONCENTRATIONS, mg/L

VC 5 µg/L
DCE 60 µg/L
PCE 5 µg/L
TCE 5 µg/L

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (µg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
COC CHEMICAL OF CONCERN
PCE TETRACHLOROETHENE
TCE TRICHLOROETHENE
DCE DICHLOROETHENE
VC VINYL CHLORIDE
DCE VALUES FOR (1)-1,2-DCE REPORTED
COD CHEMICAL OXYGEN DEMAND

NOTE:

MOST RECENT DATA PRESENTED FOR BOTH SHALLOW AND MID INTERVAL WELLS. INJECTION WELLS ARE ALL SCREENED IN THE SHALLOW INTERVAL.

Figure 6

COMPOSITE OF INTERPRETED PLUME EXTENTS FOR ALL COCs BASED ON MOST CURRENT DATA

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

P:\3210-RAC IV\CTO-0010\DWG\080870\08087006.DWG
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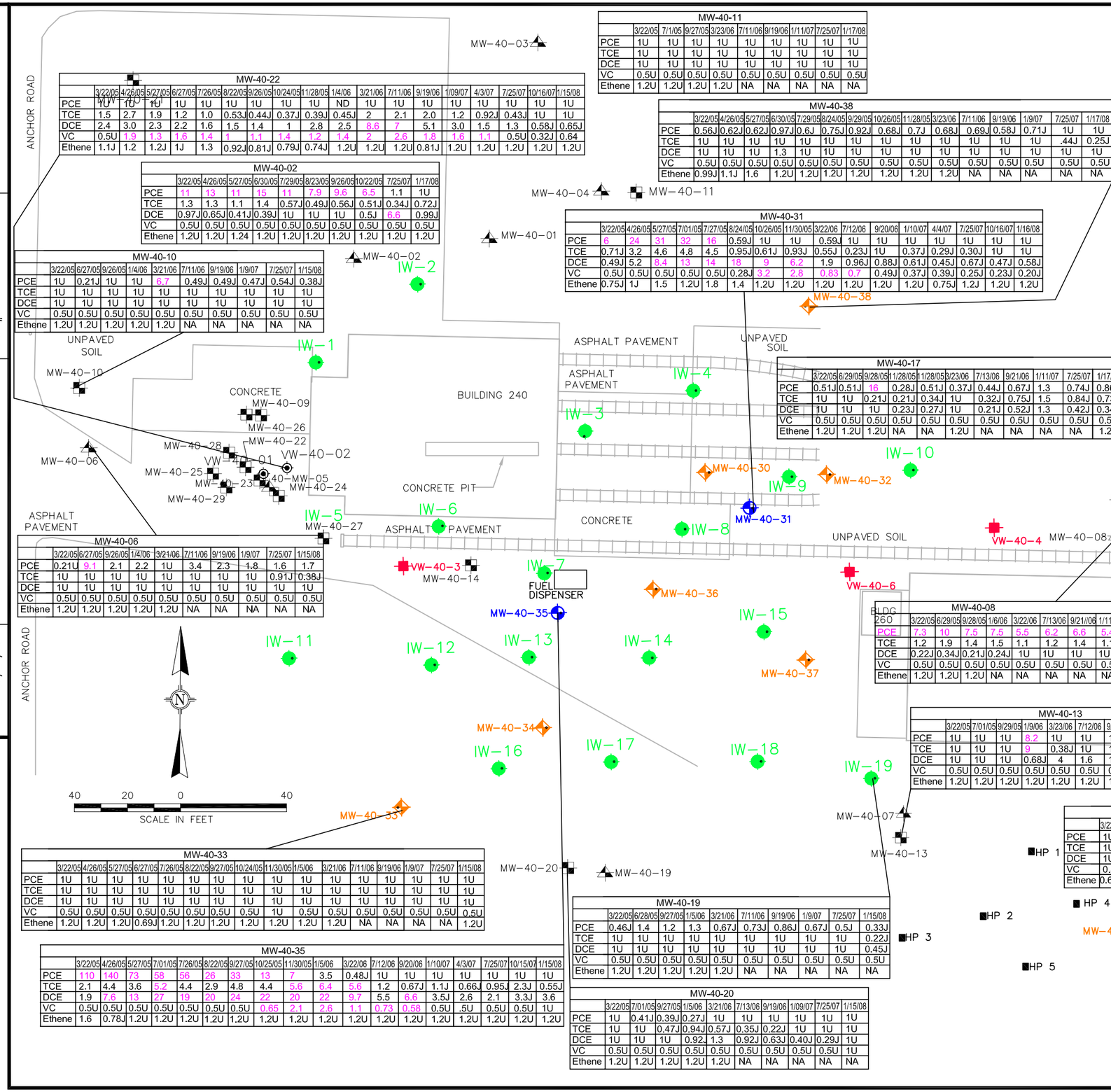

MW-40-11	3/22/05	7/1/05	9/27/05	3/23/06	7/11/06	9/19/06	1/11/07	7/25/07	1/17/08
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-22	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/09/07	4/3/07	7/25/07	10/16/07	1/15/08
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	ND	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J	0.37J	0.39J	0.45J	2	2.1	2.0	1.2	0.92J	0.43J	1U	1U
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4	1	2.8	2.5	8.6	7	5.1	3.0	1.5	1.3	0.58J	0.65J
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1	1.4	1.2	1.4	2	2.6	1.8	1.6	1.1	0.5U	0.32J	0.64
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J	0.79J	0.74J	1.2U	1.2U	1.2U	0.81J	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-02	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/26/05	10/22/05	7/25/07	1/17/08
PCE	11	13	11	15	11	7.9	9.6	6.5	1.1	1U
TCE	1.3	1.3	1.1	1.4	0.57J	0.49J	0.56J	0.51J	0.34J	0.72J
DCE	0.97J	0.65J	0.41J	0.39J	1U	1U	1U	0.5J	6.6	0.99J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.24	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-10	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	1U	0.21J	1U	1U	6.7	0.49J	0.49J	0.47J	0.54J	0.38J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-38	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/24/05	9/29/05	10/26/05	11/28/05	3/23/06	7/11/06	9/19/06	1/9/07	7/25/07	1/17/08
PCE	0.56J	0.62J	0.62J	0.97J	0.6J	0.75J	0.92J	0.68J	0.7J	0.68J	0.69J	0.58J	0.71J	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	.44J	0.25J
DCE	1U	1U	1U	1.3	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.99J	1.1J	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-31	3/22/05	4/26/05	5/27/05	7/01/05	7/27/05	8/24/05	10/26/05	11/30/05	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/16/08
PCE	6	24	31	32	16	0.59J	1U	1U	0.59J	1U	1U	1U	1U	1U	1U	1U
TCE	0.71J	3.2	4.6	4.8	4.5	0.95J	0.61J	0.93J	0.55J	0.23J	1U	0.37J	0.29J	0.30J	1U	1U
DCE	0.49J	5.2	8.4	13	14	18	9	6.2	1.9	0.96J	0.88J	0.61J	0.45J	0.67J	0.47J	0.58J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.28J	3.2	2.8	0.83	0.7	0.49J	0.37J	0.39J	0.25J	0.23J	0.20J
Ethene	0.75J	1J	1.5	1.2U	1.8	1.4	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.75J	1.2J	1.2U	1.2U

MW-40-17	3/22/05	6/29/05	9/28/05	11/28/05	11/28/05	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
PCE	0.51J	0.51J	16	0.28J	0.51J	0.37J	0.44J	0.67J	1.3	0.74J	0.86J
TCE	1U	1U	0.21J	0.21J	0.34J	1U	0.32J	0.75J	1.5	0.84J	0.73J
DCE	1U	1U	1U	0.23J	0.27J	1U	0.21J	0.52J	1.3	0.42J	0.34J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	1.2U	NA	NA	NA	NA	1.2U

MW-40-18	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
PCE	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U
Ethene	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-06	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	0.21U	9.1	2.1	2.2	1U	3.4	2.3	1.8	1.6	1.7
TCE	1U	1U	1U	1U	1U	1U	1U	1U	0.91J	0.38J
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-08	3/22/05	6/29/05	9/28/05	1/6/06	3/22/06	7/13/06	9/21//06	1/11/07	4/4/07	7/25/07	10/16/07	1/16/08
PCE	7.3	10	7.5	7.5	5.5	6.2	6.6	5.4	5.3	6.1	7.0	6.8
TCE	1.2	1.9	1.4	1.5	1.1	1.2	1.4	1.1	1.1	1.5	1.5	1.5
DCE	0.22J	0.34J	0.21J	0.24J	1U	1U	1U	1U	0.23J	0.30J	0.33J	
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA	NA	NA	NA	NA

MW-40-15	3/22/05	6/30/05	9/28/05	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
	1U	1U	0.26J	0.23J	1U	1U	1U	1U	1U	1U
	1U	1U	0.26J	0.21J	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.1J	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-13	3/22/05	7/01/05	9/29/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	7/25/07	1/15/08
PCE	1U	1U	1U	8.2	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	9	0.38J	1U	1U	1U	1U	1U
DCE	1U	1U	1U	0.68J	4	1.6	1.3	0.88J	1.7	0.40J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-16	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
PCE	1U	1U	1U	1U	1U	1U	ND
TCE	1U	1U	1U	1U	1U	1U	ND
DCE	1U	1U	1U	1U	1U	1U	ND
VC	0.5U	0.5U	1U	1U	0.5U	0.5U	ND
Ethene	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-39	3/22/05	4/26/05	4/26/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/30/05	1/6/06	3/21/06	7/11/06	9/21/06	1/9/07	7/25/07	1/15/08
PCE	1U	1U	1U	1U	0.34J	0.29J	0.35J	0.42J	0.49J	0.71J	0.72J	1.7	2.4	2.5	2.8	1.3
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	NA	NA	NA	NA	NA	NA	NA	NA

MW-40-33	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/27/05	10/24/05	11/30/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	1.2U

MW-40-35	3/22/05	4/26/05	5/27/05	7/01/05	7/26/05	8/22/05	9/27/05	10/25/05	11/30/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/15/08
PCE	110	140	73	58	56	26	33	13	7	3.5	0.48J	1U	1U	1U	1U	1U	1U	1U
TCE	2.1	4.4	3.6	5.2	4.4	2.9	4.8	4.4	5.6	6.4	5.6	1.2	0.67J	1.1J	0.66J	0.95J	2.3J	0.55J
DCE	1.9	7.6	13	27	19	20	24	22	20	22	9.7	5.5	6.6	3.5J	2.6	2.1	3.3J	3.6
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.65	2.1	2.6	1.1	0.73	0.58	0.5U	.5U	0.5U	0.5U	1U
Ethene	1.6	0.78J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-19	3/22/05	6/28/05	9/27/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	0.46J	1.4	1.2	1.3	0.67J	0.73J	0.86J	0.67J	0.5J	0.33J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	0.22J
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	0.45J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-20	3/22/05	7/01/05	9/27/05	1/5/06	3/21/06	7/13/06	9/19/06	1/09/07	7/25/07	1/15/08
PCE	1U	0.41J	0.39J	0.27J	1U	1U	1U	1U	1U	1U
TCE	1U	1U	0.47J	0.94J	0.57J	0.35J	0.22J	1U	1U	1U
DCE	1U	1U	1U	0.92J	1.3	0.92J	0.63J	0.40J	0.29J	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 — SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (μg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05
PCE TETRACHLOROETHENE
TCE TRICHLOROETHENE
DCE DICHLOROETHENE
VC VINYL CHLORIDE

Figure 7

COC CONCENTRATIONS IN SHALLOW AND MID-SHALLOW MONITORING WELLS NOT SAMPLED DURING APRIL, 2008

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 08087007.DWG
DCN: ECSD-2201-0008-0870
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV:
DRAWN BY: MD
DATE: 05/21/08

P:\3210-RAC IV\CTO-0010\DWG\080870\08087007.DWG
PLOT/UPDATE: MAY 28 2008 16:53:45

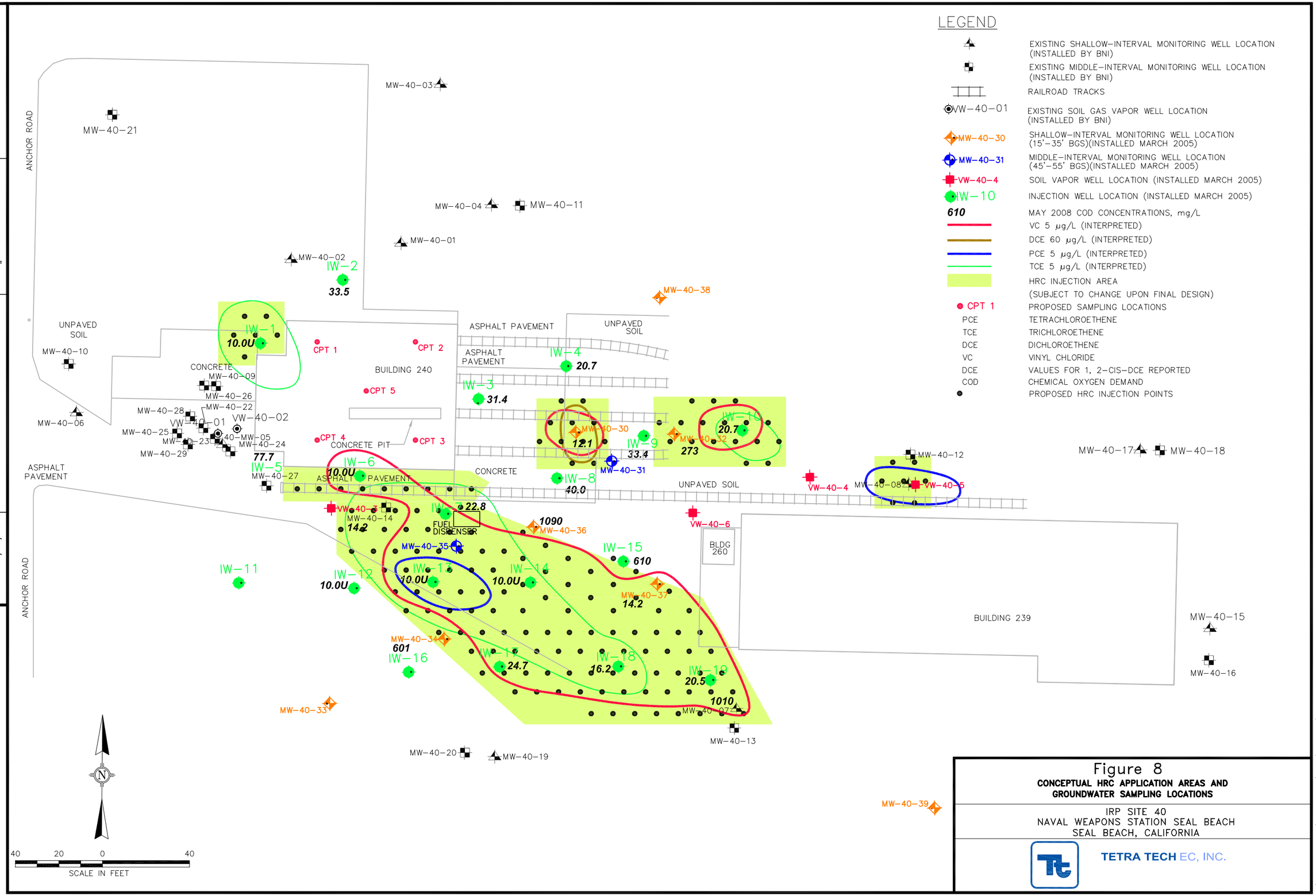

Figure 8
CONCEPTUAL HRC APPLICATION AREAS AND GROUNDWATER SAMPLING LOCATIONS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 08087008.DWG
DCN: ECSD-2201-0008-0870
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV:
DRAWN BY: MD
DATE: 06/20/08

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PLOT/UPDATE: JUL 08 2008 16:58:52

TETRA TECH EC, INC.

SUMMARY OF FIELD ACTIVITIES AND DATA FOR JULY 2008 MONITORING EVENT ENHANCED IN SITU BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS

INSTALLATION RESTORATION PROGRAM SITE 40 NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CA

Date: August 20, 2008

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Agencies
Patricia Hannon (Water Board)
Stephen Niou (DTSC)

This summary report provides an overview of monitoring activities conducted during July 2008 in association with enhanced in situ bioremediation (EISB) of groundwater at Installation Restoration Program (IRP) Site 40 at Naval Weapons Station Seal Beach, Seal Beach, California. This report includes presentation and assessment of relevant data collected during this period. A summary of the general status of the project and recommendations based on the conclusions are also provided.

The field activities for this period included groundwater and soil gas monitoring in various wells and surface gas emissions monitoring. Monitoring activities, along with the dates they were conducted, are listed in Table 1.

Groundwater and soil gas analytical data, as well as groundwater level measurements, are briefly discussed below. For this monitoring event (July 2008), chemicals of concern (COCs) and a focused suite of microbial and geochemical parameters were assessed in groundwater samples from monitoring wells MW-40-02, -07, -08, -14, -30, -32, -34, -36, and -37. These wells were proposed for either quarterly or semiannual monitoring based on established criteria as discussed in the prior report (May 2008). Most of these wells are key compliance wells located in the central portion of the site where low-level contamination is still being detected.

Presentation of Data

Wells proposed for annual monitoring were not sampled during the July 2008 event. Data from past events for these wells are presented on Figure 1 and are not further discussed. Data from wells proposed for semiannual monitoring (MW-40-02, -07, -08, -14, and -34) were sampled during this event, and the data are presented on Figure 2. Wells proposed for quarterly monitoring (MW-40-30, -32 -36, -and -37) were also sampled during this event, and the data are presented on Figure 3.

Continuing Evaluation of HRC® Migration/Persistence and COCs

This subsection provides a summary of data collected during July 2008 to assess Hydrogen Release Compound (HRC®) migration and its effects, followed by key observations regarding COC concentrations in the selected groundwater monitoring wells during the July 2008 event.

Continuing evaluation of HRC migration primarily included assessment of shallow interval groundwater monitoring wells MW-40-07, -30, -32, -34, -36, and -37 (Refer to Figure 1 for well locations). These monitoring wells are located within the areas where HRC was initially injected in April 2007. Each of these wells is still impacted by one or more COCs at levels exceeding their respective maximum contaminant levels (MCLs), and each is located in the area expected to be influenced by the HRC. Chemical oxygen demand (COD) has been measured over the duration of the project to evaluate lactate presence and to assess the migration and persistence of HRC near these wells. Additionally, volatile fatty acids (VFAs), including acetic acid, propionic acid, and butyric acid, are breakdown products of HRC, and their presence indicates microbial activity is occurring as microbes degrade the HRC.

COD and VFA

COD and VFA data are presented in Table 2.

- The July 2008 COD concentrations were somewhat lower than those measured during the prior (April 2008) event, but they continued to remain elevated in wells MW-40-07 (624 milligrams per liter [mg/L]), MW-40-32 (121 mg/L), MW-40-34 (228 mg/L), and MW-40-36 (437 mg/L). During the April 2007 event (prior to the HRC injection), COD concentrations ranged from 12.3 to 53.7 mg/L in the above wells. In addition, VFAs were detected in MW-40-07, -32, -34, and -36, although again, at lower concentrations than those measured during the July 2008 event. Thus, substrate levels may be declining as expected as the HRC degrades; however, HRC is still present and being metabolized, to some extent, in these areas.
- COD concentrations in wells MW-40-30 (37.7 mg/L) and MW-40-37 (41.9 mg/L), which have the highest residual concentrations of dichloroethene (DCE), slightly exceeded the COD concentrations detected during the prior monitoring event in April 2008 (12.1 and 14.2 mg/L, respectively). However, these levels are still generally in the range considered to be background. In addition, VFAs were not detected in either of the samples collected from these wells in July 2008. These data continue to indicate that migration and metabolism of HRC in these areas are still not as significant as in other areas.
- COD concentrations in wells MW-40-02 and -14, which are located outside the HRC injection area, were 112 and 31.5 mg/L, respectively.

COC Concentrations in Semiannual Monitoring Wells

- As noted on Figure 2, MW-40-14, the only mid-shallow interval well in which COCs still exceed respective MCLs, has residual trichloroethene (TCE) (5.8 micrograms per liter [μg/L]), DCE (14 μg/L), and vinyl chloride (VC) (3.6 μg/L) at concentrations above respective MCLs (5 μg/L, 6 μg/L, and 0.5 μg/L, respectively). These values are reasonably similar to the prior results. Perchloroethene (PCE) increased slightly, from 4.6 μg/L to 5.2 μg/L, and now exceeds its MCL (5 μg/L).
- For the shallow interval wells, results for MW-40-02 (no COCs exceeding MCLs), MW-40-08 (only PCE [11 μg/L] exceeds its MCL), and MW-40-34 (only VC [1.3 μg/L] exceeds its MCL) were consistent with prior results. MW-40-07 showed a decrease in DCE concentration (from 42 μg/L to 12 μg/L), accompanied by a slight increase in VC (from 5.4 to 8.3 μg/L).

COC Concentrations in Quarterly Monitoring Wells

- Figure 3 shows that the PCE concentration in MW-40-30 increased from 0.84 J μg/L ("J" indicates an estimated value) to 5.6 μg/L, and now exceeds its MCL. PCE concentrations did not exceed the MCL in any of the other quarterly monitored wells during the July 2008 event.
- TCE also increased in MW-40-30, from 2.2 to 12 μg/L, and now exceeds its MCL. However, TCE concentrations are below the MCL in all other quarterly monitored wells.
- DCE is present at concentrations exceeding its MCL in quarterly monitored wells MW-40-30 (47 μg/L), MW-40-32 (8.6 μg/L), and MW-40-37 (82 μg/L). These concentrations represent decreases over levels measured during the April 2008 event in each case except for MW-40-37.
- VC is present at concentrations exceeding its MCL in quarterly monitored wells MW-40-30 (4.2 μg/L), MW-40-32 (3.8 μg/L), MW-40-36 (3.5 μg/L), and MW-40-37 (18 μg/L). These represent slight decreases in concentrations over those reported during the previous monitoring event in April 2008, with the exception of MW-40-37, which shows a slight increase in concentration.

COC concentrations for the semiannually monitored shallow and mid-shallow wells are presented on Figure 2. COC concentrations for the quarterly monitored shallow wells are presented on Figure 3 (no deep wells are scheduled for quarterly monitoring).

In general, substantial reductions in COCs have been achieved following the HRC injection in the central area of the site, and in many cases, concentrations continue to remain below MCLs. However, COC levels exceeding MCLs remain stable in some wells, and minor increases in some COC levels in samples from MW-40-14 and -30 may indicate rebound in these areas.

Microbiological and Geochemical Parameters

Data from the July 2008 event reflecting concentrations of *Dehalococcoides* spp. (DHC) organisms, which are critical to the reductive dechlorination process, and total biomass (a measure of total viable bacteria) in key monitoring wells are included in Table 2. Suppressed dissolved oxygen (DO) levels and oxidation reduction potential (ORP) provide additional indication of microbial metabolism of the HRC (effectiveness in generating/maintaining reducing conditions). DO and ORP data are included in Table 3, and cation (calcium, magnesium, potassium, iron, and sodium) concentrations are presented in Table 4. Note that monitoring wells MW-40-02 and -14 were not analyzed for microbiological and geochemical parameters.

1) Key observations regarding microbiological parameters for relevant wells are as follows (refer to Table 2):

- Total biomass counts for July 2008 ranged from 2.13×10^8 to 1.72×10^9 cells per liter (cells/L) and were similar to those measured during the April 2008 event (4.57×10^8 to 5.24×10^9 cells/L).
- DHC levels ranged from 1.1×10^5 to 1.06×10^7 cells/L, which are generally lower than levels measured in April 2008 (6.38×10^6 to 1.88×10^8 cells/L), but still higher than those measured in January 2008 (6.8×10^3 to 4.3×10^7 cells/L).
- Total biomass levels remain high, and while measured at lower concentrations during the prior event, DHC organisms are still present at reasonably high levels. This, along with continual decreases in COC levels, indicates that biodegradation is still occurring, but the rate is likely decreasing as the HRC degrades.

2) Key observations regarding relevant geochemical parameters for monitored wells are as follows (refer to Tables 3 and 4):

- Based on the July 2008 readings, DO concentrations in the monitoring wells remained less than 0.2 mg/L (given limitations associated with this measurement, this essentially represents non-detect).
- ORP values measured during the July 2008 event were negative, ranging from -5 to -168 millivolts (mV). These values represent an increase over the range of values measured during the April 2008 event (-117 to -202 mV). The highest reading (-5 mV) was measured in MW-40-30, which has low COD and has been the most problematic in terms of treatment. It is noted that ORP values in the wells monitored during this event had all been measured in the positive range during the April 2007 sampling event (prior to the HRC injection). However, while they have been negative since then, a slowly increasing trend is evident.
- Cation data are of interest mainly to track the persistence of sodium, a component of the originally injected donor (sodium lactate). Sodium concentrations in the July 2008 samples ranged from 246 to 394 mg/L, which are somewhat higher than those measured during the baseline event (March 2005), which ranged from 211 to 288 mg/L.
- The pH readings ranged from 6.12 to 7.31 standard pH units, a range that is generally considered acceptable for bioremediation.
- Overall, the July 2008 geochemical data indicate maintenance of reducing conditions supportive of reductive dechlorination in most areas. However, declining substrate levels (as indicated by the COD data, discussed above), accompanied by continued increases in ORP levels indicate that the system is likely becoming more oxidized, and thus less supportive of reductive dechlorination.

Soil Gas Data. Methane gas surface emissions monitoring was performed on July 18, 2008. Methane gas emissions were not detected within Buildings 239 and 240 and surrounding areas during this monitoring event.

Soil gas monitoring of probes was conducted on July 18, 2008. The results indicated that the 29 probes tested in the field had methane gas present at concentrations from 12.1 to 86 percent in air during July 2008 monitoring event. The highest methane concentration was detected in the soil gas probe in injection well IW-9. Hydrogen sulfide was detected in 9 of 29 probes with concentrations ranging from 2 to 17 parts per million (ppm). The highest hydrogen sulfide concentrations were detected in the soil gas probe in injection wells IW-8 and IW-9, at 17 and 15 ppm, respectively.

In addition, soil gas samples were collected in 1-liter Tedlar bags from vapor monitoring wells (VW-40-01, -02, -03, -04, and -06), and a select number of soil gas monitoring probes that are installed in groundwater monitoring well MW-40-34 and injection wells IW-1, -3, and -7. VC was detected in seven of nine samples analyzed at concentrations ranging from 360 micrograms per cubic meter ($\mu g/m^3$) (or 940 parts per billion in volume [ppbv]) in the soil gas probe installed in MW-40-34 to 3,400 $\mu g/m^3$ (or 9,100 ppbv) in the soil gas probe installed in injection well IW-7. DCE was detected in seven of nine sampled wells ranging in concentration from 890 J $\mu g/m^3$ in the soil gas probe installed in injection well IW-7 to 10,500 $\mu g/m^3$ in the soil gas probe installed in injection well IW-1. TCE was detected in all nine probes at concentrations from 290 J $\mu g/m^3$ in soil gas monitoring well VW-40-04 to 23,300 $\mu g/m^3$ in soil gas monitoring well VW-40-03. PCE was detected in six of nine samples at concentrations ranging from 2,000 $\mu g/m^3$ in soil gas monitoring well VW-40-06 to 17,600 $\mu g/m^3$ in the soil gas probe installed in monitoring well MW-40-34. A summary of the analytical results for the soil gas concentrations is presented in Table 5.

Methane gas concentrations in samples collected in Tedlar bags from the soil gas monitoring probes and vapor monitoring wells and analyzed in the laboratory ranged from 0.12 percent in soil gas monitoring well VW-40-04 to 67.3 percent in the soil gas probe installed in monitoring well MW-40-34. Concentrations of methane in soil gas have been continually decreasing at the site.

Groundwater Levels. Groundwater level measurements were conducted on July 16, 2008. Groundwater elevations within the site ranged from 0.94 foot above mean sea level (msl) in MW-40-13 to 2.28 feet above msl in MW-40-02. In general, water level measurements collected in April 2008 did not indicate a change in groundwater level within the monitoring area in comparison with the elevations measured during the previous monitoring event in April 2008.

CONCLUSIONS

Over the life of the project, significant reductions in total chloroethene concentrations have been observed in all compliance monitoring wells. However low-level residual COCs (mostly DCE and VC) persist above respective MCLs in several wells, mainly in the central portion of the site. In addition, relatively low substrate levels observed in key areas, along with increasing ORP levels and decreasing DHC counts, indicate that the system may be reverting to more oxidizing conditions in critical areas where COCs are still present.

Overall, the data continue to suggest that:

1) enhanced in situ bioremediation has been very effective in reducing COC levels in groundwater,
2) reduction of residual COCs will likely continue to occur, but the rate will likely decrease even further, given that the system appears to be slowly reverting to more oxidized conditions, and
3) the site is approaching a point where (as planned) monitored natural attenuation (MNA) will likely be sufficient for site groundwater to reach MCLs.

However, there is still uncertainty regarding the time frame to reach MCLs and the potential for contaminant rebound to occur (as potentially suggested by increased COC levels in MW-40-14 and -30).

As noted previously (April 2008 Report), dechlorinating organisms generally do not thrive (i.e., reproduce) when total chloroethene levels fall below about 50 μg/L, as is the case at this site. Nevertheless, with the presence of sufficient dechlorinating biomass, contaminant reduction to below MCLs is commonly observed (as has been at this site) under enhanced bioremediation. Despite the generally positive results to date, it is likely that the dechlorinating organisms currently present in the subsurface are stressed due to substrate limitations, low chloroethene levels, or both. Thus, it is expected that significant benefits can be derived from a final application of substrate and possibly fresh dechlorinating organisms via bioaugmentation.

RECOMMENDATIONS

The following recommendations are based on the above evaluation and analysis of the data:

1) Conduct future monitoring as proposed in the July 8, 2008 summary report.

2) Collect several grab groundwater samples at various depths from inside the locomotive maintenance shop (Building 240) to assess the potential for further rebound in the vicinity of MW-40-14. General procedures for accomplishing this are described in the July 8, 2008 summary report.

3) Apply a final round of HRC at strategic locations to address residual contamination. Depending on the outcome of the HRC injection, if deemed necessary, conduct bioaugmentation. To the extent practicable, this is expected to:

   a. maximize (increase the rate and extent of) the treatment processes already occurring,

   b. reduce the time frame for MNA processes to meet MCLs, and

   c. help guard against future contaminant rebound. HRC application will be conducted as specified in the July 8, 2008 summary report.

TABLES

Table 1 Summary of Monitoring Activities Conducted During July 2008

Table 2 COD, VFA, DHC, and PLFA Data for Samples Collected in July 2008

Table 3 Anions, Alkalinity, DO, ORP, and pH Data for Samples Collected in July 2008

Table 4 Cation Concentrations in Samples Collected in July 2008

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FIGURES

Figure 1 COC Concentrations for Shallow and Mid Shallow Monitoring Wells Proposed for Annual Monitoring

Figure 2 COC Concentrations for Shallow and Mid Shallow Monitoring Wells Proposed for Semiannual Monitoring, July 2008

Figure 3 COC Concentrations for Shallow Monitoring Wells Proposed for Quarterly Monitoring, July 2008

TABLES

TABLE 1

SUMMARY OF MONITORING ACTIVITIES CONDUCTED DURING JULY 2008

Date	Event	Wells Sampled[1]	Analytes/Parameters	Notes
7/15/08	Soil vapor sampling	VW-40-01, -02, -03, -04, -06, MW-40-34, IW-1, -3, and -7.	VOCs and fixed gases	Laboratory analysis
7/15/08-7/16/08	Groundwater sampling	MW-40-02, -07, -08, -14, -30, -32, -34, -36, and -37	VOCs, dissolved gases, TDS, cations, anions, alkalinity, COD, DNA, PLFAs, VFAs	Laboratory and field parameters
7/16/08	Groundwater level measurement	MW-40-01, -02, -06, 07, 08, -10, -11, -13, -14, -15, -17, -19, -20, -22, -30 through 39, and IW-1 through IW-17.	Not applicable	Groundwater level measurements
7/18/08	Soil vapor/gas probe monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, and IW-1 through IW-4 and IW-6 through IW-17.	Methane, oxygen, carbon dioxide, VOCs, and carbon monoxide	Field testing
7/18/08	Surface emissions monitoring	Not applicable	Methane gas concentrations	Inside Building 240 and western portion of Building 239, and areas surrounding the above buildings

Notes:

[1]Refer to Figures 1 and 2 for well locations.

COD – chemical oxygen demand
DNA – deoxyribonucleic acid
PLFA – poly-lipid fatty acid
TDS – total dissolved solids
VFA – volatile fatty acid
VOC – volatile organic compound

TABLE 2

COD, VFA, DHC, AND PLFA DATA COLLECTED IN JULY 2008

Location	COD (mg/L)	Acetic Acid (mg/L)	Propionic Acid (mg/L)	Butyric Acid (mg/L)	DHC (cells/L)	Total PLFA Biomass (cells/L)
MW-40-02	112	NA	NA	NA	NA	NA
MW-40-07	624	112.6	35.8	7.3	1.10E+05	1.60E+09
MW-40-14	31.5	NA	NA	NA	NA	NA
MW-40-30	37.7	<1	<1	<1	2.38E+05	1.72E+09
MW-40-32	121	30.8	21.9	<1	1.06E+07	2.13E+08
MW-40-34	228	71.5	73.6	<1	1.22E+05	1.70E+09
MW-40-36	437	79.4	209.0	<1	7.22E+05	1.71E+09
MW-40-37	41.9	<1	<1	<1	2.46E+05	5.79E+08

Notes:
Pyruvic acid, lactic acid, and formic acid were not detected.

cells/L – cells per liter
COD – chemical oxygen demand
DHC – *Dehalococcoides* spp.
mg/L – milligrams per liter
NA – not analyzed
PLFA – phospholipid fatty acid
VFA – volatile fatty acid

TABLE 3

ANIONS, ALKALINITY, DO, ORP, AND pH DATA FOR SAMPLES COLLECTED IN JULY 2008

Location	Chloride (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	TDS (mg/L)	DO (mg/L)	ORP (mV)	pH (pH units)
MW-40-02	NA	NA	NA	NA	NA	NA	0.08	-167	6.82
MW-40-07	348	0.500 U	0.287	2.78	1440	2230	0.09	-142	6.46
MW-40-08	NA	NA	NA	NA	NA	NA	0.14	-29	7.31
MW-40-14	NA	NA	NA	NA	NA	NA	0.13	-110	6.12
MW-40-30	161	0.100 U	0.0913 J	136	570	1180	0.11	-5	6.38
MW-40-32	127	0.200 U	0.141	2.24	1260	1600	0.09	-154	6.58
MW-40-34	138	0.200 U	0.0817 J	3.48	965	1490	0.14	-168	6.39
MW-40-36	250	0.200 U	0.0931 J	0.799	930	1730	0.11	-161	6.51
MW-40-37	448	0.200 U	0.100 U	188	650	1810	0.12	-109	6.63

Notes:

DO – dissolved oxygen

J – estimated value below the laboratory reporting limit

mg/L – milligrams per liter

mV – millivolt

NA – not analyzed

ORP – oxidation/reduction potential

TDS – total dissolved solids

U – analyte not detected above the (project) quantitation limit

TABLE 4

CATION CONCENTRATIONS IN SAMPLES COLLECTED IN JULY 2008

Location	Calcium (mg/L)	Iron (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)
MW-40-07	368	14.1	94.7	9.3	340
MW-40-30	50.2	3.28	13.9	ND	337
MW-40-32	123	19.3	37.8	2.72J	394
MW-40-34	154	38.6	29.7	7.53	295
MW-40-36	186	32.5	74.4	7.08	246
MW-40-37	214	6.6	72.1	6.74	293

Notes:

J – estimated value below the laboratory reporting limit
mg/L – milligrams per liter
ND – not detected

TABLE 5

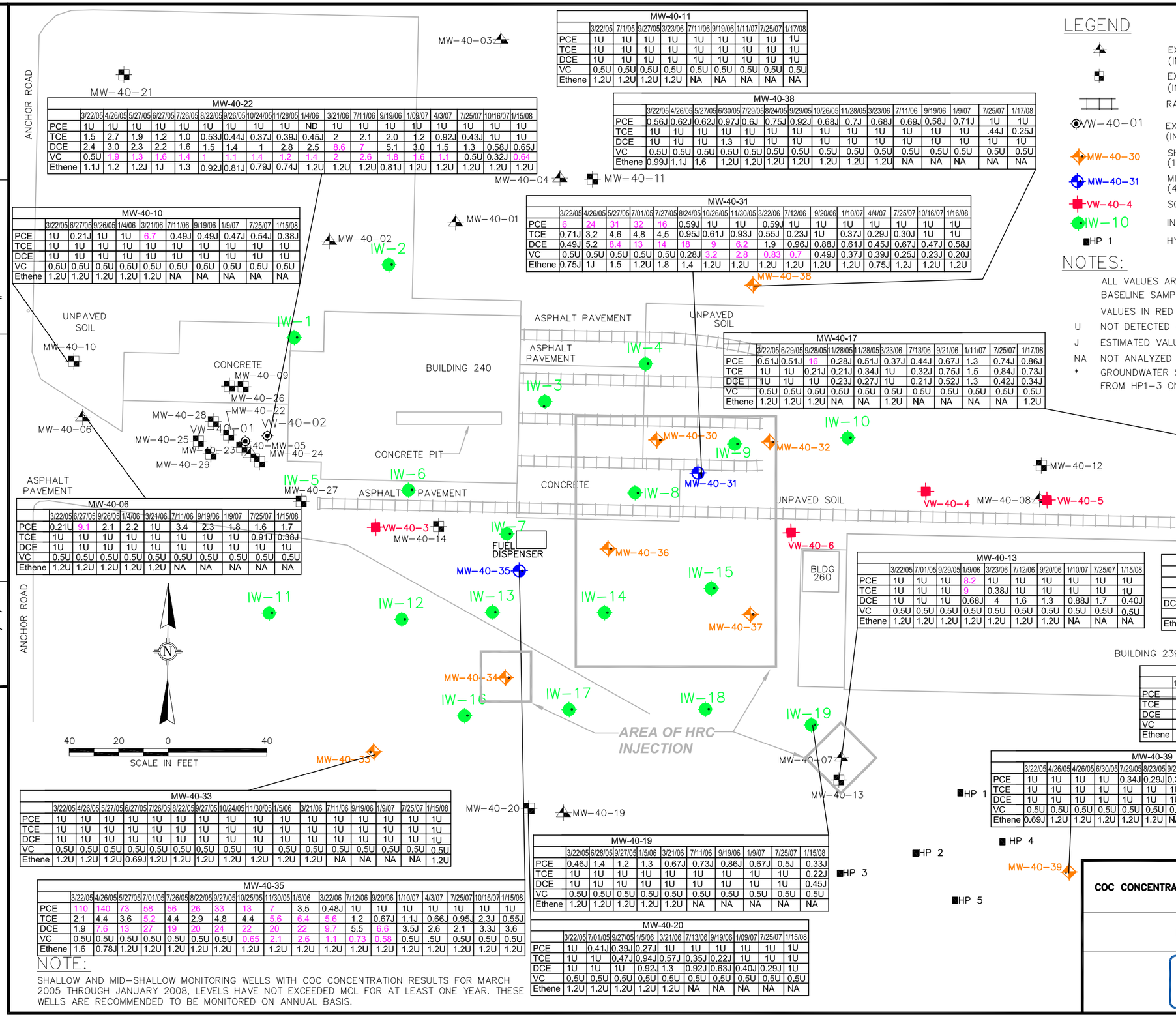
PCE, TCE, DCE, AND VC CONCENTRATIONS IN SOIL GAS SAMPLES COLLECTED IN JULY 2008

Probe/Well ID	PCE		TCE		cis-1,2-DCE		Vinyl Chloride	
	Result ppbv	Result µg/m^3	Result ppbv	Result µg/m^3	Result ppbv	Result µg/m^3	Result ppbv	Result µg/m^3
IW-1	52 U	360 U	87 J	480 J	2400	9900	2900	7500
IW-1 (FD)	52 U	360 U	87 J	480 J	2600	10500	3000	8000
VW-40-01	52 U	360 U	430	2400	680	2800	1200	3200
VW-40-02	52 U	360 U	370	2100	410	1700	730	1900
VW-40-03	550	3900	4200	23300	860	3500	520	1400
IW-7	300	2100	1000	5600	220	890	3400	9100
MW-40-34	2500	17600	660	3600	830	3400	360	940
IW-3	360	2500	300	1700	52 U	210 U	51 U	130 U
VW-40-06	280	2000	220	1200	500	2100	2700	7200
VW-40-04	550	3900	53 J	290 J	52 U	210 U	51 U	130 U

Notes:

µg/m^3 – micrograms per cubic meter
DCE – dichloroethene
FD – field duplicate
ID – identification
J – estimated value
PCE – perchloroethene
ppbv – parts per billion in volume
TCE – trichloroethene
U – analyte not detected above the (project) quantitation limit

FIGURES



MW-40-11	3/22/05	7/1/05	9/27/05	3/23/06	7/11/06	9/19/06	1/11/07	7/25/07	1/17/08
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-22	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/09/07	4/3/07	7/25/07	10/16/07	1/15/08
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	ND	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J	0.37J	0.39J	0.45J	2	2.1	2.0	1.2	0.92J	0.43J	1U	1U
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4	1	2.8	2.5	8.6	7	5.1	3.0	1.5	1.3	0.58J	0.65J
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1	1.4	1.2	1.4	2	2.6	1.8	1.6	1.1	0.5U	0.32J	0.64
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J	0.79J	0.74J	1.2U	1.2U	1.2U	0.81J	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-38	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/24/05	9/29/05	10/26/05	11/28/05	3/23/06	7/11/06	9/19/06	1/9/07	7/25/07	1/17/08
PCE	0.56J	0.62J	0.62J	0.97J	0.6J	0.75J	0.92J	0.68J	0.7J	0.68J	0.69J	0.58J	0.71J	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	.44J	0.25J
DCE	1U	1U	1U	1.3	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.99J	1.1J	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-10	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	1U	0.21J	1U	1U	6.7	0.49J	0.49J	0.47J	0.54J	0.38J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-31	3/22/05	4/26/05	5/27/05	7/01/05	7/27/05	8/24/05	10/26/05	11/30/05	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/16/08
PCE	6	24	31	32	16	0.59J	1U	1U	0.59J	1U	1U	1U	1U	1U	1U	1U
TCE	0.71J	3.2	4.6	4.8	4.5	0.95J	0.61J	0.93J	0.55J	0.23J	1U	0.37J	0.29J	0.30J	1U	1U
DCE	0.49J	5.2	8.4	13	14	18	9	6.2	1.9	0.96J	0.88J	0.61J	0.45J	0.67J	0.47J	0.58J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.28J	3.2	2.8	0.83	0.7	0.49J	0.37J	0.39J	0.25J	0.23J	0.20J
Ethene	0.75J	1J	1.5	1.2U	1.8	1.4	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.75J	1.2J	1.2U	1.2U

MW-40-17	3/22/05	6/29/05	9/28/05	11/28/05	11/28/05	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
PCE	0.51J	0.51J	16	0.28J	0.51J	0.37J	0.44J	0.67J	1.3	0.74J	0.86J
TCE	1U	1U	0.21J	0.21J	0.34J	1U	0.32J	0.75J	1.5	0.84J	0.73J
DCE	1U	1U	1U	0.23J	0.27J	1U	0.21J	0.52J	1.3	0.42J	0.34J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	1.2U	NA	NA	NA	NA	1.2U

MW-40-18	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
PCE	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-06	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	0.21U	9.1	2.1	2.2	1U	3.4	2.3	1.8	1.6	1.7
TCE	1U	1U	1U	1U	1U	1U	1U	1U	0.91J	0.38J
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-13	3/22/05	7/01/05	9/29/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	7/25/07	1/15/08
PCE	1U	1U	1U	8.2	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	9	0.38J	1U	1U	1U	1U	1U
DCE	1U	1U	1U	0.68J	4	1.6	1.3	0.88J	1.7	0.40J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-15	3/22/05	6/30/05	9/28/05	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
	1U	1U	0.26J	0.23J	1U	1U	1U	1U	1U	1U
	1U	1U	0.26J	0.21J	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.1J	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-16	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
PCE	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	1U	1U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-39	3/22/05	4/26/05	4/26/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/30/05	1/6/06	3/21/06	7/11/06	9/21/06	1/9/07	7/25/07	1/15/08
PCE	1U	1U	1U	1U	0.34J	0.29J	0.35J	0.42J	0.49J	0.71J	0.72J	1.7	2.4	2.5	2.8	1.3
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	NA	NA	NA	NA	NA	NA	NA	NA

MW-40-33	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/27/05	10/24/05	11/30/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	1.2U

MW-40-35	3/22/05	4/26/05	5/27/05	7/01/05	7/26/05	8/22/05	9/27/05	10/25/05	11/30/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/15/08
PCE	110	140	73	58	56	26	33	13	7	3.5	0.48J	1U	1U	1U	1U	1U	1U	1U
TCE	2.1	4.4	3.6	5.2	4.4	2.9	4.8	4.4	5.6	6.4	5.6	1.2	0.67J	1.1J	0.66J	0.95J	2.3J	0.55J
DCE	1.9	7.6	13	27	19	20	24	22	20	22	9.7	5.5	6.6	3.5J	2.6	2.1	3.3J	3.6
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.65	2.1	2.6	1.1	0.73	0.58	0.5U	.5U	0.5U	0.5U	0.5U
Ethene	1.6	0.78J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

NOTE:

SHALLOW AND MID-SHALLOW MONITORING WELLS WITH COC CONCENTRATION RESULTS FOR MARCH 2005 THROUGH JANUARY 2008, LEVELS HAVE NOT EXCEEDED MCL FOR AT LEAST ONE YEAR. THESE WELLS ARE RECOMMENDED TO BE MONITORED ON ANNUAL BASIS.

MW-40-19	3/22/05	6/28/05	9/27/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	0.46J	1.4	1.2	1.3	0.67J	0.73J	0.86J	0.67J	0.5J	0.33J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	0.22J
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	0.45J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-20	3/22/05	7/01/05	9/27/05	1/5/06	3/21/06	7/13/06	9/19/06	1/09/07	7/25/07	1/15/08
PCE	1U	0.41J	0.39J	0.27J	1U	1U	1U	1U	1U	1U
TCE	1U	1U	0.47J	0.94J	0.57J	0.35J	0.22J	1U	1U	1U
DCE	1U	1U	1U	0.92J	1.3	0.92J	0.63J	0.40J	0.29J	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 — SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (μg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

Figure 1

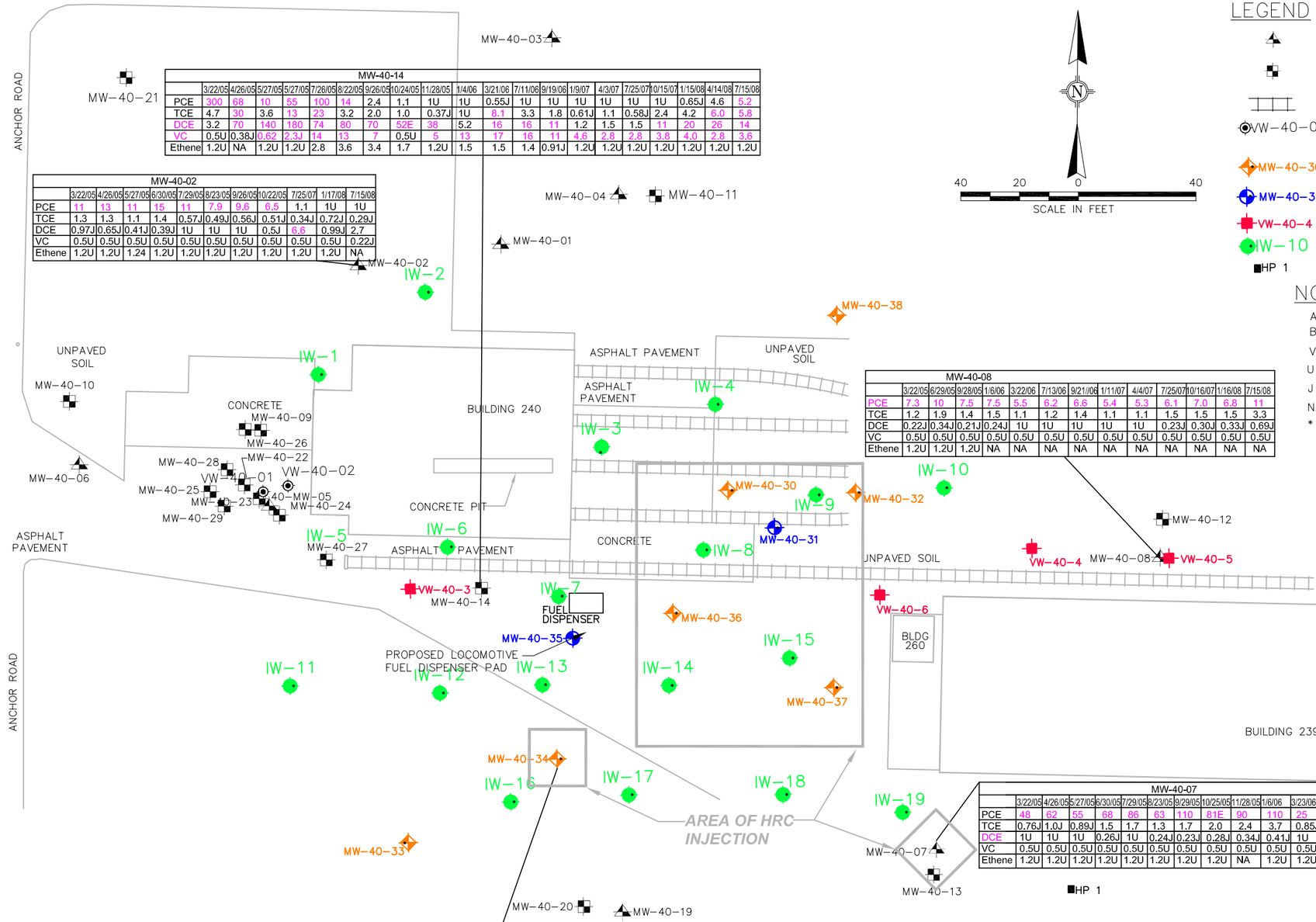
COC CONCENTRATIONS FOR SHALLOW AND MID SHALLOW MONITORING WELLS PROPOSED FOR ANNUAL MONITORING

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 08118901.DWG
DCN: ECSD-2201-0008-1189
CTO: #0010
APPROVED BY: HH
CHECKED BY: ML
REV:
DRAWN BY: MD
DATE: 08/11/08

P:\3210-RAC IV\CTO-0010\DWG\081189\08118901.DWG
PLOT/UPDATE: AUG 18 2008 12:06:57



LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 — SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (µg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005

VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN

J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT

NA NOT ANALYZED

* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

MW-40-14

	3/22/05	4/26/05	5/27/05	5/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	4/3/07	7/25/07	10/15/07	1/15/08	4/14/08	7/15/08
PCE	300	68	10	55	100	14	2.4	1.1	1U	1U	0.55J	1U	1U	1U	1U	1U	1U	0.65J	4.6	5.2
TCE	4.7	30	3.6	13	23	3.2	2.0	1.0	0.37J	1U	8.1	3.3	1.8	0.61J	1.1	0.58J	2.4	4.2	6.0	5.8
DCE	3.2	70	140	180	74	80	70	52E	38	5.2	16	16	11	1.2	1.5	1.5	11	20	26	14
VC	0.5U	0.38J	0.62	2.3J	14	13	7	0.5U	5	13	17	16	11	4.6	2.8	2.8	3.8	4.0	2.8	3.6
Ethene	1.2U	NA	1.2U	1.2U	2.8	3.6	3.4	1.7	1.2U	1.5	1.5	1.4	0.91J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-02

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/26/05	10/22/05	7/25/07	1/17/08	7/15/08
PCE	11	13	11	15	11	7.9	9.6	6.5	1.1	1U	1U
TCE	1.3	1.3	1.1	1.4	0.57J	0.49J	0.56J	0.51J	0.34J	0.72J	0.29J
DCE	0.97J	0.65J	0.41J	0.39J	1U	1U	1U	0.5J	6.6	0.99J	2.7
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.22J
Ethene	1.2U	1.2U	1.24	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA

MW-40-08

	3/22/05	6/29/05	9/28/05	1/6/06	3/22/06	7/13/06	9/21/06	1/11/07	4/4/07	7/25/07	10/16/07	1/16/08	7/15/08
PCE	7.3	10	7.5	7.5	5.5	6.2	6.6	5.4	5.3	6.1	7.0	6.8	11
TCE	1.2	1.9	1.4	1.5	1.1	1.2	1.4	1.1	1.1	1.5	1.5	1.5	3.3
DCE	0.22J	0.34J	0.21J	0.24J	1U	1U	1U	1U	1U	0.23J	0.30J	0.33J	0.69J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

MW-40-07

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/28/05	1/6/06	3/23/06	7/11/06	9/21/06	1/9/07	4/4/07	7/25/07	10/16/07	1/15/08	4/14/08	7/16/08
PCE	48	62	55	68	86	63	110	81E	90	110	25	100	94	83	49	11	1.4J	2.8	2.6	1.3
TCE	0.76J	1.0J	0.89J	1.5	1.7	1.3	1.7	2.0	2.4	3.7	0.85J	3.2	3.1	2.7	1.8	6.7	1U	1.7	1.7	1.8
DCE	1U	1U	1U	0.26J	1U	0.24J	0.23J	0.28J	0.34J	0.41J	1U	0.31J	0.43J	0.34J	1U	36	54	47	42	12
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	5.4	8.3
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.95J	1.2U	1.2U	1.2U	0.80J

MW-40-34

	3/22/05	4/26/05	5/27/05	6/28/05	7/26/05	8/22/05	9/27/05	10/24/05	11/28/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/16/08	4/14/08	7/16/08
PCE	9.1	140	180	5.8	6.8	190	190	37	31	29	22	18	28	22	24	4.5	1U	1U	1U	1U
TCE	1U	1.2	1.6	1.3	2.1	5	12	8.1	2.1	1.3	0.64J	0.92J	1.2	1.0	1.2	1.3	1.4J	0.65J	0.25J	1U
DCE	1U	1U	0.24J	130	130	20	65	74	7.5	4.7	2.1	2.3	2.8	1.8	1.9	14	19	8.5	3.0	1.6
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.1	1.6	0.59	0.55	0.67	0.53	0.66	0.5U	2.2J	2.6	1.7	1.3
Ethene	1.2U	1.2U	1.2U	1.1J	0.8J	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

NOTE:

MONITORING WELLS MW-40-02,-07,-14,-34 IN WHICH CONCENTRATIONS OF ONE OR MORE COCs HAVE EXCEEDED RESPECTIVE MCL LEVELS DURING RECENT OR LATEST MONITORING EVENTS, BUT ARE LESS THAN 10 TIMES MCL.

Figure 2

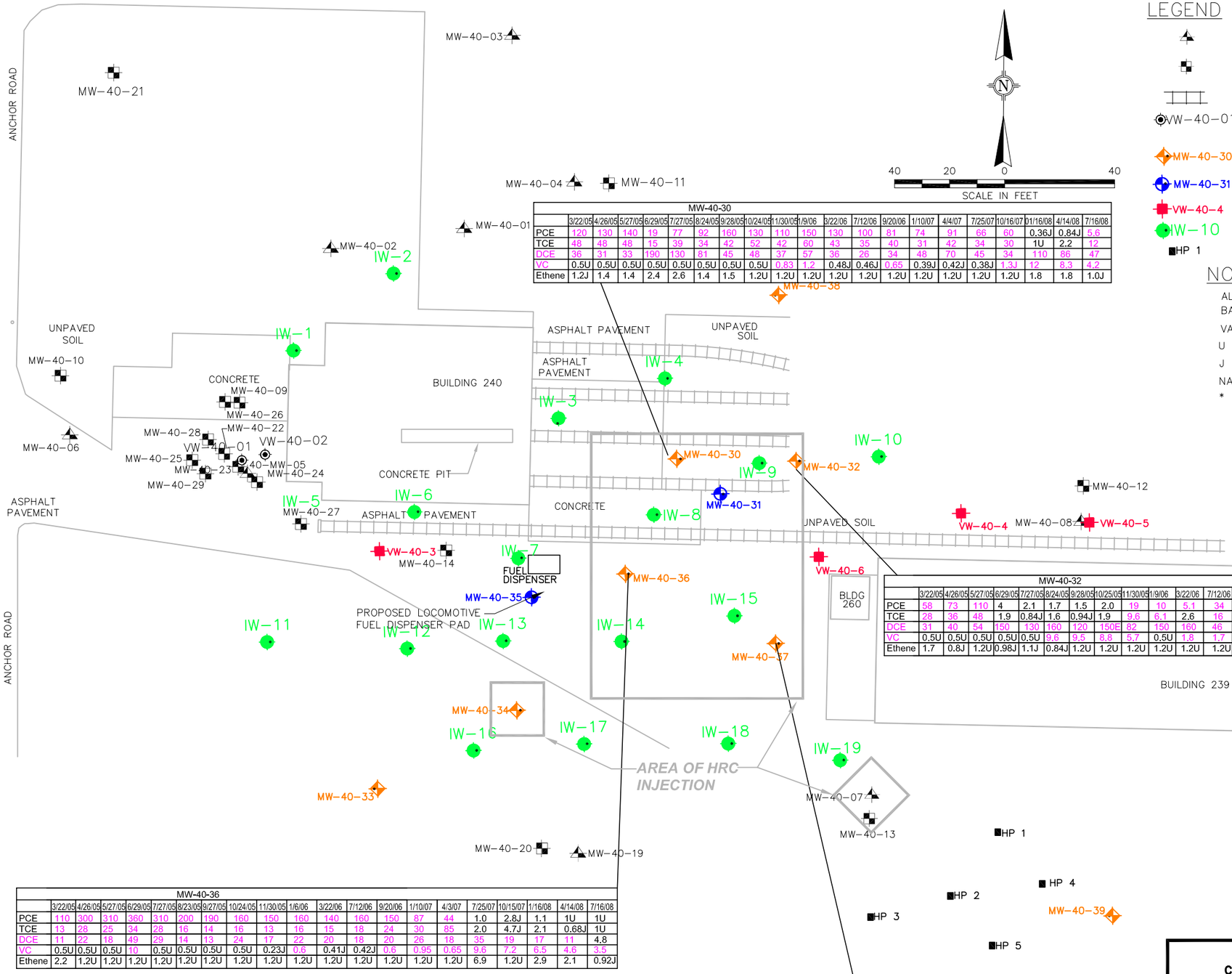
COC CONCENTRATIONS FOR SHALLOW AND MID-SHALLOW MONITORING WELLS PROPOSED FOR SEMIANNUAL MONITORING, JULY 2008

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 08118902.DWG
DCN: ECSD-2201-0008-1189
CTO: #0010
APPROVED BY: HH
CHECKED BY: NW
REV:
DRAWN BY: MD
DATE: 08/11/08

P:\3210-RAC IV\CTO-0010\DWG\081189\08118902.DWG
PLOT/UPDATE: AUG 18 2008 12:26:34



LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 — SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

40 20 0 40
SCALE IN FEET

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (µg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005

VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN

J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT

NA NOT ANALYZED

* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

MW-40-30

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/24/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	01/16/08	4/14/08	7/16/08
PCE	120	130	140	19	77	92	160	130	110	150	130	100	81	74	91	66	60	0.36J	0.84J	5.6
TCE	48	48	48	15	39	34	42	52	42	60	43	35	40	31	42	34	30	1U	2.2	12
DCE	36	31	33	190	130	81	45	48	37	57	36	26	34	48	70	45	34	110	86	47
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.83	1.2	0.48J	0.46J	0.65	0.39J	0.42J	0.38J	1.3J	12	8.3	4.2
Ethene	1.2J	1.4	1.4	2.4	2.6	1.4	1.5	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.8	1.8	1.0J

MW-40-32

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/25/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/16/08	4/14/08	7/16/08
PCE	58	73	110	4	2.1	1.7	1.5	2.0	19	10	5.1	34	39	50	47	10	1U	0.74J	0.60J	0.22J
TCE	28	36	48	1.9	0.84J	1.6	0.94J	1.9	9.6	6.1	2.6	16	20	23	22	13	1.4	1.3	3.1	1.3
DCE	31	40	54	150	130	160	120	150E	82	150	160	46	44	30	25	26	10	12	20	8.6
VC	0.5U	0.5U	0.5U	0.5U	0.5U	9.6	9.5	8.8	5.7	0.5U	1.8	1.7	1.8	1.2	0.97	1.6	9.5	5.6	4.8	3.8
Ethene	1.7	0.8J	1.2U	0.98J	1.1J	0.84J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	4.9	0.99J	0.88J	0.75J

MW-40-36

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/24/05	11/30/05	1/6/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/16/08	4/14/08	7/16/08
PCE	110	300	310	360	310	200	190	160	150	160	140	160	150	87	44	1.0	2.8J	1.1	1U	1U
TCE	13	28	25	34	28	16	14	16	13	16	15	18	24	30	85	2.0	4.7J	2.1	0.68J	1U
DCE	11	22	18	49	29	14	13	24	17	22	20	18	20	26	18	35	19	17	11	4.8
VC	0.5U	0.5U	0.5U	10	0.5U	0.5U	0.5U	0.5U	0.23J	0.6	0.41J	0.42J	0.6	0.95	0.65	9.6	7.2	6.5	4.6	3.5
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	6.9	1.2U	2.9	2.1	0.92J

MW-40-37

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/25/05	11/30/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/15/07	1/16/08	4/14/08	7/16/08
PCE	250	330	190	15	140	170	370	120E	390	440	100	120	1.3	2.1	1.1	0.31J	1.8J	0.36J	1U	0.48J
TCE	12	12	63	16	72	56	53	38	29	48	28	46	16	0.94J	4.9	0.36J	3.1J	1.3	1.3	1.5
DCE	5.0	4.9	110	280	170	100	79	50E	48	63	35	36	140	140	89	64	69	94	58	82
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.2	3.6	4.5	18	18	24	18	18	12	18
Ethene	1.5	3.7	4.6	5.7	5.0	4.1	3.5	2.9	2.9	3.0	1.2U	2	2.6	4.1	3.0	11	1.2U	6.5	4.6	5.6

NOTE:

SHALLOW AND MID-SHALLOW MONITORING WELLS IN WHICH CONCENTRATIONS OF ONE OR MORE COCs HAVE EXCEEDED RESPECTIVE MCL LEVELS DURING RECENT OR LATEST MONITORING EVENTS.

Figure 3

COC CONCENTRATIONS FOR SHALLOW MONITORING WELLS PROPOSED FOR QUARTERLY MONITORING, JULY 2008

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 08118903.DWG
DCN: ECSD-2201-0008-1189
CTO: #0010
APPROVED BY: HH
CHECKED BY: NW
REV:
DRAWN BY: MD
DATE: 08/11/08

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PLOT/UPDATE: AUG 18 2008 12:32:39

TETRA TECH EC, INC.

SUMMARY OF FIELD ACTIVITIES AND DATA FOR OCTOBER 2008 MONITORING EVENT ENHANCED IN SITU BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS

INSTALLATION RESTORATION PROGRAM SITE 40 NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

Date: December 10, 2008

Prepared by: Hamlet Hamparsumian and Mark E. Losi, Tetra Tech EC, Inc. (TtEC)

Distribution: **Navy**
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Agencies
Patricia Hannon (Water Board)
Stephen Niou (DTSC)

This report provides an overview of site activities conducted during October/November 2008 in association with enhanced in situ bioremediation (EISB) of groundwater at Installation Restoration Program (IRP) Site 40 at Naval Weapons Station Seal Beach, Seal Beach, California. This report includes the presentation and assessment of relevant monitoring data collected during this period. Also included is a summary of additional site activities, including the final application of Hydrogen Release Compound (HRC®) to address the residual contamination present as limits of the EISB effort are approached. A summary of the general status of the project and recommendations based on the conclusions is also provided.

The field activities for this period included groundwater and soil gas monitoring in various wells/locations, surface gas emissions monitoring, and injection of HRC. These activities, along with the dates they were conducted, are listed in Table 1. For this monitoring event (October 2008), chemicals of concern (COCs) and a focused suite of microbial and geochemical parameters were assessed in groundwater samples from monitoring wells MW-40-02, -07, -08, -14, -30, -32, -34, -36, and -37. These wells were proposed for either quarterly or semiannual monitoring based on established criteria as discussed in a prior report (TtEC 2008). Most of these wells are key compliance wells located in the central portion of the site where low-level contamination is still being detected. In addition, grab groundwater samples were collected at various depths from inside the locomotive maintenance shop (Building 240) to assess the potential for further rebound in the vicinity of MW-40-14. Results of the monitoring, along with a description of activities associated with the HRC® injection, are discussed below.

PRESENTATION OF DATA

Wells proposed for annual monitoring were not sampled during the October 2008 event. Data from past events for these wells are presented on Figure 1 and are not further discussed. Data from wells proposed for semiannual monitoring (MW-40-02, -07, -08, -14, and -34) were sampled during this event, and the data are presented on Figure 2. Wells proposed for quarterly monitoring (MW-40-30, -32 -36, -and -37) were also

sampled during this event, and the data are presented on Figure 3. Data from the sampled cone penetrometer test (CPT) borings within Building 240, along with boring locations, are presented on Figure 4. Also presented on Figure 4 are the HRC injection points.

EVALUATION OF HRC PERSISTENCE AND COC IN REGULARLY MONITORED WELLS

This subsection provides a summary of data collected during October 2008 to assess HRC migration and its effects, followed by key observations regarding COC concentrations in the selected groundwater monitoring wells during the October 2008 event.

Continuing evaluation of HRC persistence primarily included assessment of shallow interval groundwater monitoring wells MW-40-07, -30, -32, -34, -36, and -37 (refer to Figure 1 for well locations). These monitoring wells are located within the areas where HRC was initially injected in April 2007. Each of these wells is still, or was recently, impacted by one or more COCs at concentrations exceeding their respective maximum contaminant levels (MCLs), and each is located in the area expected to be influenced by the HRC. Chemical oxygen demand (COD) has been measured over the duration of the project to evaluate lactate presence and to assess the migration and persistence of HRC near these wells. Additionally, volatile fatty acids (VFAs), including acetic acid, propionic acid, and butyric acid, are breakdown products of HRC, and their presence indicates microbial activity is occurring as microbes degrade the HRC.

COD and VFAs

COD and VFA data are presented in Table 2.

- The October 2008 COD concentrations were again lower than those measured during the prior (July 2008) event. Notable decreases occurred in wells MW-40-07 (from 624 milligrams per liter [mg/L] in July 2008, to 167 in October 2008), MW-40-32 (from 121 mg/L in July 2008 to 49.5 mg/L in October 2008), MW-40-34 (from 228 mg/L in July 2008 to 43.4 mg/L in October 2008), and MW-40-36 (from 437 mg/L in July 2008 to 41.4 mg/L in October 2008). During the April 2007 event (prior to the HRC injection), COD concentrations ranged from 12.3 to 53.7 mg/L in the above wells. In addition, VFAs were detected only in MW-40-07 and -32. VFAs had been detected in MW-40-07, -32, -34, and -36 during the July 2008 event. Thus, substrate levels are clearly declining as expected as the HRC degrades; however, HRC is still present and being metabolized, to a minimal extent, in some areas.
- COD concentrations in wells MW-40-30 (33.3 mg/L) and MW-40-37 (37.3 mg/L), which have the highest residual COC concentrations, are approaching the levels detected during the April 2008 monitoring event (12.1 and 14.2 mg/L, respectively). These levels are generally in the range considered to be background. In addition, VFAs were not detected in either of the samples collected from these wells in October 2008 (nor were they in July, 2008). These data continue to indicate a lack of HRC in these areas.
- COD concentrations in wells MW-40-02 and -14, which are located outside the HRC injection area, were 94.2 and 41.4 mg/L, respectively.

COCs

COC concentrations for the semiannually monitored shallow and mid-shallow wells are presented on Figure 2. COC concentrations for the quarterly monitored shallow wells are presented on Figure 3 (no deep wells are scheduled for quarterly monitoring).

COC Concentrations in Semiannually Monitored Wells

- As noted on Figure 2, MW-40-14, the only mid-shallow interval well in which COCs still exceed their respective MCLs, has residual trichloroethene (TCE) (5.9 micrograms per liter [μg/L]), dichloroethene (DCE) (13 μg/L), and vinyl chloride (VC) (6.0 μg/L) at concentrations above their MCLs (5 μg/L, 6 μg/L, and 0.5 μg/L, respectively). These values are similar to prior results. Tetrachloroethene (PCE) decreased slightly, from 5.2 μg/L to 4.8 μg/L, and is now below its MCL (5 μg/L).
- For the shallow interval wells, results for MW-40-02 (no COCs exceeding MCLs), MW-40-08 (only PCE [10 μg/L] exceeds its MCL), and MW-40-34 (only VC [1.1 μg/L] exceeds its MCL) were consistent with prior results. MW-40-07 showed decreases in both DCE (from 12 μg/L to 3.9 μg/L), and VC concentrations (from 8.3 to 4.7 μg/L). For MW-40-07, only VC currently exceeds its MCL.

COC Concentrations in Quarterly Monitored Wells

- Figure 3 shows that the PCE concentration in MW-40-30 decreased from 5.6 μg/L to 2.6 μg/L, and is again below its MCL. PCE concentrations no longer exceed the MCL in any of the other quarterly monitored wells sampled during the July 2008 event.
- TCE, however, again increased in MW-40-30, from 12 μg/L to 29 μg/L, which is in excess of its MCL. However, TCE concentrations remained below the MCL in all other quarterly monitored wells.
- DCE is present at concentrations exceeding its MCL in quarterly monitored wells MW-40-30 (31 μg/L), MW-40-32 (5.1 μg/L), and MW-40-37 (110 μg/L).
- VC is present at concentrations exceeding its MCL in quarterly monitored wells MW-40-30 (5.4 μg/L), MW-40-32 (4.2 μg/L), MW-40-36 (2.3 μg/L), and MW-40-37 (27 μg/L). These concentrations are consistent with the previous monitoring event (July 2008), with the exception of MW-40-37, which shows a continued increase in concentration.

In general, substantial reductions in COCs have been achieved following the HRC injection in the central area of the site, and in many cases, concentrations continue to remain below MCLs. However, COC levels exceeding MCLs remain stable in some wells, and increases in some COC levels may indicate rebound in these areas (mainly MW-40-14, -30, and -37).

Microbiological and Geochemical Parameters

Data from the October 2008 event reflecting concentrations of *Dehalococcoides* spp. (DHC) organisms, which are critical to the reductive dechlorination process, and total biomass (a measure of total viable bacteria) in key monitoring wells are included in Table 2. Suppressed dissolved oxygen (DO) levels and oxidation reduction potential (ORP) provide additional indication of microbial metabolism of the HRC (effectiveness in generating/maintaining reducing conditions). DO and ORP data are included in Table 3, and cation (calcium, magnesium, potassium, iron, and sodium) concentrations are presented in Table 4. Note that monitoring wells MW-40-02 and -14 were not analyzed for microbiological and geochemical parameters.

Key observations regarding microbiological parameters are as follows (refer to Table 2):

- Total biomass counts for October 2008 ranged from 1.10×10^8 to 2.53×10^9 cells per liter (cells/L) and were similar to those measured during the July 2008 event (2.13×10^8 to 1.72×10^9 cells/L).

- DHC levels in five of the six wells sampled ranged from 1.5 x 10^6 to 2.7 x 10^7 cells/L, which are reasonably high, and are still comparable to levels measured in July 2008. The other well (MW-40-34) had a DHC count of 8.2 x 10^4. In this well, the only COC exceeding its MCL is VC at a level of 1.1 μg/L.
- Total biomass levels remain high, and DHC organisms are still present at reasonably high levels in key locations. However, COC concentrations have decreased to near background levels. Overall, the potential for biodegradation of chloroethenes is still there; however, it is likely that the system may be substrate limited at this point.

Key observations regarding relevant geochemical parameters for monitored wells are as follows (refer to Tables 3 and 4):

- Based on the October 2008 readings, DO concentrations in the monitoring wells remained at or less than 0.25 mg/L (given limitations associated with this measurement, this essentially represents nondetect).
- ORP values measured during the July 2008 event were negative, ranging from +45 to -108 millivolts (mV). In general, these values represent an increase over the range of values measured during the July 2008 event (-5 to -168). A value of +22.4 mV was measured in MW-40-30, which has low COD and continues to be the most problematic area in terms of treatment. In general, increasing ORP values is consistent with decreasing COD levels, and appears to indicate that the surface conditions are becoming more oxidized.
- Cation data are of interest mainly to track the persistence of sodium, a component of the originally injected donor (sodium lactate). Sodium concentrations in the October 2008 samples ranged from 231 to 360 mg/L, which is comparable with those measured in July 2008 (from 246 to 394 mg/L). This may actually indicate a slight decrease. Sodium values appear to be approaching the baseline levels measured during March 2005, which ranged from 211 to 288 mg/L. It is noted that HRC does not contain sodium.
- The pH readings ranged from 5.94 to 7.45 standard pH units. The 5.94 value was measured in well MW-40-30 in which treatment has continually had problems. The pH in this well may be dropping below the lower range that is generally considered acceptable for bioremediation (approximately 6.0 - 6.5). All other pH values are in the acceptable range.
- The October 2008 geochemical data generally indicate maintenance of reducing conditions supportive of reductive dechlorination in most areas. However, substrate levels (as indicated by the COD) are approaching background, indicating that the HRC applied in April 2007 is spent. Concurrent increases in ORP levels indicate that the system is likely becoming more oxidized. This information, along with the relatively high DHC and total biomass counts, suggests that the potential for continued reductive dechlorination likely exists, however, the system may be substrate limited at this time.

SOIL GAS DATA AND WATER LEVEL MEASUREMENTS

Soil Gas Data. Methane gas surface emissions monitoring was performed on October 3, 2008. During this monitoring event, methane gas emissions were not detected within Buildings 239, 240, or in the surrounding areas.

Soil gas monitoring of probes was conducted on October 3, 2008. The results indicated that the 29 probes tested in the field had methane gas present at concentrations from 15.7 to 85.2 percent in air during the October 2008 monitoring event. The highest methane concentration was detected in the soil gas probe in injection well IW-9. Hydrogen sulfide was detected in 10 of 29 probes with concentrations ranging from

1 to 14 parts per million (ppm). The highest hydrogen sulfide concentrations were detected in the soil gas probes in wells MW-40-35 and IW-8, at 12 and 14 ppm, respectively.

In addition, soil gas samples were collected in 1-liter Tedlar bags from vapor monitoring wells (VW-40-01, -02, -03, -04, and -06) and a select number of soil gas monitoring probes that are installed in groundwater monitoring well MW-40-34 and injection wells IW-1, -3, and -7. VC was detected in eight of nine samples analyzed at concentrations ranging from 1,900 micrograms per cubic meter ($\mu g/m^3$) (or 730 parts per billion in volume [ppbv]) in soil gas monitoring well VW-40-03 to 14,600 $\mu g/m^3$ (or 5,500 ppbv) in the soil gas probe installed in injection well IW-7. DCE was detected in eight of nine sampled wells ranging in concentration from 670 J (estimated) $\mu g/m^3$ in the soil gas probe installed in injection well IW-3 to 15,400 $\mu g/m^3$ in the soil gas probe installed in injection well IW-1. PCE was detected in seven of nine probes at concentrations from 180 J $\mu g/m^3$ in the soil gas monitoring well VW-40-01 to 7,000 $\mu g/m^3$ in soil gas probe installed in groundwater monitoring well MW-40-34. TCE was detected in eight of nine samples at concentrations ranging from 340 J $\mu g/m^3$ in the soil gas probe installed in injection well IW-3 to 25,400 $\mu g/m^3$ in soil gas monitoring well VW-40-03. A summary of the analytical results for the soil gas concentrations is presented in Table 5.

Methane gas concentrations in samples collected in Tedlar bags from the soil gas monitoring probes and vapor monitoring wells, and analyzed in the laboratory, ranged from 37.8 percent in the soil gas probe installed in monitoring well MW-40-34 to 74.6 percent in the soil gas probe installed in injection well IW-3.

Groundwater Levels. Groundwater level measurements were collected on October 2, 2008. Groundwater elevations within the site ranged from 0.84 foot above mean sea level (msl) in MW-40-13 to 2.19 feet above msl in MW-40-02. In general, water level measurements collected in October 2008 did not indicate a change in groundwater level within the monitoring area in comparison with the elevations measured during the previous monitoring event in July 2008.

INVESTIGATION BENEATH BUILDING 240

As noted above, groundwater samples were collected at various depths from inside the locomotive maintenance shop (Building 240) to assess possible residual or source contamination, and hence the potential for further COC rebound in the vicinity of MW-40-14. These samples were also analyzed for COD, and one sample was analyzed for DHC. Direct-push technology using a CPT rig was used for collecting the samples. CPT and groundwater sampling were conducted in accordance with the procedures described in the final Addendum 2 of the final Sampling and Analysis Plan (TtEC, 2008). Sampling locations and COC results are shown on Figure 4. COD and DHC data are included in Table 2.

As can be seen on Figure 4, low levels of PCE, TCE, DCE, and VC were detected in the samples, generally at the shallower sampling depths. The concentrations are consistent with those detected elsewhere at this site, and thus there is no evidence of a major contaminant source. In addition, COD levels were low (roughly consistent with background levels), and DHC was not detected in the samples for which it was analyzed (Table 2). Based on review and evaluation of the data, the determination was made to expand the footprint of the HRC injection to include the area within Building 240, to address the relatively low-level contamination that was encountered. In addition, a “barrier” of more closely spaced injection points was applied at the downgradient edge of the building (refer to Figure 4).

FINAL HRC APPLICATION

A final round of HRC was conducted during October 23 and November 17, 2008 to address residual contamination. To the extent practicable, this is expected to: 1) maximize (increase the rate and extent of) the treatment processes, which are likely substrate limited; 2) reduce the time frame for monitored natural

attenuation (MNA) to act to meet MCLs; and 3) help guard against future contaminant rebound. The HRC application was conducted using the same methodology as the previous HRC application conducted at the site in April 2007, and as described in the final Technical Memorandum, EISB Remedial Action Optimization Work Plan (TtEC 2006). HRC was injected in 186 locations within the site. Of that, 22 are located within Building 240, and the remaining 164 locations are outside the building. The injection points were spaced approximately 10 feet apart and staggered. The areas where HRC was applied are depicted on Figure 4. Approximately 134 pounds of HRC was injected at each of the locations in the subsurface from about 12 to 35 feet below ground surface (approximately 5.85 pounds per foot). Approximately 25,000 pounds of HRC was injected in the subsurface.

The preliminary effectiveness of the HRC injection will be assessed following the next monitoring event scheduled to be conducted in January 2009. Because bacterial biomass and DHC cell counts remain relatively high, it is not anticipated that bioaugmentation will be necessary or beneficial. It is noted that (as mentioned above), low levels of contaminants are still present in MW-40-14, which is located downgradient of the Building 240 concrete pit and gravel area (the contaminant source area). In addition, concentrations of PCE, TCE, and DCE in this well had increased slightly (refer to Figure 2), but now appear stable. It was initially believed that this may have indicated the potential onset of rebound in this area, especially since COC levels in groundwater immediately upgradient (under Building 240) were not previously known. However, as noted above, results of sampling beneath this building suggest relatively minor COC impacts beneath this building, and a major source is not indicated. Nonetheless, the HRC injection included increased dosing along the western edge of Building 240 to address potential contamination migrating from beneath the building.

PLANS FOR FURTHER GROUNDWATER MONITORING

For this report, the number of wells and sampling frequency were reevaluated in the interest of streamlining the monitoring approach in light of the current state of the project. It has been almost 4 years since the inception of the EISB remedy in March 2005, and two optimization events (HRC injections) have been conducted; initially in April 2007 and recently during October and November 2008. As such, we believe current site conditions warrant updating the original monitoring plan. The main reason for the proposed change is that the original plan of quarterly monitoring during the treatment phase, followed by semiannual monitoring throughout the MNA phase, was intended to assess remedy performance and allow for treatment adjustments and optimizations as needed. However at this time, the practical limits of EISB have essentially been reached, COC levels are very low, and a final round of HRC has been applied. Although COC levels still exceed target cleanup goals (TCGs) in a few areas, these levels are expected to be significantly reduced as a result of the HRC injection that was conducted during October and November 2008, and no additional optimizations are deemed practical. Thus, MNA will be relied upon to further reduce contaminant concentrations if needed. In addition, given the low levels of VOCs, and the fact that no additional injections are planned, the potential for contaminant migration is negligible. This is supported by the fact that COCs have never been detected (or have never exceeded an MCL) in most of the perimeter wells, many of which were installed to assess potential plume migration during the remedial investigation, and prior to the EISB phase. Accordingly, there are no benefits to be derived from monitoring on a quarterly or semiannual basis at this time, as no actions will be dependent on the monitoring results. There are also no practical benefits derived at this time from the monitoring of wells in which COCs have never been detected or have never exceeded an MCL.

Accordingly, we propose to streamline the monitoring program at this time and to modify the sampling array. A well-by-well analysis was conducted to determine which wells would provide useful information and should be monitored in January 2009. Table 6 depicts the results of the evaluation, including the rationale for inclusion or exclusion in the streamlined program. The array is also depicted on Figure 5. Groundwater samples from all the selected wells will be analyzed for VOCs, COD, and field parameters; however, only samples from a select number of wells in the array will be analyzed for anions,

cations, total dissolved solids (TDS), phospholipids fatty acids, and DNA (DHC). A report summarizing the field activities and the monitoring results will be prepared following January 2009 monitoring event. The next monitoring event following the January 2009 monitoring event, will be conducted a year later in January 2010. If necessary, based on the evaluation of data to be collected during the January 2009 event, the monitoring array for the January 2010 sampling event will be reassessed in corroboration with the regulatory agencies. Following January 2010 monitoring event, the status of the site would be reviewed as part of the 5-year review process as specified in the Record of Decision (ROD) (Bechtel 2002), and any potential further actions would be identified during that process.

CONCLUSIONS

Significant reductions in total chloroethene concentrations have been observed in all compliance monitoring wells over the life of the project. However low-level residual COCs (mostly DCE and VC) continue to persist above respective MCLs in several wells, mainly in the central portion of the site. Low-level contamination was also found to be present beneath Building 240. In addition, continually decreasing substrate levels observed in essentially all areas (now near background levels) along with increasing ORP levels, indicate that the system is reverting to more oxidizing conditions in critical areas where COCs are still present. This is less favorable for reductive dechlorination and is expected to reduce the degradation rates. Thus, a final round of HRC injection was conducted in critical areas to reestablish conditions supportive of reductive dechlorination in a final attempt to reduce residual COC concentrations and maximize the extent of the EISB treatment. This represents all that can be practically accomplished at this site, and following a round of monitoring in January 2009 to assess the effectiveness of the HRC injection, the next monitoring event will be conducted on January 2010.

RECOMMENDATIONS

The following recommendations are based on the above evaluation and analysis of the data:

1. Conduct monitoring in January 2009 and one year later in January 2010 as proposed in Table 6.

2. Assess success of the HRC application conducted in October and November 2008.

3. Because the HRC application essentially represents the practical limits of what can be accomplished in terms of remediation, begin to formulate/discuss a strategy for shifting to MNA and eventual site closure.

REFERENCES

TtEC (Tetra Tech EC, Inc.). 2005. Final Remedial Design/Work Plan, Enhanced In Situ Bioremediation at Installation Restoration Program Site 40 (Concrete Pit/Gravel Area). Naval Weapons Station Seal Beach, Seal Beach, California. DCN: FWSD-RAC-05-0380. February 24.

TtEC (Tetra Tech EC, Inc.). 2006. Final Technical Memorandum, Enhanced In Situ Bioremediation Remedial Action Optimization Work Plan, at Installation Restoration Program Site 40 (Concrete Pit/Gravel Area). Naval Weapons Station Seal Beach, Seal Beach, California. DCN: ECSD-RACIV-07-0060. November 17.

TtEC (Tetra Tech EC, Inc.). 2008. Final Addendum 2 to the Final Sampling and Analysis Plan (Field Sampling and Quality Assurance Project Plan), Enhanced In Situ Bioremediation at Installation Restoration Program Site 40 (Concrete Pit/Gravel Area). Naval Weapons Station Seal Beach, Seal Beach, California. DCN: ECSD-2201-0010-0004. September 12.

TABLES

Table 1 Summary of Monitoring Activities Conducted During October/November 2008

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Table 6 Assessment of Recommended Monitoring Frequency for All Monitoring Wells

FIGURES

Figure 1 COC Concentrations for Shallow and Mid-Shallow Monitoring Wells Proposed for Annual Monitoring

Figure 2 COC Concentrations for Shallow and Mid-Shallow Monitoring Wells Proposed for Semiannual Monitoring, October 2008

Figure 3 COC Concentrations for Shallow Monitoring Wells Proposed for Quarterly Monitoring, October 2008

Figure 4 CPT/DPT Sampling and Results and HRC Injection Points

Figure 5 Wells Proposed for Future Monitoring

TABLES

TABLE 1

SUMMARY OF MONITORING ACTIVITIES CONDUCTED DURING OCTOBER AND NOVEMBER 2008

Date	Event	Wells Sampled[a]	Analytes[b]/Parameters	Notes
10/2/08	Soil vapor sampling	VW-40-01, -02, -03, -04, -06, MW-40-34, IW-1, -3, and -7.	VOCs and fixed gases	Laboratory analysis
10/2/08	Groundwater level measurement	MW-40-01, -02, -06, 07, 08, -10, -11, -13, -14, -15, -17, -19, -20, -22, -30 through 39, and IW-1 through IW-17.	Not applicable	Groundwater level measurements
10/3/08	Soil vapor/gas probe monitoring	Probes in wells VW-40-01 through -06, and nested probes in MW-40-32 though 39, and IW-1 through IW-4 and IW-6 through IW-17.	Methane, oxygen, carbon dioxide, VOCs, and carbon monoxide	Field testing
10/3/08	Surface emissions monitoring	Not applicable	Methane gas concentrations	Inside Building 240 and western portion of Building 239, and areas surrounding the above buildings
10/6/08-10/7/08	Groundwater sampling	MW-40-02, -07, -08, -14, -30, -32, -34, -36, and -37.	VOCs, Dissolved gases, TDS, Cations, Anions, Alkalinity, COD, DNA, PLFAs, VFAs	Laboratory and field parameters
10/7/08-10/8/08	Land Surveying	Not applicable	Not applicable	Survey for HRC® injection and CPT locations.
10/7/08-10/8/08	Geophysical Surveying	Not applicable	Not applicable	Geophysical survey for subsurface clearance of the CPT locations.
10/21/08-10/22/08	CPT groundwater sampling beneath Building 240	CPT 17, 18, 19, 20, and 21	VOCs, COD, DNA	Samples collected from three depths per point. Not all samples analyzed for all parameters. Refer to Figure 4 for CPT locations.
10/23/08-11/18/08	HRC application	Not applicable	Not applicable	Refer to Figure 4 for injection point locations.

Notes:

[a] Refer to Figures for well/sampling locations.

[b] Not all compounds analyzed for all wells.

Abbreviations and Acronyms

COD – chemical oxygen demand
CPT – cone penetrometer test
DNA – deoxyribonucleic acid
HRC – hydrogen release compound
PLFA – phospholipids acid
TDS – total dissolved solid
VFA – volatile fatty acid
VOC – volatile organic compound

TABLE 2

COD, VFA, DHC, AND PLFA DATA COLLECTED DURING OCTOBER 2008

Location	COD (mg/L)	Acetic Acid (mg/L)	Propionic Acid (mg/L)	Butyric Acid (mg/L)	DHC (cells/L)	Total PLFA Biomass (cells/L)
MW-40-02	94.2	NA	NA	NA	NA	NA
MW-40-07	167	179.7	129.5	87.5	2.97E+06	2.53E+09
MW-40-14	41.4	NA	NA	NA	NA	NA
MW-40-30	33.3	<1	<1	<1	1.85E+06	1.89E+09
MW-40-32	49.5	4.5	3	<1	2.71E+07	1.10E+08
MW-40-34	43.4	<1	<1	<1	8.16E+04	1.44E+09
MW-40-36	41.4	<1	<1	<1	6.12E+06	1.29E+09
MW-40-37	37.3	<1	<1	<1	1.47E+06	5.89E+08
CPT 17 13'	31.5	NA	NA	NA	NA	NA
CPT 17 20'	19.1	NA	NA	NA	NA	NA
CPT 17 25'	21.1	NA	NA	NA	NA	NA
CPT 18 13'	14.9	NA	NA	NA	NA	NA
CPT 18 22'	17	NA	NA	NA	NA	NA
CPT 18 26'	31.5	NA	NA	NA	NA	NA
CPT 19 16'	59	NA	NA	NA	<4.90E+02	NA
CPT 19 25'	40.3	NA	NA	NA	NA	NA
CPT 19 32'	38.2	NA	NA	NA	NA	NA
CPT 20 12'	38.2	NA	NA	NA	NA	NA
CPT 20 22'	44.5	NA	NA	NA	NA	NA
CPT 20 28'	46.5	NA	NA	NA	NA	NA
CPT 21 16'	34	NA	NA	NA	NA	NA
CPT 21 24'	44.5	NA	NA	NA	NA	NA
CPT 21 30'	71.6	NA	NA	NA	NA	NA

Notes:

Pyruvic acid and formic acid were not detected; lactic acid was detected in MW-40-31 and MW-40-35 during the January 2008 event at 52.9 mg/L and 609.8 mg/L, respectively.

Abbreviations and Acronyms

cells/L – cells per liter
COD – chemical oxygen demand
CPT – cone penetrometer test
DHC – *Dehalococcoides* spp.
mg/L – milligrams per liter
NA – not analyzed
PLFA – phospholipid fatty acid
VFA – volatile fatty acid

TABLE 3

ANIONS, ALKALINITY, DO, ORP, AND pH DATA COLLECTED DURING OCTOBER 2008

Location	Chloride (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	DO (mg/L)	ORP (mV)	pH (pH units)
MW-40-02	NA	NA	NA	NA	NA	0.11	-80.7	7.45
MW-40-07	395	<0.200	0.170	1.36	1440	0.10	-83.2	6.74
MW-40-08	NA	NA	NA	NA	NA	0.15	45.0	6.80
MW-40-14	NA	NA	NA	NA	NA	0.19	-50.1	6.62
MW-40-30	172	<0.200	0.100	124	612	0.09	22.4	5.94
MW-40-32	130	<0.200	0.0900 J	1.36	1170	0.14	-81.4	6.62
MW-40-34	157	<0.200	0.361	3.6	928	0.25	-108.4	6.85
MW-40-36	273	<0.200	0.114	1.18	848	0.19	-102.1	6.62
MW-40-37	482	<0.200	0.0900 J	193	671	0.04	-46.8	6.52

Abbreviations and Acronyms

DO – dissolved oxygen

mg/L – milligrams per liter

mV – millivolt

NA – not analyzed

ORP – oxidation/reduction potential

TABLE 4

CATION CONCENTRATIONS IN SAMPLES COLLECTED IN OCTOBER 2008

Location	Calcium (mg/L)	Iron (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)
MW-40-07	330	17.6	86.4	7.79	320
MW-40-30	58.5	4.33	16.4	<5.00	326
MW-40-32	146	21.7	45.1	2.79 J	360
MW-40-34	150	30.7	30.2	6.53	283
MW-40-36	161	24.7	63.3	5.68	231
MW-40-37	210	6.55	70.7	5.78	282

Abbreviations and Acronyms

J – estimated value below the laboratory reporting limit
mg/L – milligrams per liter

TABLE 5

PCE, TCE, DCE, AND VC CONCENTRATIONS IN SOIL GAS SAMPLES COLLECTED IN OCTOBER 2008

Probe/Well ID	PCE		TCE		cis-1,2-DCE		Vinyl Chloride	
	Result ppbv	Result µg/m^3	Result ppbv	Result µg/m^3	Result ppbv	Result µg/m^3	Result ppbv	Result µg/m^3
IW-1	21 U	140 U	170	930	3800	15400	4600	12000
IW-1 (FD)	21 U	140 U	150	820	3600	14500	4400	11500
IW-3	60	420	61	340	160	670	5300	14000
IW-7	910	6400	980	5400	180	720	5500	14600
MW-40-34	990	7000	320	1800	810	3300	1100	3000
VW-40-01	26 J	180 J	390	2200	610	2500	1600	4400
VW-40-02	21 U	140 U	86 J	480 J	1100	4500	1700	4500
VW-40-03	390	2800	4600	25400	1100	4400	730	1900
VW-40-04	280	2000	21 U	110 U	21 U	84 U	20 U	54 U
VW-40-06	270	1900	250	1400	620	2600	2200	5700

Abbreviations and Acronyms

µg/m^3 – micrograms per cubic meter
DCE – dichloroethene
FD – field duplicate
ID – identification
J – estimated value
PCE – perchloroethene
ppbv – parts per billion by volume
TCE – trichloroethene
U – analyte not detected above the (project) quantitation limit

TABLE 6

ASSESSMENT OF RECOMMENDED MONITORING FREQUENCY FOR ALL MONITORING WELLS

Well	Exceedance (Based on October 2008 data, for monitoring wells and April 2008 data for injection wells)	Recommendation	Recommended Analyses	Comment/Rationale[a]
MW-40-02	None	No Further Monitoring	N/A	Upgradient, no contamination present for over a year
MW-40-06	None	No Further Monitoring	N/A	Upgradient, no contamination present for over 2 years
MW-40-07	VC - 4.7 µg/L	Annual Monitoring	VOCs, COD, field parameters[b], anions/cations, alkalinity, TOC, DNA	Minor contamination present, shallow downgradient check well
MW-40-08	PCE - 6.8 µg/L	Annual Monitoring	VOCs, COD, field parameters[b]	Minor contamination present, shallow downgradient check well
MW-40-10	None	No Further Monitoring	N/A	Upgradient, no contamination present for over a year
MW-40-11	None	No Further Monitoring	N/A	Crossgradient, COCs never detected
MW-40-13	None	Annual Monitoring	VOCs, COD, field parameters[b]	No contamination present, deep downgradient check well
MW-40-14	TCE - 5.9 µg/L DCE - 13 µg/L VC - 6 µg/L	Annual Monitoring	VOCs, COD, field parameters[b], anions/cations, alkalinity, TOC	Contaminant still present
MW-40-15	None	No Further Monitoring	N/A	Far downgradient, no exceedences ever detected
MW-40-16	None	No Further Monitoring	N/A	Far downgradient, COCs never detected
MW-40-17	None	No Further Monitoring	N/A	Far downgradient, one exceedence in 9/05
MW-40-18	None	No Further Monitoring	N/A	Far downgradient, COCs never detected
MW-40-20	None	No Further Monitoring	N/A	Downgradient, no exceedences ever detected
MW-40-22	VC - 0.64 µg/L	Annual Monitoring	VOCs, COD, field parameters[b]	Minimal contamination still present, upgradient check well
MW-40-30	TCE - 29 mg/L DCE - 31 µg/L VC - 5.4 µg/L	Annual Monitoring	VOCs, COD, field parameters[b], anions/cations, alkalinity, TOC, DNA	Contamination still present
MW-40-31	None	Annual Monitoring	VOCs, COD, field parameters[b]	Deep centrally located check well
MW-40-32	DCE - 5.1 µg/L VC - 4.2 µg/L	Annual Monitoring	VOCs, COD, field parameters[b], anions/cations, alkalinity, TOC	Minimal contamination still present
MW-40-33	None	No Further Monitoring	N/A	Crossgradient, COCs never detected
MW-40-34	VC - 1.1 µg/L	Annual Monitoring	VOCs, COD, field parameters[b], anions/cations, alkalinity, TOC, DNA	Minimal contamination still present
MW-40-35	None	Annual Monitoring	VOCs, COD, field parameters[b]	Deep centrally located check well
MW-40-36	VC - 2.3 µg/L	Annual Monitoring	VOCs, COD, field parameters[b]	Minimal contamination still present
MW-40-37	DCE - 110 µg/L VC - 27 µg/L	Annual Monitoring	VOCs, COD, field parameters[b] , anions/cations, alkalinity, TOC, DNA	Contamination still present
MW-40-38		No Further Monitoring	N/A	Crossgradient, no exceedences ever detected

TABLE 6

ASSESSMENT OF RECOMMENDED MONITORING FREQUENCY FOR ALL MONITORING WELLS

Well	Exceedance (Based on October 2008 data, for monitoring wells and April 2008 data for injection wells)	Recommendation	Recommended Analyses	Comment/Rationale[a]
MW-40-39		Annual Monitoring	VOCs, COD, field parameters[b]	Shallow, downgradient check well
IW-1	TCE - 7.3 µg/L VC - 3.8 µg/L	Annual Monitoring	VOCs, COD, field parameters[b], anions/cations, alkalinity, TOC	Minimal contamination still present, upgradient check well
IW-4	VC - 4.8 µg/L	Annual Monitoring	VOCs, COD, field parameters[b]	Minimal contamination still present, crossgradient check well
IW-6	DCE - 32 µg/L VC - 6.9 µg/L	Annual Monitoring	VOCs, COD, field parameters**, anions/cations, alkalinity, TOC, DNA	Minimal contamination still present, crossgradient check well
IW-12	VC - 0.99 µg/L	Annual Monitoring	VOCs, COD, field parameters[b]	Contamination still present, in-plume well
IW-14	TCE - 8.6 µg/L VC - 11 µg/L	Annual Monitoring	VOCs, COD, field parameters[b]	Contamination still present, in-plume well
IW-16	VC - 1.7 µg/L	Annual Monitoring	VOCs, COD, field parameters[b]	Minimal contamination still present, crossgradient check well
Vapor Probe				
IW-1	Methane - 78.4%	Annual Monitoring	Field testing for methane, CO_2, Co, O, hydrogen sulfide, and lab analysis for VOCs, fixed gases	High methane concentrations updgradient of Building 240
IW-7	Methane - 71.4%	Annual Monitoring	Same as above	High methane concentrations south of Building 240
MW-40-37	Methane - 70.7%	Annual Monitoring	Same as above	High methane concentrations west of Building 239
VW-40-3	Methane - 68.7%	Annual Monitoring	Same as above	High methane concentrations south of Building 240
VW-40-6	Methane - 70.2%	Annual Monitoring	Same as above	High methane concentrations northwest of Building 239

Notes:

Refer to Figures 1, 2, and 3 for concentrations and overall trends.

[a] Additionally, most wells are in the area of the recent HRC injection, and will be used to assess the progeress of this treatment

[b] Dissolved oxyen, oxidation/reduction potential, temperature, electrical conductivity, pH

Abbreviations and Acronyms

COC – chemical of concern
COD – chemical oxygen demand
DCE – dichloroethene
J - Estimated value - between detection and reporting limit
MCL – maximum contaminant level
mg/L – milligrams per liter
N/A – not applicable
PCE – tetrachloroethene
TCE – trichloroethene
TOC – total organic compound
VC – vinyl chloride
VOC – volatile organic compound
µg/L – micrograms per liter

FIGURES

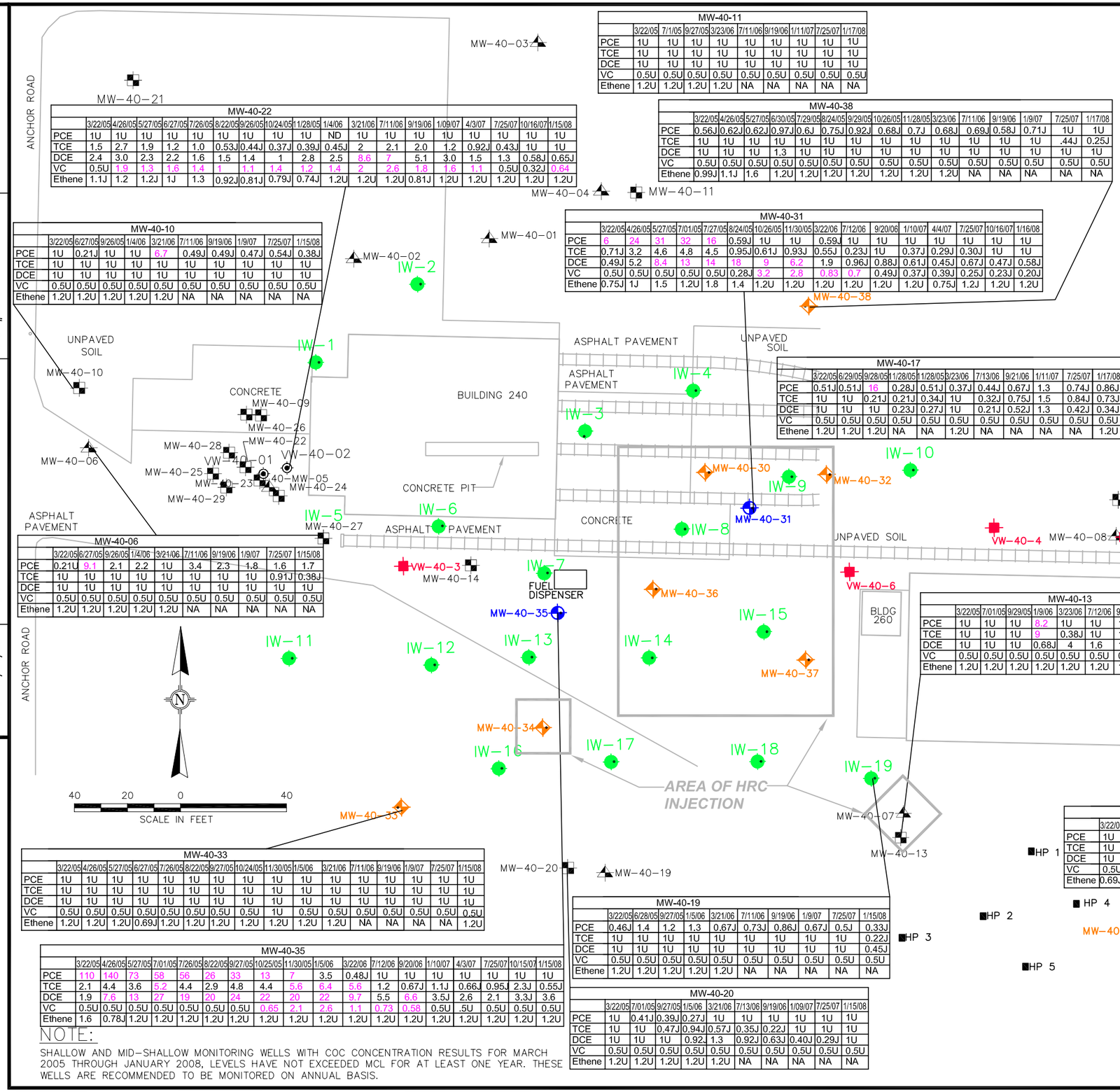
DRAWING NO: 09003301.DWG

DCN: ECSD-2201-0009-0033 CTO: #0010

APPROVED BY: HH

CHECKED BY: ML REV:

DRAWN BY: MD DATE: 10/23/08



MW-40-11	3/22/05	7/1/05	9/27/05	3/23/06	7/11/06	9/19/06	1/11/07	7/25/07	1/17/08
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-22	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/09/07	4/3/07	7/25/07	10/16/07	1/15/08
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	ND	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1.5	2.7	1.9	1.2	1.0	0.53J	0.44J	0.37J	0.39J	0.45J	2	2.1	2.0	1.2	0.92J	0.43J	1U	1U
DCE	2.4	3.0	2.3	2.2	1.6	1.5	1.4	1	2.8	2.5	8.6	7	5.1	3.0	1.5	1.3	0.58J	0.65J
VC	0.5U	1.9	1.3	1.6	1.4	1	1.1	1.4	1.2	1.4	2	2.6	1.8	1.6	1.1	0.5U	0.32J	0.64
Ethene	1.1J	1.2	1.2J	1J	1.3	0.92J	0.81J	0.79J	0.74J	1.2U	1.2U	1.2U	0.81J	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-38	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/24/05	9/29/05	10/26/05	11/28/05	3/23/06	7/11/06	9/19/06	1/9/07	7/25/07	1/17/08
PCE	0.56J	0.62J	0.62J	0.97J	0.6J	0.75J	0.92J	0.68J	0.7J	0.68J	0.69J	0.58J	0.71J	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	.44J	0.25J
DCE	1U	1U	1U	1.3	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.99J	1.1J	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-10	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	1U	0.21J	1U	1U	6.7	0.49J	0.49J	0.47J	0.54J	0.38J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-31	3/22/05	4/26/05	5/27/05	7/01/05	7/27/05	8/24/05	10/26/05	11/30/05	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/16/08
PCE	6	24	31	32	16	0.59J	1U	1U	0.59J	1U	1U	1U	1U	1U	1U	1U
TCE	0.71J	3.2	4.6	4.8	4.5	0.95J	0.61J	0.93J	0.55J	0.23J	1U	0.37J	0.29J	0.30J	1U	1U
DCE	0.49J	5.2	8.4	13	14	18	9	6.2	1.9	0.96J	0.88J	0.61J	0.45J	0.67J	0.47J	0.58J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.28J	3.2	2.8	0.83	0.7	0.49J	0.37J	0.39J	0.25J	0.23J	0.20J
Ethene	0.75J	1J	1.5	1.2U	1.8	1.4	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.75J	1.2J	1.2U	1.2U

MW-40-17	3/22/05	6/29/05	9/28/05	11/28/05	11/28/05	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
PCE	0.51J	0.51J	16	0.28J	0.51J	0.37J	0.44J	0.67J	1.3	0.74J	0.86J
TCE	1U	1U	0.21J	0.21J	0.34J	1U	0.32J	0.75J	1.5	0.84J	0.73J
DCE	1U	1U	1U	0.23J	0.27J	1U	0.21J	0.52J	1.3	0.42J	0.34J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	1.2U	NA	NA	NA	NA	1.2U

MW-40-18	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
PCE	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-06	3/22/05	6/27/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	0.21U	9.1	2.1	2.2	1U	3.4	2.3	1.8	1.6	1.7
TCE	1U	1U	1U	1U	1U	1U	1U	1U	0.91J	0.38J
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-13	3/22/05	7/01/05	9/29/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	7/25/07	1/15/08
PCE	1U	1U	1U	8.2	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	9	0.38J	1U	1U	1U	1U	1U
DCE	1U	1U	1U	0.68J	4	1.6	1.3	0.88J	1.7	0.40J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA

MW-40-15	3/22/05	6/30/05	9/28/05	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
	1U	1U	0.26J	0.23J	1U	1U	1U	1U	1U	1U
	1U	1U	0.26J	0.21J	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.1J	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-16	1/6/06	3/23/06	7/13/06	9/21/06	1/11/07	7/25/07	1/17/08
PCE	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	1U	1U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-39	3/22/05	4/26/05	4/26/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/30/05	1/6/06	3/21/06	7/11/06	9/21/06	1/9/07	7/25/07	1/15/08
PCE	1U	1U	1U	1U	0.34J	0.29J	0.35J	0.42J	0.49J	0.71J	0.72J	1.7	2.4	2.5	2.8	1.3
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	NA	NA	NA	NA	NA	NA	NA	NA

MW-40-33	3/22/05	4/26/05	5/27/05	6/27/05	7/26/05	8/22/05	9/27/05	10/24/05	11/30/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	1.2U

MW-40-35	3/22/05	4/26/05	5/27/05	7/01/05	7/26/05	8/22/05	9/27/05	10/25/05	11/30/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/15/08
PCE	110	140	73	58	56	26	33	13	7	3.5	0.48J	1U	1U	1U	1U	1U	1U	1U
TCE	2.1	4.4	3.6	5.2	4.4	2.9	4.8	4.4	5.6	6.4	5.6	1.2	0.67J	1.1J	0.66J	0.95J	2.3J	0.55J
DCE	1.9	7.6	13	27	19	20	24	22	20	22	9.7	5.5	6.6	3.5J	2.6	2.1	3.3J	3.6
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.65	2.1	2.6	1.1	0.73	0.58	0.5U	.5U	0.5U	0.5U	0.5U
Ethene	1.6	0.78J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-19	3/22/05	6/28/05	9/27/05	1/5/06	3/21/06	7/11/06	9/19/06	1/9/07	7/25/07	1/15/08
PCE	0.46J	1.4	1.2	1.3	0.67J	0.73J	0.86J	0.67J	0.5J	0.33J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	0.22J
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	0.45J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

MW-40-20	3/22/05	7/01/05	9/27/05	1/5/06	3/21/06	7/13/06	9/19/06	1/09/07	7/25/07	1/15/08
PCE	1U	0.41J	0.39J	0.27J	1U	1U	1U	1U	1U	1U
TCE	1U	1U	0.47J	0.94J	0.57J	0.35J	0.22J	1U	1U	1U
DCE	1U	1U	1U	0.92J	1.3	0.92J	0.63J	0.40J	0.29J	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 HYDROPUNCH LOCATIONS*

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (μg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

NOTE:

SHALLOW AND MID-SHALLOW MONITORING WELLS WITH COC CONCENTRATION RESULTS FOR MARCH 2005 THROUGH JANUARY 2008, LEVELS HAVE NOT EXCEEDED MCL FOR AT LEAST ONE YEAR. THESE WELLS ARE RECOMMENDED TO BE MONITORED ON ANNUAL BASIS.

Figure 1

COC CONCENTRATIONS FOR SHALLOW AND MID SHALLOW MONITORING WELLS PROPOSED FOR ANNUAL MONITORING

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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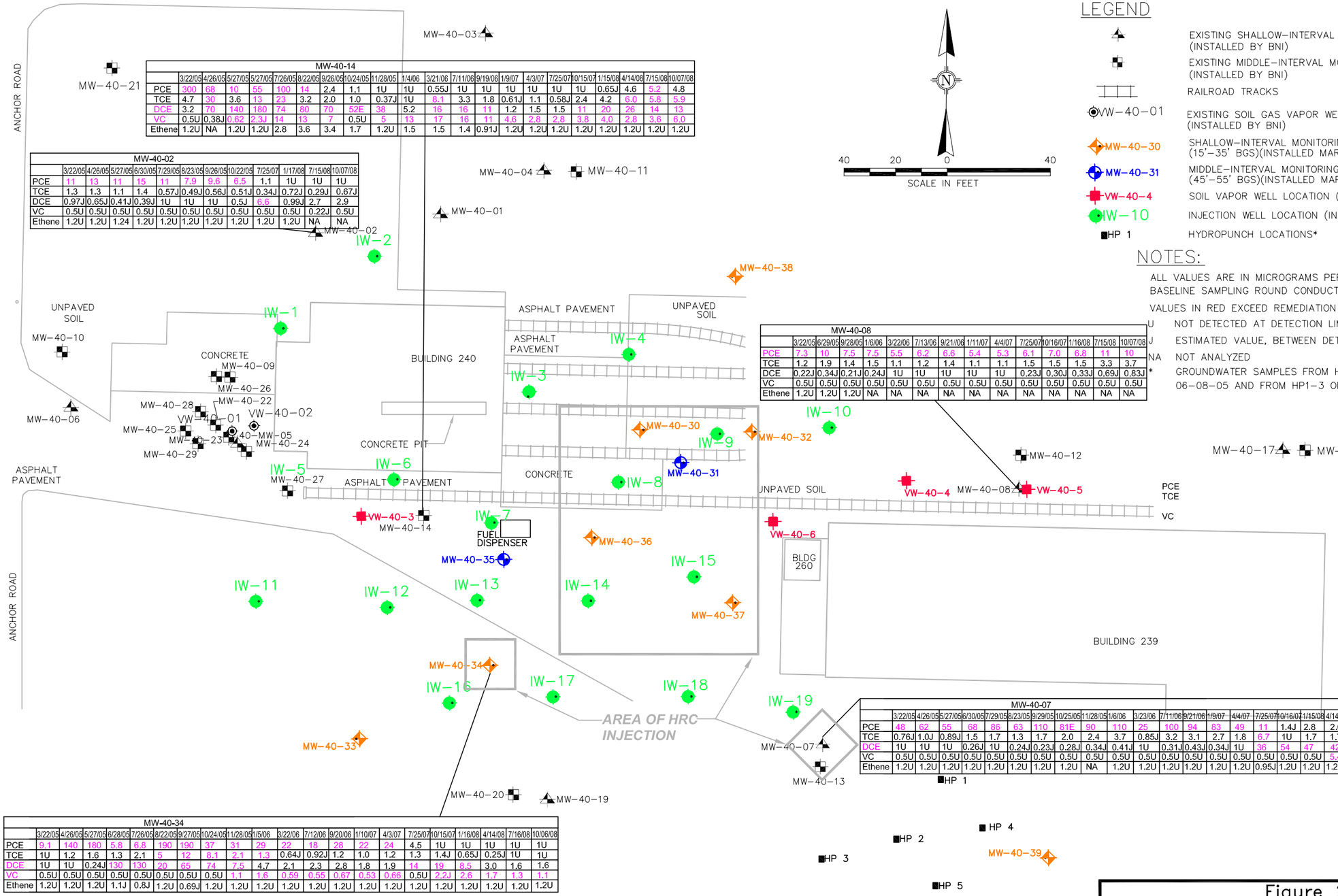

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 — SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (µg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED
* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

MW-40-14

	3/22/05	4/26/05	5/27/05	5/27/05	7/26/05	8/22/05	9/26/05	10/24/05	11/28/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	4/3/07	7/25/07	10/15/07	1/15/08	4/14/08	7/15/08	10/07/08
PCE	300	68	10	55	100	14	2.4	1.1	1U	1U	0.55J	1U	1U	1U	1U	1U	1U	0.65J	4.6	5.2	4.8
TCE	4.7	30	3.6	13	23	3.2	2.0	1.0	0.37J	1U	8.1	3.3	1.8	0.61J	1.1	0.58J	2.4	4.2	6.0	5.8	5.9
DCE	3.2	70	140	180	74	80	70	52E	38	5.2	16	16	11	1.2	1.5	1.5	11	20	26	14	13
VC	0.5U	0.38J	0.62	2.3J	14	13	7	0.5U	5	13	17	16	11	4.6	2.8	2.8	3.8	4.0	2.8	3.6	6.0
Ethene	1.2U	NA	1.2U	1.2U	2.8	3.6	3.4	1.7	1.2U	1.5	1.5	1.4	0.91J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-02

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/26/05	10/22/05	7/25/07	1/17/08	7/15/08	10/07/08
PCE	11	13	11	15	11	7.9	9.6	6.5	1.1	1U	1U	1U
TCE	1.3	1.3	1.1	1.4	0.57J	0.49J	0.56J	0.51J	0.34J	0.72J	0.29J	0.67J
DCE	0.97J	0.65J	0.41J	0.39J	1U	1U	1U	0.5J	6.6	0.99J	2.7	2.9
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.22J	0.5U
Ethene	1.2U	1.2U	1.24	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA

MW-40-08

	3/22/05	6/29/05	9/28/05	1/6/06	3/22/06	7/13/06	9/21/06	1/11/07	4/4/07	7/25/07	10/16/07	1/16/08	7/15/08	10/07/08
PCE	7.3	10	7.5	7.5	5.5	6.2	6.6	5.4	5.3	6.1	7.0	6.8	11	10
TCE	1.2	1.9	1.4	1.5	1.1	1.2	1.4	1.1	1.1	1.5	1.5	1.5	3.3	3.7
DCE	0.22J	0.34J	0.21J	0.24J	1U	1U	1U	1U	1U	0.23J	0.30J	0.33J	0.69J	0.83J
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

MW-40-07

	3/22/05	4/26/05	5/27/05	6/30/05	7/29/05	8/23/05	9/29/05	10/25/05	11/28/05	1/6/06	3/23/06	7/11/06	9/21/06	1/9/07	4/4/07	7/25/07	10/16/07	1/15/08
PCE	48	62	55	68	86	63	110	81E	90	110	25	100	94	83	49	11	1.4J	2.8
TCE	0.76J	1.0J	0.89J	1.5	1.7	1.3	1.7	2.0	2.4	3.7	0.85J	3.2	3.1	2.7	1.8	6.7	1U	1.7
DCE	1U	1U	1U	0.26J	1U	0.24J	0.23J	0.28J	0.34J	0.41J	1U	0.31J	0.43J	0.34J	1U	36	54	47
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.95J	1.2U	1.2U

MW-40-16

	4/14/08	7/16/08	10/06/08
PCE	2.6	1.3	1U
TCE	1.7	1.8	1.1
DCE	42	12	3.9
VC	5.4	8.3	4.7
Ethene	1.2U	0.80J	1.6

MW-40-34

	3/22/05	4/26/05	5/27/05	6/28/05	7/26/05	8/22/05	9/27/05	10/24/05	11/28/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/16/08	4/14/08	7/16/08	10/06/08
PCE	9.1	140	180	5.8	6.8	190	190	37	31	29	22	18	28	22	24	4.5	1U	1U	1U	1U	1U
TCE	1U	1.2	1.6	1.3	2.1	5	12	8.1	2.1	1.3	0.64J	0.92J	1.2	1.0	1.2	1.3	1.4J	0.65J	0.25J	1U	1U
DCE	1U	1U	0.24J	130	130	20	65	74	7.5	4.7	2.1	2.3	2.8	1.8	1.9	14	19	8.5	3.0	1.6	1.6
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.1	1.6	0.59	0.55	0.67	0.53	0.66	0.5U	2.2J	2.6	1.7	1.3	1.1
Ethene	1.2U	1.2U	1.2U	1.1J	0.8J	1.2U	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

NOTE:

MONITORING WELLS MW-40-02,-07,-14,-34 IN WHICH CONCENTRATIONS OF ONE OR MORE COCs HAVE EXCEEDED RESPECTIVE MCL LEVELS DURING RECENT OR LATEST MONITORING EVENTS, BUT ARE LESS THAN 10 TIMES MCL.

Figure 2

COC CONCENTRATIONS FOR SHALLOW AND MID-SHALLOW MONITORING WELLS PROPOSED FOR SEMIANNUAL MONITORING, OCTOBER 2008

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 09003302.DWG
DCN: ECSD-2201-0009-0033
CTO: #0010
APPROVED BY: HH
CHECKED BY: NW
REV:
DRAWN BY: MD
DATE: 10/23/08

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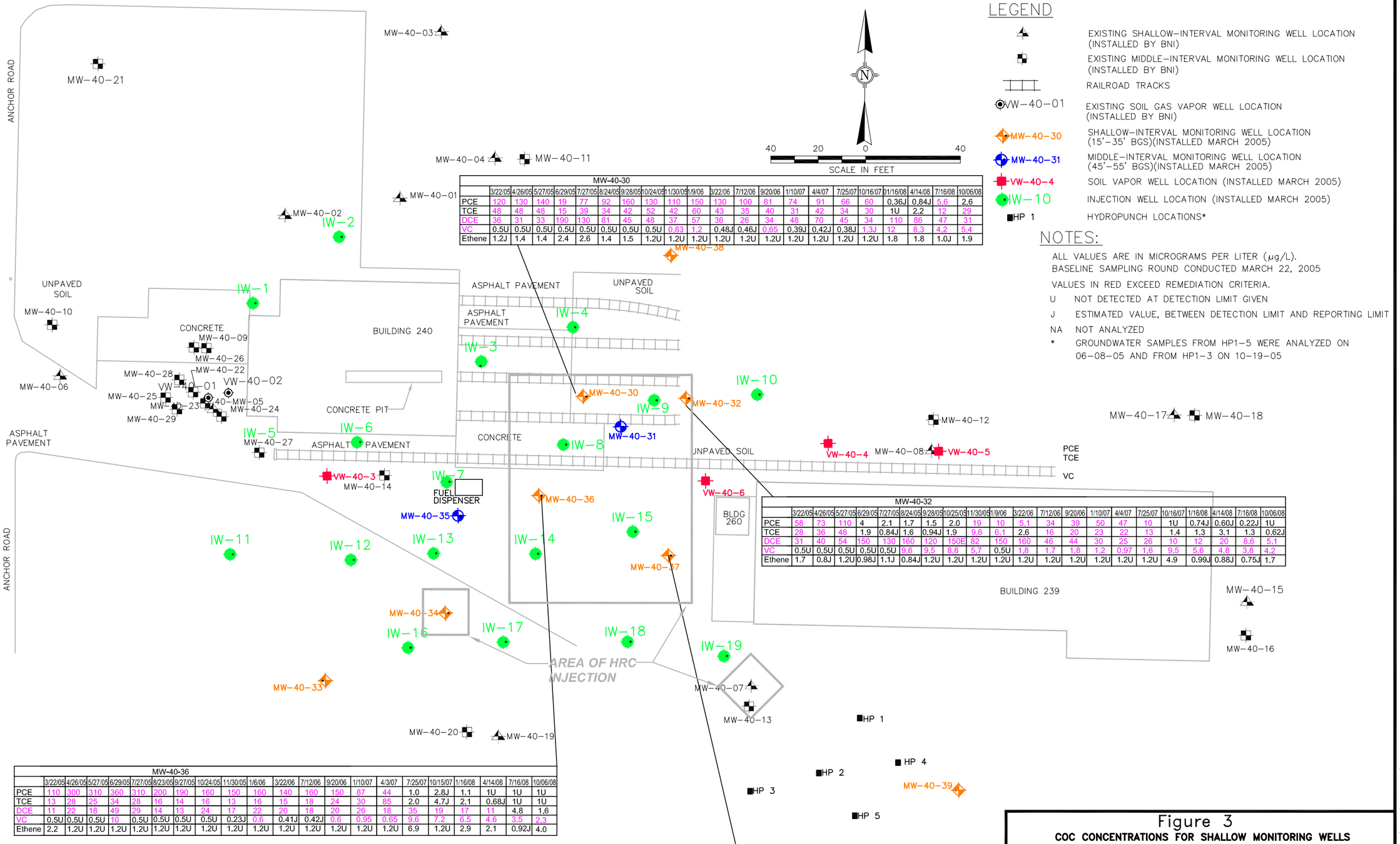
PLOT/UPDATE: NOV 26 2008 15:26:09



LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 — EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 — SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 — MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 — SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 — INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HP 1 — HYDROPUNCH LOCATIONS*

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (µg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005

VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN

J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT

NA NOT ANALYZED

* GROUNDWATER SAMPLES FROM HP1-5 WERE ANALYZED ON 06-08-05 AND FROM HP1-3 ON 10-19-05

MW-40-30

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/24/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	01/16/08	4/14/08	7/16/08	10/06/08
PCE	120	130	140	19	77	92	160	130	110	150	130	100	81	74	91	66	60	0.36J	0.84J	5.6	2.6
TCE	48	48	48	15	39	34	42	52	42	60	43	35	40	31	42	34	30	1U	2.2	12	29
DCE	36	31	33	190	130	81	45	48	37	57	36	26	34	48	70	45	34	110	86	47	31
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.83	1.2	0.48J	0.46J	0.65	0.39J	0.42J	0.38J	1.3J	12	8.3	4.2	5.4
Ethene	1.2J	1.4	1.4	2.4	2.6	1.4	1.5	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.8	1.8	1.0J	1.9

MW-40-32

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/24/05	9/28/05	10/25/05	11/30/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/16/08	4/14/08	7/16/08	10/06/08
PCE	58	73	110	4	2.1	1.7	1.5	2.0	19	10	5.1	34	39	50	47	10	1U	0.74J	0.60J	0.22J	1U
TCE	28	36	48	1.9	0.84J	1.6	0.94J	1.9	9.6	6.1	2.6	16	20	23	22	13	1.4	1.3	3.1	1.3	0.62J
DCE	31	40	54	150	130	160	120	150E	82	150	160	46	44	30	25	26	10	12	20	8.6	5.1
VC	0.5U	0.5U	0.5U	0.5U	0.5U	9.6	9.5	8.8	5.7	0.5U	1.8	1.7	1.8	1.2	0.97	1.6	9.5	5.6	4.8	3.8	4.2
Ethene	1.7	0.8J	1.2U	0.98J	1.1J	0.84J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	4.9	0.99J	0.88J	0.75J	1.7

MW-40-36

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/24/05	11/30/05	1/6/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/16/08	4/14/08	7/16/08	10/06/08
PCE	110	300	310	360	310	200	190	160	150	160	140	160	150	87	44	1.0	2.8J	1.1	1U	1U	1U
TCE	13	28	25	34	28	16	14	16	13	16	15	18	24	30	85	2.0	4.7J	2.1	0.68J	1U	1U
DCE	11	22	18	49	29	14	13	24	17	22	20	18	20	26	18	35	19	17	11	4.8	1.6
VC	0.5U	0.5U	0.5U	10	0.5U	0.5U	0.5U	0.5U	0.23J	0.6	0.41J	0.42J	0.6	0.95	0.65	9.6	7.2	6.5	4.6	3.5	2.3
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	6.9	1.2U	2.9	2.1	0.92J	4.0

MW-40-37

	3/22/05	4/26/05	5/27/05	6/29/05	7/27/05	8/23/05	9/27/05	10/25/05	11/30/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/15/07	1/16/08	4/14/08	7/16/08	10/06/08
PCE	250	330	190	15	140	170	370	120E	390	440	100	120	1.3	2.1	1.1	0.31J	1.8J	0.36J	1U	0.48J	1U
TCE	12	12	63	16	72	56	53	38	29	48	28	46	16	0.94J	4.9	0.36J	3.1J	1.3	1.3	1.5	1.7
DCE	5.0	4.9	110	280	170	100	79	50E	48	63	35	36	140	140	89	64	69	94	58	82	110
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.2	3.6	4.5	18	18	24	18	18	12	18	27
Ethene	1.5	3.7	4.6	5.7	5.0	4.1	3.5	2.9	2.9	3.0	1.2U	2	2.6	4.1	3.0	11	1.2U	6.5	4.6	5.6	7

NOTE:

SHALLOW AND MID-SHALLOW MONITORING WELLS IN WHICH CONCENTRATIONS OF ONE OR MORE COCs HAVE EXCEEDED RESPECTIVE MCL LEVELS DURING RECENT OR LATEST MONITORING EVENTS.

Figure 3

COC CONCENTRATIONS FOR SHALLOW MONITORING WELLS PROPOSED FOR QUARTERLY MONITORING, OCTOBER 2008

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

DRAWING NO: 09003303.DWG
DCN: ECSD-2201-0009-0033
CTO: #0010
APPROVED BY: HH
CHECKED BY: NW
REV:
DRAWN BY: MD
DATE: 10/23/08

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PLOT/UPDATE: NOV 26 2008 15:27:34

DRAWING NO: 09003304.DWG

DCN: ECSD-2201-0009-0033 CTO: #0010

APPROVED BY: HH

CHECKED BY: HH REV:

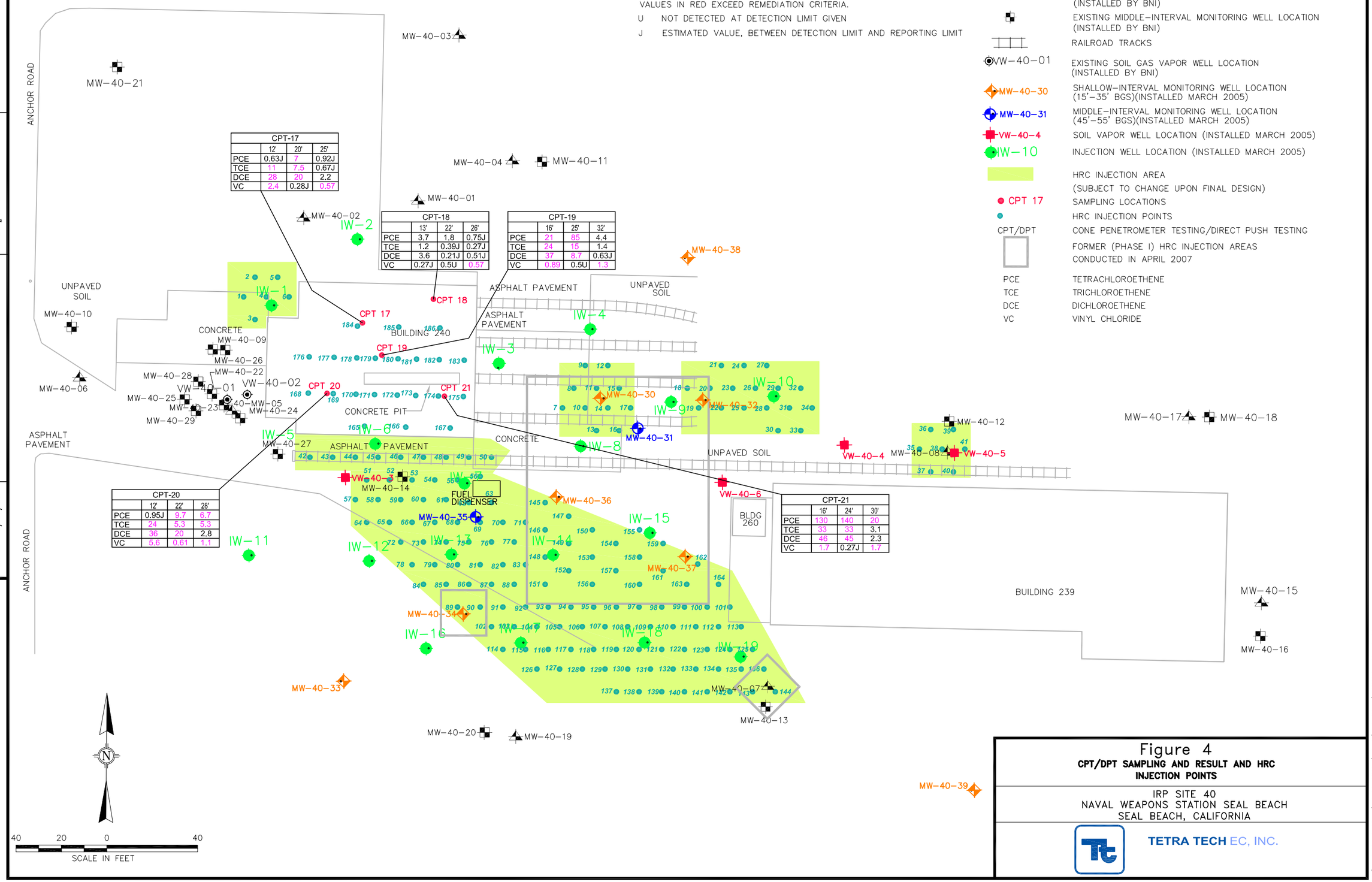
DRAWN BY: MD DATE: 10/27/08

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (µg/L).
VALUES IN RED EXCEED REMEDIATION CRITERIA.
U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT

LEGEND

- EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
- RAILROAD TRACKS
- VW-40-01 EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
- MW-40-30 SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
- MW-40-31 MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
- VW-40-4 SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
- IW-10 INJECTION WELL LOCATION (INSTALLED MARCH 2005)
- HRC INJECTION AREA (SUBJECT TO CHANGE UPON FINAL DESIGN)
- CPT 17 SAMPLING LOCATIONS
- HRC INJECTION POINTS
- CPT/DPT CONE PENETROMETER TESTING/DIRECT PUSH TESTING
- FORMER (PHASE I) HRC INJECTION AREAS CONDUCTED IN APRIL 2007
- PCE TETRACHLOROETHENE
- TCE TRICHLOROETHENE
- DCE DICHLOROETHENE
- VC VINYL CHLORIDE



CPT-17	12'	20'	25'
PCE	0.63J	7	0.92J
TCE	11	7.5	0.67J
DCE	28	20	2.2
VC	2.4	0.28J	0.57

CPT-18	13'	22'	26'
PCE	3.7	1.8	0.75J
TCE	1.2	0.39J	0.27J
DCE	3.6	0.21J	0.51J
VC	0.27J	0.5U	0.57

CPT-19	16'	25'	32'
PCE	21	85	4.4
TCE	24	15	1.4
DCE	37	8.7	0.63J
VC	0.89	0.5U	1.3

CPT-20	12'	22'	28'
PCE	0.95J	9.7	6.7
TCE	24	5.3	5.3
DCE	36	20	2.8
VC	5.6	0.61	1.1

CPT-21	16'	24'	30'
PCE	130	140	20
TCE	33	33	3.1
DCE	46	45	2.3
VC	1.7	0.27J	1.7

Figure 4

CPT/DPT SAMPLING AND RESULT AND HRC INJECTION POINTS

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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PLOT/UPDATE: NOV 26 2008 15:30:08

DRAWING NO: 09003305.DWG

DCN: ECSD-2201-0009-0033

CTO: #0010

APPROVED BY: HH

CHECKED BY: ML

REV:

DRAWN BY: MD

DATE: 11/26/08

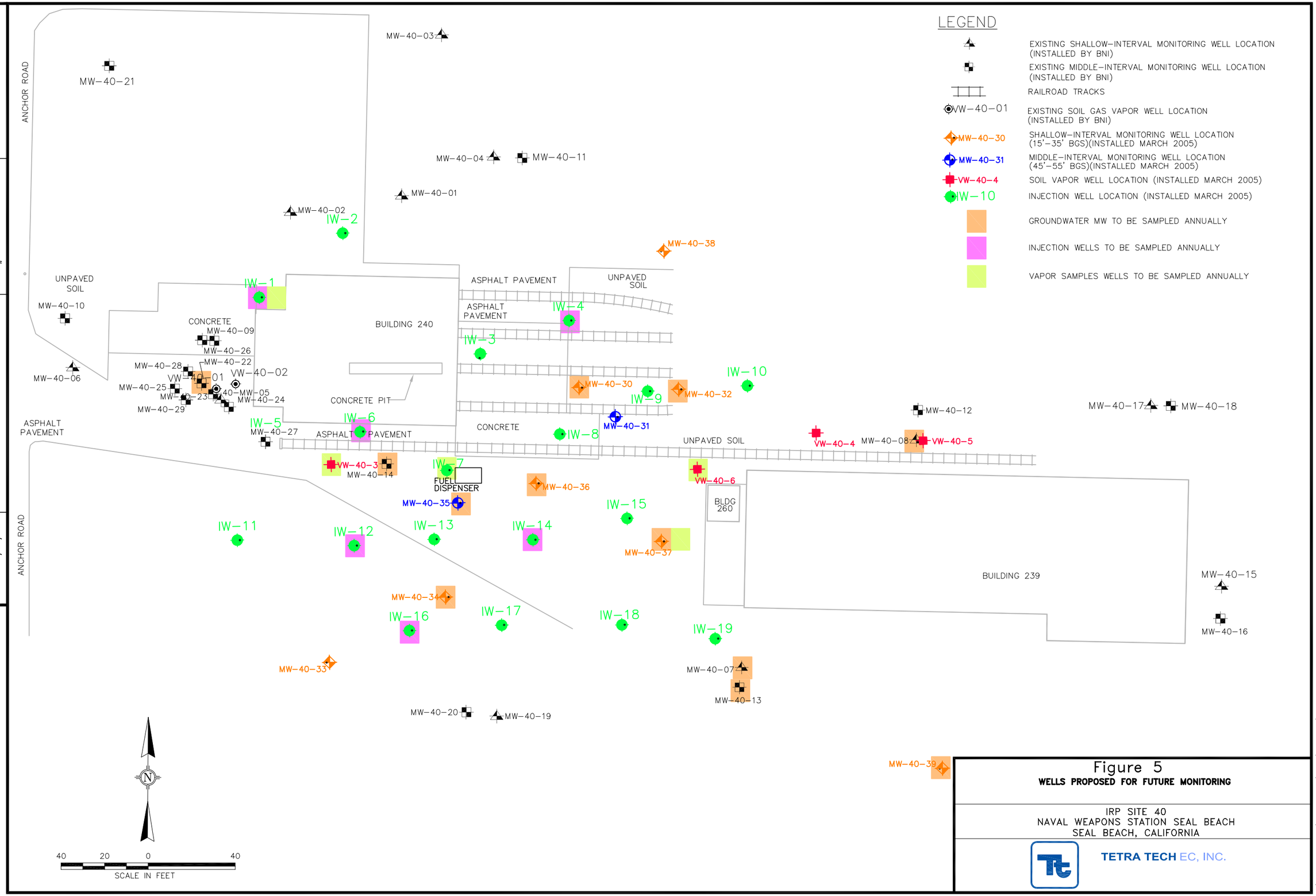

Figure 5

WELLS PROPOSED FOR FUTURE MONITORING

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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PLOT/UPDATE: NOV 26 2008 15:23:51

TETRA TECH EC, INC.

SUMMARY OF FIELD ACTIVITIES AND DATA FOR MAY 2009 MONITORING EVENT ENHANCED IN SITU BIOREMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS

INSTALLATION RESTORATION PROGRAM SITE 40 NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

Date: August 10, 2009

Prepared by: Hamlet Hamparsumian and Mark E. Losi, Tetra Tech EC, Inc. (TtEC)

Distribution: **Navy**
Si T. Le (NAVFAC SW RPM)
Pei-Fen Tamashiro (NAVWPNSTA Seal Beach IR Program Manager)

Agencies
Patricia Hannon (Water Board)
Stephen Niou (Department of Toxic Substances Control [DTSC])

This report provides an overview of site activities conducted in May 2009 associated with enhanced in situ bioremediation (EISB) of groundwater at Installation Restoration Program Site 40 at Naval Weapons Station Seal Beach, Seal Beach, California. This report includes the presentation and assessment of relevant monitoring data collected during this period. This is the first sampling event conducted after the final application of Hydrogen Release Compound (HRC®) in November 2008 to address the residual contamination present as limits of the EISB effort are approached. A summary of the general status of the project and recommendations based on the conclusions are also provided.

The field activities for this period included groundwater and soil gas monitoring in various wells/locations, and surface gas emissions monitoring. These activities, along with the dates they were conducted, are listed in Table 1. For this monitoring event (May 2009), chemicals of concern (COCs) and a focused suite of microbial and geochemical parameters were assessed in groundwater samples from monitoring wells MW-40-07, -08, -13, -14, -22, -30, -31 -32, -34, -35, -36, -37, and -39; and injection wells IW-1, -4, -6, -12, -14, and -16 (microbial and geochemical parameters were not analyzed in samples from all wells). These wells were proposed for semiannual monitoring based on established criteria as discussed in a prior report (TtEC 2008). Most of these wells are key compliance wells located in the central portion of the site where low-level contamination is still being reported. Results of the monitoring are discussed below.

PRESENTATION OF DATA

Data from the May 2009 event, along with data from past events for the above wells, are presented on Figure 1. Current (May 2009) COC concentrations and inferred plume delineations for the above wells are presented on Figure 2.

EVALUATION OF HRC DISTRIBUTION AND COCS IN REGULARLY MONITORED WELLS

A final HRC injection event was conducted in November 2008. This subsection provides a summary of data collected in May 2009 to assess HRC distribution, followed by key observations regarding COC concentrations in the selected groundwater monitoring wells sampled during the May 2009 event. Note that for the following discussions, a concentration followed by the letter "J" indicates that the concentration is an estimated (trace) level.

Evaluation of HRC presence primarily included assessment of shallow interval groundwater monitoring wells MW-40-07, -30, -32, -34, -36, and -37 (refer to Figure 1 for well locations). Each of these wells is still, or was recently, impacted by one or more COCs at concentrations exceeding their respective maximum contaminant levels (MCLs), and each is located in the area expected to be influenced by the HRC. Also included in this assessment are monitoring wells MW-40-08, -13, -14, -22, -31, -35, and -39; and injection wells IW-1, -4, -6, -12, -14, and -16 (used for sodium lactate injection during the initial injection phase). Chemical oxygen demand (COD) has been measured over the duration of the project to evaluate lactate presence and to assess the migration and persistence of HRC near these wells. Volatile fatty acids (VFAs), including acetic acid, propionic acid, and butyric acid, have been measured as well. These compounds are breakdown products of HRC, and their presence indicates that microbial activity is occurring as microbes degrade the HRC.

COD and VFAs

COD and VFA data are presented in Table 2 and discussed below:

- COD levels were generally variable, but were high in the following key plume wells (where contamination had been persistent in the past): MW-40-14 (3,350 milligrams per liter [mg/L]), MW-40-30 (1,090 mg/L), and MW-40-32 (2,130 mg/L). These concentrations are significantly elevated over concentrations measured in these wells during the prior (October 2008) event (41.4, 33.3, and 49.5 mg/L, respectively). This indicates effective distribution of HRC in the areas of these wells.
- Another COD increase, although less significant, was observed in well MW-40-07 (237 mg/L in May 2009 versus 167 mg/L in October 2008). COD results were not significantly elevated following the HRC injection when compared to results from the October 2008 monitoring event in other key wells MW-40-34, -36, and -37 (7.34 J, 57.3, and 30.1 mg/L, respectively, in May 2009 versus 43.4, 41.4, and 37.3 mg/L, respectively, in October 2008).
- COD levels in other locations (injection wells used as monitoring wells) were variable, ranging from 12.1 mg/L (IW-4) to 6,250 mg/L (IW-1).
- VFAs were measured in wells IW-6, MW-40-07, -30, -34, and -37. As shown in Table 2, one or more VFAs were detected in wells IW-6, MW-40-07, and MW-40-30, where COD concentrations ranged from 94.4 mg/L (IW-6) to 1,090 mg/L (MW-40-30). VFAs were not detected in wells MW-40-34 (COD of 7.34 J) and MW-40-37 (COD of 30.1). Thus, the presence of VFAs in areas where COD was elevated (likely due to the HRC application) indicates microbial activity in those areas.

In summary, variability in COD data suggests that the HRC distribution was not uniform, which is consistent with results from past efforts to achieve substrate distribution at this site. However, given the low contaminant levels (see next section), it is unlikely that further addition of substrate would be beneficial.

COC Concentrations

Figure 1 presents historical COC concentrations over the life of the project through May 2009 for the shallow and mid-shallow wells. Figure 2 contains only the concentrations measured during the May 2009 event, and interpreted plume delineations based on the May 2009 data. COC concentrations are discussed below:

- As can be seen on Figure 1, decreases in COC concentrations in monitoring wells versus prior results were observed in:
  - MW-40-08 (tetrachloroethene [PCE] from 10 to 3.1 micrograms per liter [μg/L]),
  - MW-40-30 (trichloroethene [TCE] from 29 to 2.0 μg/L; dichloroethene [DCE] from 31 to 5.7 μg/L),
  - MW-40-32 (DCE from 5.1 to 0.64 J μg/L; vinyl chloride [VC] from 4.2 to 1.3 μg/L), and
  - MW-40-37 (DCE from 110 to 46 μg/L; VC from 27 to 13 μg/L).
- Other minor COC decreases were observed in monitoring wells:
  - MW-40-34 (VC from 1.1 to 0.35J μg/L), and
  - MW-40-36 (VC from 2.3 to 1.9 μg/L).
- Notable COC decreases in monitored injection wells versus prior results were also observed in:
  - IW-1 (TCE from 7.3 to 0.28 J μg/L; VC from 3.8 to 0.79 μg/L),
  - IW-6 (DCE from 32 to 3.6 μg/L; VC from 6.9 to 2.6 μg/L),
  - IW-4 (VC from 4.8 to 1.6 μg/L), and
  - IW-14 (TCE from 8.6 to <1 μg/L; VC from 11 to 1.4 μg/L).
- Notable COC increases were observed in the following monitoring wells:
  - MW-40-14 (PCE from 4.8 to 8.7 μg/L; TCE from 5.9 to 36 μg/L; DCE from 13 to 19 μg/L; VC from 6.0 to 23 μg/L), and
  - MW-40-35 (DCE from 3.6 to 11 μg/L).

  This could potentially be attributed to desorption of contaminants due to the injection of HRC, as both of these wells had very high COD concentrations (3,350 mg/L and 1,300 mg/L, respectively). If this is the case, it is expected that these concentrations would decrease over time due to biodegradation and other attenuation mechanisms.

Plume Interpretations

- As shown on Figure 2, PCE and TCE exceed their MCLs (5 μg/L for both COCs) only in well MW-40-14. Due to the high COD level measured in this well, it is likely that treatment will occur and reductions will be observed during the next event.
- DCE exceeds its MCL (6 μg/L) only in a small localized area within the center of the site. In the few wells where it exceeds its MCL, concentrations are decreasing, with the exception of MW-40-14. As noted above, this may be due to contaminant desorption resulting from the HRC injection and will be reassessed following the next monitoring event.

- Low concentrations of VC, generally in the 1 to 2 μg/L range, form a residual plume in the central portion of the site. In addition, several wells in the center of the plume had concentrations exceeding 5 μg/L (ten times the MCL).

It is clear that substantial reductions in COCs have been achieved following the two rounds of HRC injections in the central area of the site (conducted in April 2007 and November 2008), and in most cases, COC concentrations are below MCLs, or are near MCLs and decreasing. In addition, while increases in COC levels in MW-40-14 and to a lesser extent MW-40-35 were noted during this event, the next event should help determine whether this trend is transitory and possibly a result of desorption of the contaminants due to the injection of HRC.

Microbiological and Geochemical Parameters

Data from the May 2009 event from select wells reflecting concentrations of *Dehalococcoides* spp. (DHC) organisms, which are critical to the reductive dechlorination process, and total biomass (a measure of total viable bacteria) in key monitoring wells are included in Table 2. Dissolved oxygen (DO) levels and oxidation reduction potential (ORP) provide additional indication of microbial metabolism of the HRC (effectiveness in generating/maintaining reducing conditions). DO and ORP data are included in Table 3, and cation (calcium, magnesium, potassium, iron, and sodium) concentrations are presented in Table 4.

Key observations regarding microbiological parameters are as follows (refer to Table 2):

- Total biomass counts for May 2009 ranged from 4.36×10^8 to 5.87×10^9 cells per liter (cells/L) and were generally similar to those measured during the October 2008 event (1.10×10^8 to 2.53×10^9 cells/L).
- DHC levels ranged from 1.77×10^4 to 9.19×10^6 cells/L, a range which is slightly lower, but comparable with, the range of levels measured in October 2008 (8.16×10^4 to 2.71×10^7 cells/L). Because DHC organisms are obligate chloroethene respirers (require chloroethenes to survive), it is expected that DHC populations would decline as COC concentrations are reduced.

Key observations regarding select geochemical parameters for monitored wells are as follows (refer to Tables 3 and 4):

- Based on the May 2009 readings, DO concentrations in the monitoring wells remained at or less than 0.5 mg/L (given limitations associated with this measurement, this essentially represents not detected).
- ORP values measured during the May 2009 event were negative for 17 of the 19 monitoring points, ranging from -11.6 millivolts (mV) to -152.3 mV. The ORP values for IW-1 and MW-40-39 were positive (19.3 and 47.0 mV, respectively). In general, the values in the negative range reflect reducing conditions favorable for reductive dechlorination.
- Nitrate was either not detected or detected at very low concentrations, and sulfate levels were depressed in treatment area wells relative to well MW-40-39, which is located downgradient and outside the active treatment zone. These data also reflect reducing conditions favorable for reductive dechlorination.
- The pH readings ranged from 6.02 to 7.60 standard pH units. All but two of the values fell between 6.67 and 7.60 standard pH units, which are within 6.5 to 8.5, a range that is generally accepted as favorable for bioremediation. The values not falling within this range were 6.02 (IW-1) and 6.27 (IW-4); these are not optimal but can still be considered acceptable.

- Cation data are of interest mainly to track the persistence of sodium, a component of the originally injected electron donor (sodium lactate). Concentrations of sodium in the monitoring wells in which it was measured during the May 2009 event ranged from 216 to 328 mg/L. These concentrations are comparable with those measured in monitoring wells during the October 2008 event (231 to 360 mg/L). This is generally consistent with a slightly decreasing trend observed during the last event (October 2008), and suggests that sodium concentrations continue to approach the baseline levels measured during March 2005, which ranged from 211 to 288 mg/L. Sodium concentrations measured in injection wells IW-1 and IW-6 were 616 and 513 mg/L, respectively. These values are somewhat higher, and likely reflect residual sodium from the original sodium lactate that was injected directly into these wells (it is noted that HRC does not contain sodium).
- Total organic carbon (TOC) was also measured in several wells to supplement COD readings is assessing HRC migration. TOC concentrations ranged from 3.49 mg/L (MW-40-34) to 2,060 mg/L (IW-1). TOC and COD measurements correlated well, with the highest TOC levels being measured in IW-1 (2,060 mg/L) and MW-40-14 (1,170 mg/L), which also had the highest COD levels (6,250 and 3,350 mg/L, respectively).
- Total dissolved solids (TDS) were measured during this event to help in assessment of secondary groundwater effects due to the injections. The highest TDS level was measured in upgradient well IW-1 (4,420 mg/L), which likely reflects the high organic content (COD of 6,250 mg/L) of the groundwater sample from this well as a result of the HRC injection. The TDS in upgradient well MW-40-22 was significantly lower at 2,020 mg/L, and the COD level in this well was only 20.3 mg/L. Other TDS results from samples collected in the central and downgradient portions of the site were similar to those of MW-40-22 (1,960 and 1,050 mg/L, respectively, in wells MW-40-07 and -39). The lowest TDS level was measured in cross-gradient well MW-40-39 (1,050 mg/L). Each of these wells had much lower COD levels than was observed in IW-1.

The May 2009 microbiological and geochemical data generally indicate the presence of sufficient microorganisms and maintenance of reducing conditions supportive of reductive dechlorination in most areas. Substrate levels (as indicated by the COD data) were variable, but there is still ample electron donor present within the subsurface.

SOIL GAS DATA AND WATER LEVEL MEASUREMENTS

Soil Gas Data. Methane gas surface emissions monitoring was performed on June 3, 2009. During this monitoring event, methane gas emissions were not detected within Buildings 239 or 240, or in the surrounding areas.

Soil gas monitoring of probes was conducted on June 3, 2009. The results indicated that the 28 probes tested in the field had methane gas present at concentrations from 0.1 to 85.7 percent in air during the May 2009 monitoring event. The highest methane concentration was in the soil gas probe in injection well IW-17. The average methane concentration in all 28 wells was 68.86 percent in air. Hydrogen sulfide was reported in 11 of 28 probes with concentrations ranging from 1 to 13 parts per million (ppm). The highest hydrogen sulfide concentrations were in the soil gas probes in injection wells IW-8 and IW-16, at 12 and 13 ppm, respectively.

In addition, soil gas samples were collected in 1-liter Tedlar bags from a vapor monitoring well (VW-40-03) and a select number of soil gas monitoring probes that are installed in groundwater monitoring well MW-40-37 and injection wells IW-1, -6, and -7. VC was reported in all sampled wells at concentrations from 940 micrograms per cubic meter ($\mu g/m^3$) (or 360 parts per billion in volume [ppbv]) in the soil gas probe installed in injection well IW-7 to 6,700 $\mu g/m^3$ (or 2,500 ppbv) in soil gas monitoring well IW-6.

DCE was reported in all sampled wells at concentrations ranging from 590 J (estimated) $\mu g/m^3$ in soil gas monitoring well IW-6 to 7,800 $\mu g/m^3$ in soil gas monitoring well VW-40-03. PCE was not reported in any of the samples. TCE was reported in all samples at concentrations from 180 J $\mu g/m^3$ in the soil gas probe installed in injection well IW-1 to 8,700 $\mu g/m^3$ in soil gas monitoring well VW-40-03. A summary of the analytical results for the soil gas concentrations is presented in Table 5.

Methane gas concentrations in samples collected in Tedlar bags from the soil gas monitoring probes and vapor monitoring wells, and analyzed in the laboratory, ranged from 21.9 percent in the soil gas probe installed in monitoring well MW-40-37 to 60.9 percent in the soil gas probe installed in injection well IW-7.

Groundwater Levels. Groundwater level measurements were collected on May 28, 2009. Groundwater elevations within the site ranged from (-0.08) foot below mean sea level (msl) in MW-40-31 to 1.61 feet above msl in MW-40-34. In general, water level measurements collected in October 2008 did not indicate a significant change in groundwater level within the monitoring area in comparison with the elevations measured during the previous monitoring event in November 2008. However, groundwater elevation trends since the start of the project (March 2005) show an overall general declining trend in groundwater level at the site. Groundwater levels ranged from approximately 2 to 3 feet above msl in March 2005 to about 0.75 to 1.60 feet above msl in May 2009.

CONCLUSIONS

Significant reductions in total chloroethene concentrations have been observed in all monitoring wells over the life of the project. In addition, COD data indicate that ample electron donor is present in the subsurface, although distribution is not uniform. Further, microbiological and geochemical data suggest an environment favorable for reductive dechlorination to continue. However, while total biomass and DHC organisms are still present at reasonably high levels in key locations, COC concentrations have decreased to very low levels, which would limit vigorous growth of key dechlorinating organisms.

Therefore, with the possible exception of the areas represented by MW-40-14 and -37, the potential for enhanced bioremediation of chloroethenes is probably reaching its limit at this point, and slower, localized biodegradation, along with other natural attenuation processes, will likely dominate the further reduction of COC levels. The final round of HRC injection conducted in critical areas to reestablish conditions supportive of reductive dechlorination was successful in reducing residual COCs concentrations and maximizing the extent of the EISB treatment. Concentrations of COCs are now very low, and it is unlikely that additional remedial efforts will result in significant cost benefits. As anticipated, monitored natural attenuation will likely be sufficient to reach remedial action goals (MCLs).

RECOMMENDATIONS

The Record of Decision (ROD) (Department of the Navy [DON] 2004) stipulates that, "when the subsurface benefits of enhanced bioremediation have been maximized, the remedy will revert to monitored natural attenuation (MNA) on a site wide basis." At this time, the COC levels in the majority of wells are less than their respective MCL, or are close to the MCLs and are exhibiting decreasing trends. With this in mind, and because additional remedial efforts would likely have a very limited effect, the following recommendations are made:

1. Based on Navy discussions with the Water Board and DTSC on 4 December 2008, conduct the next round of monitoring at Site 40 one year after the May 2009 event (in May 2010). The next monitoring event will include the same wells and analytes that were monitored in May 2009.

2. After the next monitoring event prepare a Five-Year Review report and submit it to the Navy and the agencies. The report will summarize the results and implications of groundwater treatment at Site 40 since March 2005.

REFERENCE

Department of the Navy (DON). 2004. Final Record of Decision/Remedial Action Plan, Operable Unit 4, IRP Site 40, Naval Weapons Station Seal Beach, Seal Beach, California. May.

TtEC (Tetra Tech EC, Inc.). 2008. Final Addendum 2 to the Final Sampling and Analysis Plan (Field Sampling and Quality Assurance Project Plan), Enhanced In Situ Bioremediation at Installation Restoration Program Site 40 (Concrete Pit/Gravel Area). Naval Weapons Station Seal Beach, Seal Beach, California. DCN: ECSD-2201-0010-0004. September 12.

TABLES

Table 1 Summary of Monitoring Activities Conducted in May 2009

Table 2 COD, VFA, DHC, and PLFA Data Collected in May 2009

Table 3 Anions, Alkalinity, TDS, TOC, DO, ORP, and pH Data Collected in May 2009

Table 4 Cation Concentrations in Samples Collected in May 2009

Table 5 PCE, TCE, DCE, and VC Concentrations in Soil Gas Samples Collected in May 2009

FIGURES

Figure 1 COC Concentrations in Select Shallow and Mid-Shallow Monitoring Wells and Injection Wells – May 2009

Figure 2 Composite of Interpreted Plume Extents for all COCs Based on May 2009 Data

TABLES

TABLE 1

SUMMARY OF MONITORING ACTIVITIES CONDUCTED IN MAY 2009

Date	Event	Wells Sampled[a]	Analytes[b]/Parameters	Notes
5/28/09	Soil vapor sampling	Probes in wells VW-40-03 and VW-40-06, and nested probes in MW-40-37 and IW-1 and IW-7	VOCs and fixed gases	Laboratory analysis
5/28/09	Groundwater level measurement	MW-40-01, -02, -06, 07, 08, -10, -11, -13, -14, -15, -17, -19, -20, -22, -30 through 39, and IW-1 through IW-17	Not applicable	Groundwater level measurements
6/3/09	Soil vapor/gas probe monitoring	Probes in wells VW-40-01, -2, -3, and -06, and nested probes in MW-40-30 through -39 and IW-1 through IW-4, and IW-6 through IW-17	Methane, oxygen, carbon dioxide, VOCs, and carbon monoxide	Field testing
5/28/09	Surface emissions monitoring	Not applicable	Methane gas concentrations	Inside Building 240 and western portion of Building 239, and areas surrounding the above buildings
5/28/09 and 5/29/09	Groundwater sampling	MW-40-07, -08, -13, -14, -22, -30, -31, -32, -34, -35, -36, -37, and -39, and injection wells IW-1, -4, -6, -12, -14, and -16	VOCs, dissolved gases, TDS, cations, anions, alkalinity, COD, DNA, PLFAs, VFAs	Laboratory and field parameters

Notes:

[a] Refer to figures for well/sampling locations.
[b] Not all compounds analyzed for all wells.

Abbreviations and Acronyms:

COD – chemical oxygen demand
DNA – deoxyribonucleic acid
PLFA – phospholipids fatty acid
TDS – total dissolved solid
VFA – volatile fatty acid
VOC – volatile organic compound

TABLE 2

COD, VFA, DHC, AND PLFA DATA COLLECTED IN MAY 2009

Location	COD (mg/L)	Acetic Acid (mg/L)	Propionic Acid (mg/L)	Butyric Acid (mg/L)	DHC (cells/L)	Total PLFA Biomass (cells/L)
IW-1	6,250	NA	NA	NA	NA	NA
IW-4	12.1	NA	NA	NA	NA	NA
IW-6	94.4	23	<1	<1	5.38E+06	5.87E+09
IW-12	459	NA	NA	NA	NA	NA
IW-14	45	NA	NA	NA	NA	NA
IW-16	223	NA	NA	NA	NA	NA
MW-40-07	237	17	2.3	<1	1.15E+06	2.13E+09
MW-40-08	18.2	NA	NA	NA	NA	NA
MW-40-13	15.6	NA	NA	NA	NA	NA
MW-40-14	3,350	NA	NA	NA	NA	NA
MW-40-22	20.3	NA	NA	NA	NA	NA
MW-40-30	1,090	160	450	25	9.19E+06	1.78E+09
MW-40-31	32.6	NA	NA	NA	NA	NA
MW-40-32	2,130	NA	NA	NA	NA	NA
MW-40-34	7.34 J	<1	<1	<1	1.77E+04	2.61E+09
MW-40-35	1,300	NA	NA	NA	NA	NA
MW-40-36	57.3	NA	NA	NA	NA	NA
MW-40-37	30.1	<1	<1	<1	2.90E+05	4.36E+08
MW-40-39	20.3	NA	NA	NA	NA	NA

Notes:

Pyruvic acid and formic acid were not detected; lactic acid was detected in MW-40-30 during the May 2009 event at 5.6 mg/L.

Abbreviations and Acronyms:

cells/L – cells per liter
COD – chemical oxygen demand
DHC – *Dehalococcoides* spp.
mg/L – milligrams per liter
NA – not analyzed
PLFA – phospholipid fatty acid
VFA – volatile fatty acid

TABLE 3

ANIONS, ALKALINITY, TDS, TOC, DO, ORP, AND pH DATA COLLECTED IN MAY 2009

Location	Chloride (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	TDS (mg/L)	TOC (mg/L)	DO (mg/L)	ORP (mV)	pH (pH units)
IW-1	370	ND	ND	2.16	1,130	4,420	2,060	0.49	19.3	6.02
IW-4	-	-	-	-	-	-	-	0.02	-11.6	6.27
IW-6	159	ND	0.117	21.1	1,350	-	17.6	0.37	-147.9	7.60
IW-12	-	-	-	-	-	-	-	0.15	-91.1	6.86
IW-14	-	-	-	-	-	-	-	0.13	-82.0	6.71
IW-16	-	-	-	-	-	-	-	0.39	-140.4	7.35
MW-40-07	323	ND	0.298	1.55	1,350	1,960	23.2	0.13	-112.6	7.10
MW-40-08	-	-	-	-	-	2,140	-	0.09	-32.1	6.92
MW-40-13	-	-	-	-	-	-	-	0.07	-37.7	6.90
MW-40-14	299	ND	0.0703 J	79.6	1,070	-	1,170	0.10	-72.8	6.67
MW-40-22	-	-	-	-	-	2,020	-	0.09	-129.4	6.93
MW-40-30	136	ND	ND	0.360 J	799	-	376	0.12	-70.0	6.95
MW-40-31	-	-	-	-	-	-	16.8	0.13	-121.4	7.20
MW-40-32	112	ND	ND	0.480 J	1280	-	-	0.14	-109.4	6.80
MW-40-34	84.6	ND	0.123	41.7	703	-	3.49	0.09	-64.8	6.88
MW-40-35	-	-	-	-	-	-	-	0.12	-134.9	7.22
MW-40-36	-	-	-	-	-	-	-	0.09	-152.3	6.87
MW-40-37	406	ND	ND	204	662	-	8.49	0.11	-29.1	7.11
MW-40-39	-	-	-	-	-	1,050	-	0.19	47.0	7.16

Abbreviations and Acronyms:

DO – dissolved oxygen
mg/L – milligrams per liter
mV – millivolt
- – not analyzed
ND – not detected
ORP – oxidation/reduction potential
TDS – total dissolved solids
TOC – total organic carbon

TABLE 4

CATION CONCENTRATIONS IN SAMPLES COLLECTED IN MAY 2009

Location	Calcium (mg/L)	Iron (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)
IW-1	125	160	50.1	9.49	616
IW-6	68.8	3.16	31.2	4.76J	513
MW-40-07	302	11	81	7.71	317
MW-40-14	328	44.1	83.5	6.68	328
MW-40-30	121	68.2	32.3	15.7	286
MW-40-32	270	128	86.4	14.1	277
MW-40-34	111	27.4	23.5	5.19	216
MW-40-37	210	5.35	67.9	6.73	284

Abbreviations and Acronyms:

mg/L – milligrams per liter

TABLE 5

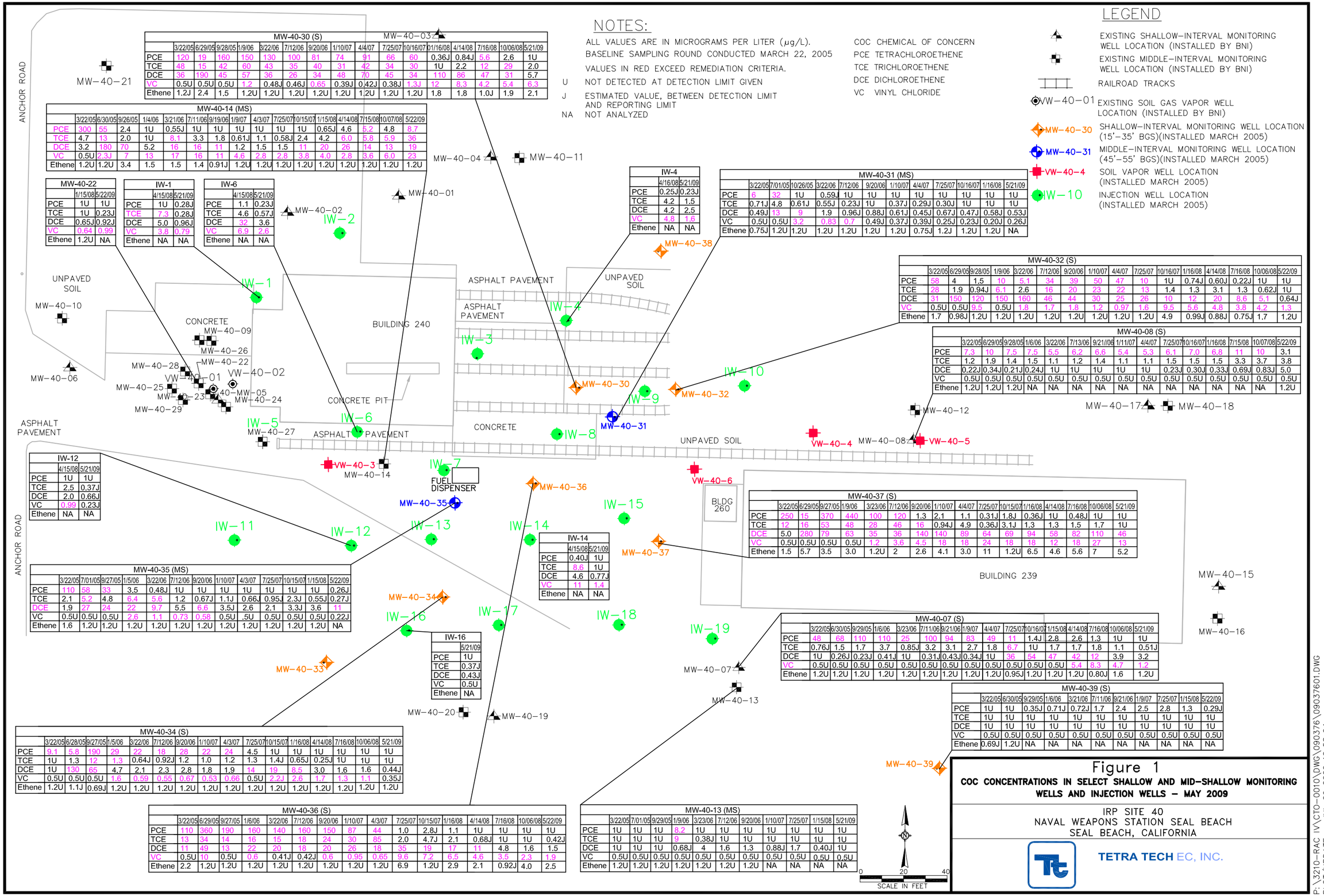
PCE, TCE, DCE, AND VC CONCENTRATIONS IN SOIL GAS SAMPLES COLLECTED IN MAY 2009

Probe/Well ID	PCE		TCE		cis-1,2-DCE		Vinyl Chloride	
	ppbv	µg/m^3	ppbv	µg/m^3	ppbv	µg/m^3	ppbv	µg/m^3
IW-1	20 U	140 U	32 J	180 J	630	2,600	430	1,100
IW-6	51 U	360 U	220 J	1,200 J	240 J	990 J	2,500	6,700
IW-6 (FD)	51 U	360 U	150 J	830 J	140 J	590 J	97 J	260 J
IW-7	20 U	140 U	260	1,400	200	810	360	940
MW-40-37	20 U	140 U	190	1,100	150	600	640	1,700
VW-40-03	200 U	1,400 U	1,600	8,700	1,900	7,800	1,300	3,400

Abbreviations and Acronyms:

µg/m^3 – micrograms per cubic meter
DCE – dichloroethene
FD – field duplicate
ID – identification
J – estimated value
PCE – perchloroethene
ppbv – parts per billion by volume
TCE – trichloroethene
U – analyte not detected above the (project) quantitation limit

FIGURES



NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (µg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED

COC CHEMICAL OF CONCERN
PCE TETRACHLOROETHENE
TCE TRICHLOROETHENE
DCE DICHLOROETHENE
VC VINYL CHLORIDE

LEGEND

EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
RAILROAD TRACKS
VW-40-01 EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
MW-40-30 SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
MW-40-31 MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
VW-40-4 SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
IW-10 INJECTION WELL LOCATION (INSTALLED MARCH 2005)

MW-40-30 (S)

	3/22/05	6/29/05	9/28/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	01/16/08	4/14/08	7/16/08	10/06/08	5/21/09
PCE	120	19	160	150	130	100	81	74	91	66	60	0.36J	0.84J	5.6	2.6	1U
TCE	48	15	42	60	43	35	40	31	42	34	30	1U	2.2	12	29	2.0
DCE	36	190	45	57	36	26	34	48	70	45	34	110	86	47	31	5.7
VC	0.5U	0.5U	0.5U	1.2	0.48J	0.46J	0.65	0.39J	0.42J	0.38J	1.3J	12	8.3	4.2	5.4	6.3
Ethene	1.2J	2.4	1.5	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.8	1.8	1.0J	1.9	2.1

MW-40-14 (MS)

	3/22/05	6/30/05	9/26/05	1/4/06	3/21/06	7/11/06	9/19/06	1/9/07	4/3/07	7/25/07	10/15/07	1/15/08	4/14/08	7/15/08	10/07/08	5/22/09
PCE	300	55	2.4	1U	0.55J	1U	1U	1U	1U	1U	1U	0.65J	4.6	5.2	4.8	8.7
TCE	4.7	13	2.0	1U	8.1	3.3	1.8	0.61J	1.1	0.58J	2.4	4.2	6.0	5.8	5.9	36
DCE	3.2	180	70	5.2	16	16	11	1.2	1.5	1.5	11	20	26	14	13	19
VC	0.5U	2.3J	7	13	17	16	11	4.6	2.8	2.8	3.8	4.0	2.8	3.6	6.0	23
Ethene	1.2U	1.2U	3.4	1.5	1.5	1.4	0.91J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-22

	1/15/08	5/22/09
PCE	1U	1U
TCE	1U	0.23J
DCE	0.65J	0.92J
VC	0.64	0.99
Ethene	1.2U	NA

IW-1

	4/15/08	5/21/09
PCE	1U	0.28J
TCE	7.3	0.28J
DCE	5.0	0.96J
VC	3.8	0.79
Ethene	NA	NA

IW-6

	4/15/08	5/21/09
PCE	1.1	0.23J
TCE	4.6	0.57J
DCE	32	3.6
VC	6.9	2.6
Ethene	NA	NA

IW-4

	4/16/08	5/21/09
PCE	0.25J	0.23J
TCE	4.2	1.5
DCE	4.2	2.5
VC	4.8	1.6
Ethene	NA	NA

MW-40-31 (MS)

	3/22/05	7/01/05	10/26/05	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/16/08	5/21/09
PCE	6	32	1U	0.59J	1U	1U	1U	1U	1U	1U	1U	1U
TCE	0.71J	4.8	0.61J	0.55J	0.23J	1U	0.37J	0.29J	0.30J	1U	1U	1U
DCE	0.49J	13	9	1.9	0.96J	0.88J	0.61J	0.45J	0.67J	0.47J	0.58J	0.53J
VC	0.5U	0.5U	3.2	0.83	0.7	0.49J	0.37J	0.39J	0.25J	0.23J	0.20J	0.26J
Ethene	0.75J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.75J	1.2J	1.2U	1.2U	NA

MW-40-32 (S)

	3/22/05	6/29/05	9/28/05	1/9/06	3/22/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/16/07	1/16/08	4/14/08	7/16/08	10/06/08	5/22/09
PCE	58	4	1.5	10	5.1	34	39	50	47	10	1U	0.74J	0.60J	0.22J	1U	1U
TCE	28	1.9	0.94J	6.1	2.6	16	20	23	22	13	1.4	1.3	3.1	1.3	0.62J	1U
DCE	31	150	120	150	160	46	44	30	25	26	10	12	20	8.6	5.1	0.64J
VC	0.5U	0.5U	9.5	0.5U	1.8	1.7	1.8	1.2	0.97	1.6	9.5	5.6	4.8	3.8	4.2	1.3
Ethene	1.7	0.98J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	4.9	0.99J	0.88J	0.75J	1.7	1.2U

MW-40-08 (S)

	3/22/05	6/29/05	9/28/05	1/6/06	3/22/06	7/13/06	9/21//06	1/11/07	4/4/07	7/25/07	10/16/07	1/16/08	7/15/08	10/07/08	5/22/09
PCE	7.3	10	7.5	7.5	5.5	6.2	6.6	5.4	5.3	6.1	7.0	6.8	11	10	3.1
TCE	1.2	1.9	1.4	1.5	1.1	1.2	1.4	1.1	1.1	1.5	1.5	1.5	3.3	3.7	3.8
DCE	0.22J	0.34J	0.21J	0.24J	1U	1U	1U	1U	1U	0.23J	0.30J	0.33J	0.69J	0.83J	5.0
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.2U

IW-12

	4/15/08	5/21/09
PCE	1U	1U
TCE	2.5	0.37J
DCE	2.0	0.66J
VC	0.99	0.23J
Ethene	NA	NA

MW-40-37 (S)

	3/22/05	6/29/05	9/27/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	4/4/07	7/25/07	10/15/07	1/16/08	4/14/08	7/16/08	10/06/08	5/21/09
PCE	250	15	370	440	100	120	1.3	2.1	1.1	0.31J	1.8J	0.36J	1U	0.48J	1U	1U
TCE	12	16	53	48	28	46	16	0.94J	4.9	0.36J	3.1J	1.3	1.3	1.5	1.7	1U
DCE	5.0	280	79	63	35	36	140	140	89	64	69	94	58	82	110	46
VC	0.5U	0.5U	0.5U	0.5U	1.2	3.6	4.5	18	18	24	18	18	12	18	27	13
Ethene	1.5	5.7	3.5	3.0	1.2U	2	2.6	4.1	3.0	11	1.2U	6.5	4.6	5.6	7	5.2

IW-14

	4/15/08	5/21/09
PCE	0.40J	1U
TCE	8.6	1U
DCE	4.6	0.77J
VC	11	1.4
Ethene	NA	NA

MW-40-35 (MS)

	3/22/05	7/01/05	9/27/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/15/08	5/22/09
PCE	110	58	33	3.5	0.48J	1U	1U	1U	1U	1U	1U	1U	0.26J
TCE	2.1	5.2	4.8	6.4	5.6	1.2	0.67J	1.1J	0.66J	0.95J	2.3J	0.55J	0.27J
DCE	1.9	27	24	22	9.7	5.5	6.6	3.5J	2.6	2.1	3.3J	3.6	11
VC	0.5U	0.5U	0.5U	2.6	1.1	0.73	0.58	0.5U	.5U	0.5U	0.5U	0.5U	0.22J
Ethene	1.6	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA

IW-16

	5/21/09
PCE	1U
TCE	0.37J
DCE	0.43J
VC	0.5U
Ethene	NA

MW-40-07 (S)

	3/22/05	6/30/05	9/29/05	1/6/06	3/23/06	7/11/06	9/21/06	1/9/07	4/4/07	7/25/07	10/16/07	1/15/08	4/14/08	7/16/08	10/06/08	5/21/09
PCE	48	68	110	110	25	100	94	83	49	11	1.4J	2.8	2.6	1.3	1U	1U
TCE	0.76J	1.5	1.7	3.7	0.85J	3.2	3.1	2.7	1.8	6.7	1U	1.7	1.7	1.8	1.1	0.51J
DCE	1U	0.26J	0.23J	0.41J	1U	0.31J	0.43J	0.34J	1U	36	54	47	42	12	3.9	3.2
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	5.4	8.3	4.7	1.2
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	0.95J	1.2U	1.2U	1.2U	0.80J	1.6	1.2U

MW-40-39 (S)

	3/22/05	6/30/05	9/29/05	1/6/06	3/21/06	7/11/06	9/21/06	1/9/07	7/25/07	1/15/08	5/22/09
PCE	1U	1U	0.35J	0.71J	0.72J	1.7	2.4	2.5	2.8	1.3	0.29J
TCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	0.69J	1.2U	NA	NA	NA	NA	NA	NA	NA	NA	NA

MW-40-34 (S)

	3/22/05	6/28/05	9/27/05	1/5/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/16/08	4/14/08	7/16/08	10/06/08	5/21/09
PCE	9.1	5.8	190	29	22	18	28	22	24	4.5	1U	1U	1U	1U	1U	1U
TCE	1U	1.3	12	1.3	0.64J	0.92J	1.2	1.0	1.2	1.3	1.4J	0.65J	0.25J	1U	1U	1U
DCE	1U	130	65	4.7	2.1	2.3	2.8	1.8	1.9	14	19	8.5	3.0	1.6	1.6	0.44J
VC	0.5U	0.5U	0.5U	1.6	0.59	0.55	0.67	0.53	0.66	0.5U	2.2J	2.6	1.7	1.3	1.1	0.35J
Ethene	1.2U	1.1J	0.69J	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U

MW-40-36 (S)

	3/22/05	6/29/05	9/27/05	1/6/06	3/22/06	7/12/06	9/20/06	1/10/07	4/3/07	7/25/07	10/15/07	1/16/08	4/14/08	7/16/08	10/06/08	5/22/09
PCE	110	360	190	160	140	160	150	87	44	1.0	2.8J	1.1	1U	1U	1U	1U
TCE	13	34	14	16	15	18	24	30	85	2.0	4.7J	2.1	0.68J	1U	1U	0.42J
DCE	11	49	13	22	20	18	20	26	18	35	19	17	11	4.8	1.6	1.5
VC	0.5U	10	0.5U	0.6	0.41J	0.42J	0.6	0.95	0.65	9.6	7.2	6.5	4.6	3.5	2.3	1.9
Ethene	2.2	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	6.9	1.2U	2.9	2.1	0.92J	4.0	2.5

MW-40-13 (MS)

	3/22/05	7/01/05	9/29/05	1/9/06	3/23/06	7/12/06	9/20/06	1/10/07	7/25/07	1/15/08	5/21/09
PCE	1U	1U	1U	8.2	1U	1U	1U	1U	1U	1U	1U
TCE	1U	1U	1U	9	0.38J	1U	1U	1U	1U	1U	1U
DCE	1U	1U	1U	0.68J	4	1.6	1.3	0.88J	1.7	0.40J	1U
VC	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethene	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	1.2U	NA	NA	NA	NA

Figure 1

COC CONCENTRATIONS IN SELECT SHALLOW AND MID-SHALLOW MONITORING WELLS AND INJECTION WELLS – MAY 2009

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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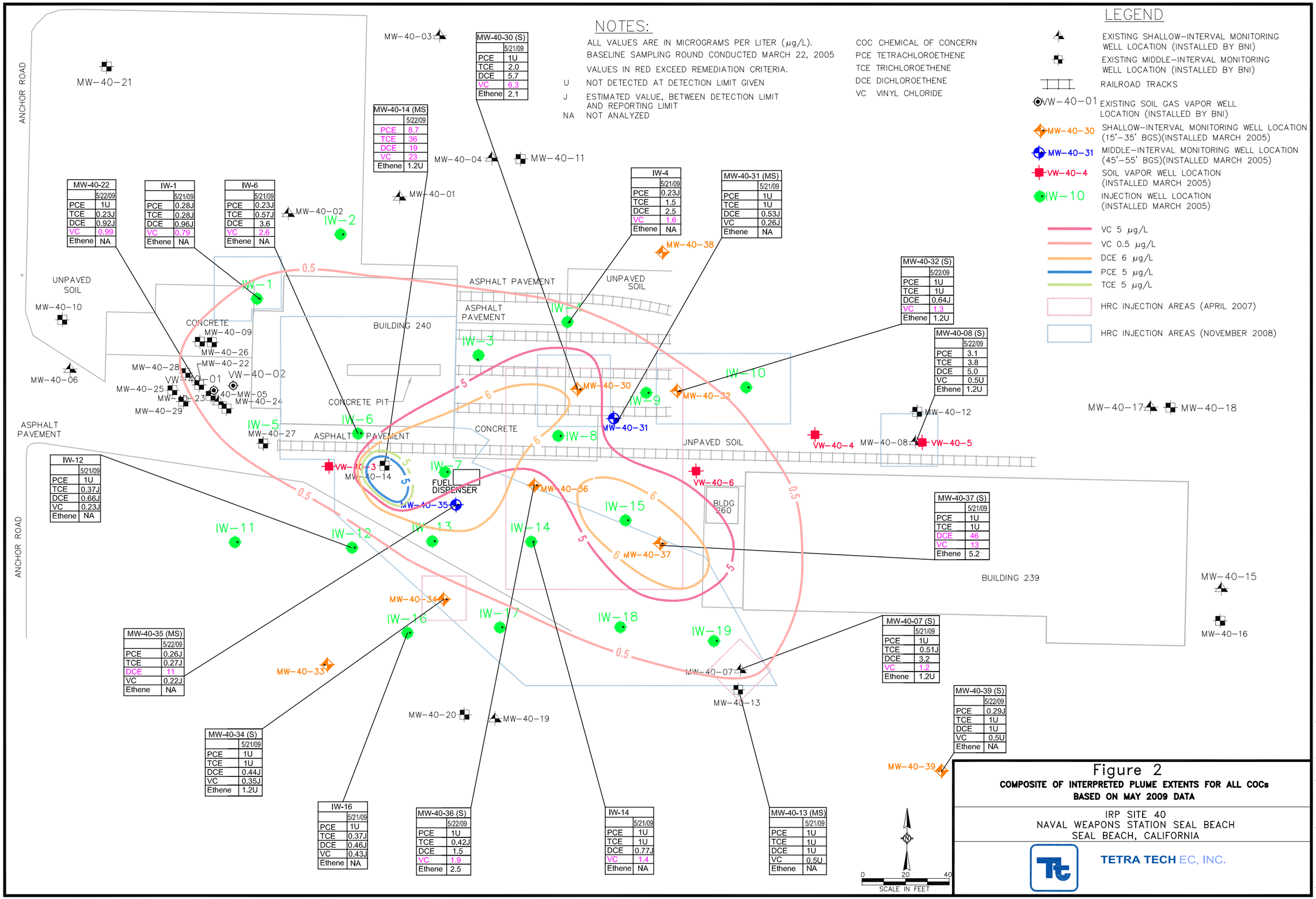

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (µg/L).
BASELINE SAMPLING ROUND CONDUCTED MARCH 22, 2005
VALUES IN RED EXCEED REMEDIATION CRITERIA.

U NOT DETECTED AT DETECTION LIMIT GIVEN
J ESTIMATED VALUE, BETWEEN DETECTION LIMIT AND REPORTING LIMIT
NA NOT ANALYZED

COC CHEMICAL OF CONCERN
PCE TETRACHLOROETHENE
TCE TRICHLOROETHENE
DCE DICHLOROETHENE
VC VINYL CHLORIDE

LEGEND

EXISTING SHALLOW-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
EXISTING MIDDLE-INTERVAL MONITORING WELL LOCATION (INSTALLED BY BNI)
RAILROAD TRACKS
VW-40-01 EXISTING SOIL GAS VAPOR WELL LOCATION (INSTALLED BY BNI)
MW-40-30 SHALLOW-INTERVAL MONITORING WELL LOCATION (15'-35' BGS)(INSTALLED MARCH 2005)
MW-40-31 MIDDLE-INTERVAL MONITORING WELL LOCATION (45'-55' BGS)(INSTALLED MARCH 2005)
VW-40-4 SOIL VAPOR WELL LOCATION (INSTALLED MARCH 2005)
IW-10 INJECTION WELL LOCATION (INSTALLED MARCH 2005)
VC 5 µg/L
VC 0.5 µg/L
DCE 6 µg/L
PCE 5 µg/L
TCE 5 µg/L
HRC INJECTION AREAS (APRIL 2007)
HRC INJECTION AREAS (NOVEMBER 2008)

MW-40-30 (S)	5/21/09
PCE	1U
TCE	2.0
DCE	5.7
VC	6.3
Ethene	2.1

MW-40-14 (MS)	5/22/09
PCE	8.7
TCE	36
DCE	19
VC	23
Ethene	1.2U

MW-40-22	5/22/09
PCE	1U
TCE	0.23J
DCE	0.92J
VC	0.99
Ethene	NA

IW-1	5/21/09
PCE	0.28J
TCE	0.28J
DCE	0.96J
VC	0.79
Ethene	NA

IW-6	5/21/09
PCE	0.23J
TCE	0.57J
DCE	3.6
VC	2.6
Ethene	NA

IW-4	5/21/09
PCE	0.23J
TCE	1.5
DCE	2.5
VC	1.6
Ethene	NA

MW-40-31 (MS)	5/21/09
PCE	1U
TCE	1U
DCE	0.53J
VC	0.26J
Ethene	NA

MW-40-32 (S)	5/22/09
PCE	1U
TCE	1U
DCE	0.64J
VC	1.3
Ethene	1.2U

MW-40-08 (S)	5/22/09
PCE	3.1
TCE	3.8
DCE	5.0
VC	0.5U
Ethene	1.2U

IW-12	5/21/09
PCE	1U
TCE	0.37J
DCE	0.66J
VC	0.23J
Ethene	NA

MW-40-37 (S)	5/21/09
PCE	1U
TCE	1U
DCE	46
VC	13
Ethene	5.2

MW-40-35 (MS)	5/22/09
PCE	0.26J
TCE	0.27J
DCE	11
VC	0.22J
Ethene	NA

MW-40-07 (S)	5/21/09
PCE	1U
TCE	0.51J
DCE	3.2
VC	1.2
Ethene	1.2U

MW-40-39 (S)	5/22/09
PCE	0.29J
TCE	1U
DCE	1U
VC	0.5U
Ethene	NA

MW-40-34 (S)	5/21/09
PCE	1U
TCE	1U
DCE	0.44J
VC	0.35J
Ethene	1.2U

IW-16	5/21/09
PCE	1U
TCE	0.37J
DCE	0.46J
VC	0.43J
Ethene	NA

MW-40-36 (S)	5/22/09
PCE	1U
TCE	0.42J
DCE	1.5
VC	1.9
Ethene	2.5

IW-14	5/21/09
PCE	1U
TCE	1U
DCE	0.77J
VC	1.4
Ethene	NA

MW-40-13 (MS)	5/21/09
PCE	1U
TCE	1U
DCE	1U
VC	0.5U
Ethene	NA

Figure 2

COMPOSITE OF INTERPRETED PLUME EXTENTS FOR ALL COCs BASED ON MAY 2009 DATA

IRP SITE 40
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

TETRA TECH EC, INC.

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