DRAFT

BASELINE GROUNDWATER MONITORING REPORT

ENHANCED *IN SITU* BIOREMEDIATION
INSTALLATION RESTORATION PROGRAM SITE 70
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

NAVFAC SW Contract No.: N68711-04-D-1107
Delivery Order No. 0014
DCN - IEEC-1107-0014-0001

APRIL 2009

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EXECUTIVE SUMMARY

This Baseline Groundwater Monitoring Report presents the results of a one-time groundwater sampling event to establish initial conditions prior to injection activities for the Enhanced *In Situ* Bioremediation (EISB) at Installation Restoration (IR) Program Site 70 (Research, Testing, and Evaluation [RT&E] Area), at Naval Weapons Station (NAVWPNSTA) Seal Beach, Seal Beach, California (Figure 1). The Baseline Groundwater Monitoring Report has been prepared on behalf of Naval Facilities Engineering Command Southwest (NAVFAC SW) under Contract No. N68711-04-D-1107, Delivery Order No. 0014.

The remediation at IR Site 70 is being conducted under the IR Program. NAVWPNSTA Seal Beach is an active federal facility and is not on the National Priorities List. The lead federal agency is the Department of the Navy (DON). California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC), and the California Regional Water Quality Control Board (RWQCB) Santa Ana Region are the state regulatory agencies providing support and oversight.

The baseline groundwater monitoring field activities were conducted between August and October 2008 in accordance with the approved Final Remedial Action Work Plan (RAWP) for implementation of the EISB at IR Site 70 (ECC/Geosyntec 2008b).

The baseline groundwater monitoring consisted of the following field activities:

- Groundwater-level measurements were collected from 70 groundwater monitoring wells (Figure 2).
- Groundwater samples were collected from 70 groundwater monitoring wells and analyzed for volatile organic compounds (VOCs), dissolved hydrocarbon gases (DHGs), volatile fatty acids (VFAs), anions, total dissolved solids (TDS), alkalinity, total organic carbon (TOC), dissolved hydrogen sulfide, dissolved metals, and *Dehalococcoides* with the vinyl chloride reductase genes (*Dhc*/VCr) (Table 1).
- Field parameters (groundwater temperature, pH, dissolved oxygen [DO], oxidation-reduction potential [ORP], specific conductance, turbidity, and depth to water) were measured during groundwater sample collection.
- Twelve soil vapor probes were installed within the source area treatment zone; soil vapor samples were collected from 11 probes and analyzed for methane and hydrogen sulfide gases (Figure 3). A twelfth location, originally planned for sampling, was not sampled due to the presence of water in the tubing.

Data obtained from the baseline monitoring will be used to evaluate the effectiveness of the EISB activities in each of the five different hydrostratigraphic units: Upper Fines, First Sand, Shell Horizon, Second Sand, and Deep Sand. This is the first time that the Deep Sand Unit has been sampled.

Hydraulic directions and gradients in each of the hydrostratigraphic units determined during the baseline event are generally consistent with previous investigations summarized in the Fifth Annual Groundwater Monitoring Report (BEI 2006) and Remedial Design Report (Geosyntec 2006). Groundwater elevations ranged from -11.03 feet (ft) below mean sea level (MSL) in Upper Fines point of compliance (POC) well MW-70-02, to -26.96 ft below MSL in the Deep Sand POC well MW-70-POC02. Horizontal hydraulic gradients ranged from 0.0007 to 0.009. This is the first time the Deep Sand hydrostratigraphic unit has been monitored.

The vertical head difference between hydrogeologic units indicates generally downward vertical gradients of groundwater flow throughout the plume and source areas between the Upper Fines, First Sand, and Shell Horizons. This is consistent with previous observations (Geosyntec 2006). However, vertical head differences in localized areas indicate an upward gradient in groundwater between the Second and First Sand Units (Geosyntec 2006). The baseline groundwater monitoring also indicates localized areas of upward gradients particularly between the Second Sand and Shell Horizon wells (e.g. Second Sand well MW-70-MNA15 and Shell Horizon well IW-70-SHB217); between Second Sand (MW-70-MNA15) and First Sand (MW-70-MNA12); and between the Deep Sand and Second Sand (e.g. MW-70-POC04 and MW-70-21). The vertical head differences in the Deep Sand POC wells were compared with the Second Sand POC wells. Two of the Deep Sand wells (MW-70-POC03 and MW-70-POC04) and paired Second Sand wells (MW-70-36 and MW-70-21) indicate an upward gradient (Figures 7 and 8). However, the vertical head difference of about 4.5 ft in Deep Sand well MW-70-POC02 and Second Sand POC well MW-70-23, indicate a downward gradient between the hydrostratigraphic units northeast of the site (Figures 7 and 8). The Deep Sand gradient and direction of groundwater flow may be influenced by agricultural production wells north and east of the site.

A review of the precipitation data from January 2005 through November 2008 for the Long Beach airport indicates that rainfall has declined since 2005, resulting in the lower water levels since the last groundwater monitoring that was conducted in 2005 and presented in the Fifth Annual Groundwater Monitoring Report (BEI 2006). Precipitation data for the Long Beach airport is presented in Appendix I. Seasonal fluctuations in water level elevations ranging up to 7 ft are observed in all units and are consistent with previous observations (Geosyntec 2006). A review of the OCWD municipal and agricultural data suggests that injection wells in the area west of IR Site 70, part of the Alamitos Barrier Injection Project, may be influencing the water levels and direction of groundwater flow in the shallow upper fines interval northwest of the source area. In addition, the direction of groundwater flow in the Deep Sand POC wells may be influenced by the extraction rates of nearby agricultural wells and municipal drinking water wells to the north and east of the site (Appendix I).

The results of the baseline groundwater monitoring are consistent with analytical results presented in previous investigations (BEI 2006). These results form the basis of initial conditions and concentrations at the wells to monitor progress and performance of the EISB activities.

VOCs were not reported in any of the Deep Sand wells, except for one reported value of toluene at an estimated concentration of 0.45J micrograms per liter (µg/L). Chloroform was not reported above its target cleanup goal (TCG) in any of the groundwater samples collected from the 70 baseline groundwater monitoring wells. The constituents of concern (COCs) 1,1-dichloroethene (1,1-DCE), cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), trichloroethene (TCE), and vinyl chloride (VC) were reported above TCGs in all hydrostratigraphic units except the Deep Sand (Figures 9 through 12; Tables 6 through 17). 1,1-DCA, 1,2-DCA, and PCE were reported above United States Environmental Protection Agency (U.S. EPA) and/or Cal/EPA primary Maximum Contaminant Limits (MCLs) in Source Area wells screened in the Upper Fines Unit. The baseline monitoring analytical results indicate that the TCE plume has been relatively stable since the conclusion of the previous groundwater monitoring program in July 2005 (BEI 2006).

Baseline groundwater samples collected from nine monitoring wells in August 2008 were tested for the presence of *Dehalococcoides* 16S ribosomal ribonucleic acid (rRNA) gene copies (*Dhc*) as well as expression of the vinyl chloride reductase gene (*VCr*). Values of the gene copies of *Dhc*/VCr per cell were reported. *Dhc*/*VCr* were reportedly not detected in groundwater samples collected from four of the nine wells. Measured levels of *Dhc*/VCr bacteria in the other five samples ranged from $7x10^2$ cells per liter (cells/L) to a maximum of $3x10^4$ cells/L. Of the five samples reportedly containing *Dhc* above the quantitation limit, all contained low levels of VCr ranging from detected to $8x10^3$ cells/L. Performance criteria provided as part of the RAWP indicate that optimal EISB performance includes observation of *Dhc*/VCr bacteria to concentrations exceeding 10^7 cells/L, and distribution of these bacteria throughout the active treatment zones.

Baseline groundwater sampling results for DHGs, dissolved metals, anions, TDS, alkalinity, dissolved hydrogen sulfide, TOC, VFAs, *Dhc*/*VCr*, and field parameters collected during August and October 2008 will be used to assess performance of the EISB injection strategy. The next complete round of performance monitoring results is scheduled for August 2009, approximately one year after EISB injection has been initiated.

Methane gas was reported in three of the eleven baseline soil gas samples at concentrations above the lower explosive limit (LEL). It is reasonable to assume that the methane could migrate from the vadose zone soils to the surface through cracks in the asphalt and/or to nearby utility corridors through preferential pathways in the subsurface. When mixed with air, concentrations of methane within the explosive range could be produced. The following precautionary measures have been instituted to protect onsite workers from the effects of methane gas production during remedial action at IR Site 70.

- Instituted a methane monitoring program to monitor and document methane levels within utility corridors and buildings where methane concentrations could accumulate in air above the LEL.
- Notified building tenants/occupants of the potential methane intrusion.
- Notified the other contractor performing subsurface work in the area of the soil gas results so appropriate precautionary measures can be taken when accessing wells or conducting other work within the area.
- Posted warning signs throughout the area and on entrances to utility corridors to warn of the potential presence of flammable vapors.
- Posted no smoking and no parking signs in areas that could potentially present an explosive hazard.
- Designated specific smoking areas that are well outside areas of potential explosive hazard.

The concentrations of hydrogen sulfide reported in soil gas samples during the baseline event do not appear to pose an explosive or human health hazard.

The results of the updated baseline conceptual site model (CSM) are generally in agreement with the previous CSM as presented in the Final Technical Memorandum, Installation Restoration Program Site 70, Installation of Enhanced *In Situ* Bioremediation System (ECC/Geosyntec 2008b), with some additional refinements as a result of additional monitoring data collected during the baseline sampling. The purpose of the baseline updated CSM is to provide a 3-dimensional analysis and visualization of both the subsurface hydrogeology and dissolved-phase TCE plume morphology utilizing the baseline groundwater monitoring information.

Generally, the TCE plume morphology is consistent with the previous CSM where the termination of fine-grained horizons causes a downward “stair casing” of the plume as it migrates laterally.

The updated interpretation of the lateral extent of the TCE plume 1,000 µg/L iso-concentration contour in the Source Area, as depicted by the updated baseline CSM does show a slightly larger Source Area. In addition, based on the Second Sand Biobarrier 1 (SSB-1) monitoring wells, the leading edge of the TCE plume has been extended an additional 100 ft to the southeast. Other major differences in the updated baseline CSM are the different interpretations in the lithology of the interbedded clays within the Shell Horizon.

Due to the data gaps observed in the data analysis and in the updated CSM, one existing First Sand Well and two existing Second Sand wells are proposed to be added to the next monitoring event. These wells will also help with the definition of the CSM as EISB activities progress. The next complete round of performance monitoring results is scheduled for August 2009, approximately one year after EISB injection has been completed.

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ACRONYMS/ABBREVIATIONS

1,1-DCE	1,1-dichloroethene
ACGIH	American Conference of Governmental Industrial Hygienists
bgs	below ground surface
cells/L	cells per liter
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-1,2-DCE	cis-1,2-dichloroethene
COC	constituent of concern
CSM	conceptual site model
Cal/EPA	California Environmental Protection Agency
DCA	dichloroethane
DCE	dichloroethene
DHGs	Dissolved Hydrocarbon Gases
Dhc	*Dehalococcoides*
Dhc/VCr	*Dhc* with the vinyl chloride reductase gene
DNA	deoxyribonucleic acid
DNAPL	dense non-aqueous phase liquid
DO	dissolved oxygen
DON	United States Department of the Navy
DQO	data quality objective
DTSC	(Cal/EPA) Department of Toxic Substances Control
ECC	Environmental Chemical Corporation
EISB	Enhanced *In Situ* Bioremediation
ERSE	Extended Removal Site Evaluation
ESTCP	Environmental Security Technology Certification Program
EVO	emulsified vegetable oil
EVS	Environmental Visualization System
FSB	First Sand Biobarrier
ft	feet
Geosyntec	Geosyntec Consultants
HMIS	Hazardous Material Identification System
IDLH	immediately dangerous to life and health
IDW	investigation-derived waste
IND	industrial service supply
IR	Installation Restoration (Program)

KB-1®	dechlorinating microbial culture
LDC	Laboratory Data Consultants
LEL	lower explosive limit
µg/L	micrograms per liter
µS/cm	microsiemens per centimeter
MCL	maximum contaminant level
mg/L	milligrams per liter
MNA	monitored natural attenuation
MSL	mean sea level
MUN	municipal and domestic supply
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NAVWPNSTA	Naval Weapons Station
NASA	National Aeronautics and Space Administration
NAVFAC SW	Naval Facilities Engineering Command Southwest
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFPA	National Fire Protection Association
NGVD29	National Geodetic Vertical Datum of 1929
NTU	nephelometric turbidity units
NWR	National Wildlife Refuge
OCWD	Orange County Water District
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
PCE	tetrachloroethylene
PEL	permissible exposure limit
PG	Professional Geologist
PMW	performance monitoring well
POC	point of compliance
ppb	parts per billion
ppbV	parts per billion by volume
ppm	parts per million
ppmV	parts per million by volume
PROC	industrial process supply
QA	quality assurance
QC	quality control
RAWP	Remedial Action Work Plan
RDO	remedial design optimization
redox	oxidation-reduction
rRNA	ribosomal ribonucleic acid
RT&E	Research, Testing, and Evaluation

RWQCB	(California) Regional Water Quality Control Board
SAB	Source Area Biobarrier
SAP	Sampling and Analysis Plan
SAT	Source Area Treatment
SC	specific conductance
SHB	Shell Horizon Biobarrier
SSB	Second Sand Biobarrier
STEL	short-term exposure limit
TCE	trichloroethene
TCG	target cleanup goal
TD	total depth
TDS	total dissolved solids
TLV	toxicity limit value
TOC	total organic carbon
trans-1,2-DCE	trans-1,2-dichloroethene
TWA	time-weighted average
UEL	upper explosive limit
U.S. EPA	United States Environmental Protection Agency
VFA	volatile fatty acids
VC	vinyl chloride
VOA	volatile organic analysis
VOC	volatile organic compound
WRD	Water Replenishment District of Southern California

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Section 1
INTRODUCTION

This Baseline Groundwater Monitoring Report presents the results of a one-time groundwater sampling event to establish initial site conditions prior to injection activities for the Enhanced *In Situ* Bioremediation (EISB) at Installation Restoration (IR) Program Site 70 (Research, Testing, and Evaluation [RT&E] Area), at Naval Weapons Station (NAVWPNSTA) Seal Beach, Seal Beach, California (Figure 1). The Baseline Groundwater Monitoring Report has been prepared on behalf of Naval Facilities Engineering Command Southwest (NAVFAC SW) under Contract No. N68711-04-D-1107, Delivery Order No. 0014.

The remediation at IR Site 70 is being conducted under the IR Program. NAVWPNSTA Seal Beach is an active federal facility and is not on the National Priorities List. The lead federal agency is the Department of the Navy (DON). California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC), and the California Regional Water Quality Control Board (RWQCB) Santa Ana Region are the state regulatory agencies providing support and oversight.

The DON, NAVFAC SW directs the 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). The Final Remedial Action Work Plan (RAWP) defines the site-specific requirements for implementation of EISB at IR Site 70 (ECC/Geosyntec 2008b). The baseline groundwater monitoring field activities were conducted between August and October 2008 in accordance with the approved Final RAWP .

The baseline groundwater monitoring consisted of the following field activities:

- Groundwater-level measurements were collected from 70 groundwater monitoring wells (Figure 2).
- Groundwater samples were collected from 70 groundwater monitoring wells and analyzed for volatile organic compounds (VOCs), dissolved hydrocarbon gases (DHGs), volatile fatty acids (VFAs), anions, total dissolved solids (TDS), alkalinity, total organic carbon (TOC), dissolved hydrogen sulfide, dissolved metals, and *Dehalococcoides* with vinyl chloride reductase gene (*Dhc*/VCr) (Table 1).
- Field parameters (groundwater temperature, pH, dissolved oxygen [DO], oxidation-reduction potential [ORP], specific conductance, turbidity, and depth to water) were measured during groundwater sample collection.
- Twelve soil vapor probes were installed within the source area treatment zone; soil vapor samples were collected from 11 probes and analyzed for methane and hydrogen

sulfide gases (Figure 3). A twelfth location, originally planned for sampling, was not sampled due to the presence of water in the tubing.

The baseline groundwater monitoring well network shown in Figure 2 consists of 70 wells screened within five hydrostrategraphic units designated as: Upper Fines, First Sand, Shell Horizon, Second Sand, and Deep Sand. The majority of these wells were installed in 2007 during the remedial action construction phase of the project (ECC/Geosyntec 2008a) and were sampled for the first time during the baseline monitoring event. Fourteen of the 70 wells in the baseline groundwater monitoring program have been sampled previously (BEI 2006).

The data from the baseline monitoring event was used to update the conceptual site model (CSM) presented in the Final Technical Memorandum (ECC/Geosyntec 2008a). The updated baseline CSM is presented in Section 6 and detailed in Appendix L.

1.1 PURPOSE

The objective of the baseline monitoring is to check the initial conditions and concentrations at the wells that will be used to monitor progress and performance of the EISB activities. The baseline sampling of the monitoring wells will provide a point of reference on existing conditions prior to the start of remediation. The baseline sampling of point of compliance (POC) wells for each specific zone of remediation will be used as the reference point to determine plume points of compliance. The updated baseline CSM will be used to track progress and performance of the EISB activities.

In the Source Area Treatment, EISB will be accomplished by injecting emulsified vegetable oil (EVO) and the dechlorinating culture KB-1® in a grid of injection wells, combined with a down-gradient biobarrier (Figure 2). The dissolved-phase plume will be treated with five biobarriers installed in targeted hydrogeologic units transecting the plume along the long axis of the plume: Source Area Biobarrier (SAB-1), First Sand Biobarriers 1 and 2 (FSB-1 and FSB-2), Shell Horizon Biobarriers 1 and 3 (SHB-1 and SHB-3), and Second Sand Biobarrier 1 (SSB-1) (Figure 2). The dissolved-phase plume will be treated with EISB as groundwater flows through each biobarrier, which will enhance natural attenuation of the groundwater as it flows between the biobarriers (ECC/Geosyntec 2008a). The remedy design was based on the vertical and lateral extent of the 250 micrograms per liter (µg/L) trichloroethene (TCE) plume per previous monitoring results (ECC/Geosyntec 2008a, BEI 2006). Active treatment will be terminated once the TCE concentrations in groundwater are reduced to 200 µg/L. Monitored natural attenuation (MNA) will be employed after the active treatment phase until target cleanup goals (TCGs) are achieved (Table 5).

1.2 BACKGROUND

IR Site 70 is located south of Westminster Boulevard and east of Seal Beach Boulevard (Figure 1). IR Site 70 encompasses approximately 40 acres. Groundwater at IR Site 70 is impacted by

chlorinated solvents, primarily TCE and associated degradation products. Groundwater impacted by TCE extends to a depth of approximately 160 ft below ground surface (bgs) (ECC/Geosyntec 2008a; BEI 2006). The remedial approach for IR Site 70 was first presented in the Revised Feasibility Study (Geosyntec 2005). Previous investigations are summarized in the RAWP (ECC/Geosyntec 2008b) and the Fifth Annual Groundwater Monitoring Report (BEI 2006).

IR Site 70, also known as the Research, Testing and Evaluation (RT&E) Area, consists of multistory office and production buildings, asphalt-paved parking areas, an assortment of aboveground tanks and attendant above- and below-ground piping distribution systems, and several concrete-lined sumps. From 1962 to 1973, the National Aeronautics and Space Administration (NASA) utilized the area for the design and manufacture of the second stage of Saturn V launch vehicle for the Apollo Program. Subsequent to NASA leaving the area, the United States Department of Energy and Garrett Engineering (Allied Signal) conducted pilot test assembly operations for a classified uranium enrichment process in portions of Building 112 (Figures 1 and 3). The tests were conducted from 1980 to 1985 but did not include either the manufacture or enrichment of uranium. Currently, the building is used for storage, communications research, and office space.

The Removal Site Evaluation Report for IR Site 70 (BNI 1996) addressed potential waste from the following areas:

- Bulkhead Fabrication Building 128;
- Vertical Assembly and Hydrotest Building 112;
- Pneumatic Test, Paint, and Packaging Building 122;
- Tool and Maintenance Building 130;
- Structural Test Tower, and
- Water Conditioning Plant

Operations at these facilities included the use of diluted acids, VOCs (including chlorinated solvents such as TCE), phenolic compounds, petroleum oils, sodium dichromate containing hexavalent chromium, detergents, metals containing paint wastes, and machine lubricating oil.

1.2.1 PHYSICAL SETTING AND SITE CONDITIONS

NAVWPNSTA Seal Beach is situated at latitude 33° 45’ 27” N and longitude 118° 4’ 22” W, San Bernardino Baseline and Meridian. NAVWPNSTA Seal Beach is located within the Los Angeles-Orange County coastal plain. Most of NAVWPNSTA Seal Beach lies in the 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, to the northeast by the Repetto and Puente Hills, to the east and southeast by the Santa Ana Mountains and the San Joaquin Hills, and to the south, southwest, and west by the Palos Verdes Hills and the Pacific Ocean. NAVWPNSTA Seal Beach slopes evenly from approximately 20 ft above MSL in the northwestern part, near IR Site

70, to sea level in the tidal flats of the Seal Beach National Wildlife Refuge (NWR) in the southeast (Figure 1, ECC/Geosyntec 2008b). The most pronounced feature at NAVWPNSTA Seal Beach is part of the Landing Hill on the southwest at a maximum elevation of 50 ft above MSL(ECC/Geosyntec 2008b).

The area climate is classified as a marine-influenced southern California coastal region with temperature ranges from winter lows that range from 30°F to summer highs around 90°F. Annual precipitation is variable with an average of 12.5 inches. Annual precipitation data for the area for January 2005 to November 2008 is presented in Appendix I. Prevailing winds average 4 miles per hour from the west with occasional strong dry winds ("Santa Anas"), occurring in the fall and winter. Groundwater levels are influenced by years of high precipitation or drought, as well as tidal cycles (ECC/Geosyntec 2008b).

The sequence of stratigraphic units underlying NAVWPNSTA Seal Beach from youngest (shallowest) to oldest (deepest) is:

- Recent Alluvium with a maximum thickness of approximately 80 to 100 ft. The upper 50 ft consists of fine sands, silty clays, and clays; lower unit consist of sands and gravels, silty sands, silty clays, and clays
- Upper Pleistocene Lakewood Formation is present at the site starting at depths of approximately 80 to 100 ft and extending to depths of approximately 350 ft, beyond the scope of the investigations at IR Site 70. Units are discontinuous and contain zones of high and low permeability (DWR 1961).
- Lower Pleistocene San Pedro Formation
- Pliocene Pico Formation

NAVWPNSTA Seal Beach is located in the Newport-Inglewood fault zone. Two faults, the Seal Beach fault and the Los Alamitos fault, are part of the Newport-Inglewood fault zone. The Seal Beach fault is located in the southern portion of the Newport-Inglewood fault zone. On the station, the Seal Beach fault has uplifted Upper Pleistocene deposits at Landing Hill and Hog Island (JEG 1995). Movement along the fault appears to not have displaced recent sediments. The Los Alamitos fault lies parallel to the Seal Beach fault and about 2.25 miles northeast of the Alamitos Gap (see Figure I-1, Appendix I).

1.2.2 SITE SPECIFIC HYDROGEOLOGY

NAVWPNSTA Seal Beach is located at the southwestern corner of the Orange County 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 station (JEG 1995).

There are four general aquifer zones identified at NAVWPSTA Seal Beach and include (JEG 1995):

- 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 in some parts, deposits of the Late Pliocene Pico Formation; and
- a confined zone of saline water underlying the freshwater zone.

The shallow groundwater underlying NAVWPNSTA Seal Beach (upper Recent Alluvium deposits) is within the Lower Santa Ana River Basin (Orange County management zone) (RWQCB 1995, with Amendment R8-2004-001). Beneficial uses of groundwater within the Orange County management zone include municipal and domestic supply (MUN), agricultural supply (AGR), industrial service supply (IND), and industrial process supply (PROC). Shallow groundwater underlying IR Site 70 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).

The principal freshwater body (lower Recent Alluvium deposits and Upper Pleistocene Lakewood Formation) is a large confined aquifer occupying two zones. The first zone is approximately 75 to 200 ft deep and saline. The second zone is approximately 250 to 1,000 ft deep and freshwater. This second zone is the primary water supply source for neighboring cities. Groundwater levels in this principal freshwater zone fluctuate from year to year due to variations in pumping, infiltration, and recharge. Recharge to this aquifer is primarily from unconfined areas upgradient and from unlined rivers that are hydraulically connected to the aquifer. Seasonal variations occur with highs in the wet winter months and lows in the dry summer months when large quantities of water are used for irrigation (JEG 1995).

The six hydrostratigraphic units presented in the Final Technical Memorandum (ECC/Geosyntec 2008a) are:

1. Upper Fines Unit (ground surface to approximately 60 feet [ft] bgs). The Upper Fines Unit comprises three zones: a) a shallow zone of surficial soils and recent clayey sediments; b) an intermediate zone of interbedded silts, clays, and sandy silts and clays that include a semi-perched zone; and c) a lower zone of interbedded silts, clays, and fine- to coarse-grained, silty to clayey sands. A zone of organic material, mainly wood chips, was encountered in a number of boreholes at a depth of approximately 45 to 50 ft bgs.

2. First Sand Unit (approximately 60 to 105 ft bgs). The First Sand Unit consists of poorly-graded, fine-grained sands and silty sands. A coarse sand/fine gravel layer was encountered in several borings between 80 and 95 ft bgs. This coarse layer lies just above or slightly within the

underlying Shell Horizon Unit. The First Sand Unit varies in thickness from approximately 30 to 50 ft.

3. Shell Horizon Unit (approximately 105 to 135 ft bgs). The Shell Horizon Unit is characterized by a sequence of interbedded clays, silts, sands, and gravels with laterally discontinuous interbeds of dense shells and shell fragments. This unit is characterized by a sequence of interbedded clays, silts, sands, and gravels below the source area grading to predominantly fine grained sand in the vicinity of remedial design optimization (RDO) well RDO-6A/B between 1st and 2nd Street in the dissolved-phase plume area. This unit has been subdivided into the Shell Horizon (interbedded clays) and Shell Horizon (fine-grained sands) to reflect differences in the hydrogeologic characteristics and potential plume migration behavior. Shell and gravel layers were encountered in some but not all borings, comprising interbeds within the Shell Horizon Unit that do not appear to be spatially extensive. Wood chips were encountered in several borings at a depth of about 110 ft bgs.

4. Second Sand Unit (approximately 135 to 170 ft bgs). Similar in character to the First Sand Unit, however, this deeper unit appears to be slightly coarser in its upper section.

5. Deep Clay Unit (approximately 170 to 190 ft bgs). The Deep Clay Unit consists of an upper clay to silty clay horizon and an underlying clayey silt, silt, sandy silt, or sandy clay layer. The upper clay to silty clay horizon appears to be a continuous low-permeability unit that is encountered at depths ranging between 164 to 176 ft bgs. The upper clay to silty clay unit grades downward to clayey silt, silt, sandy silt, or sandy clay. This underlying layer is 3 to 20 ft thick, extending to depths of 175 to 188 ft bgs. Below the clayey silt, silt, sandy silt, or sandy clay layer is a silty sand and sand layer, up to 6 ft thick, which has been found to a depth of 191 ft bgs in extended removal site evaluation (ERSE) borings at NAVWPNSTA Seal Beach.

6. Deep Sand Unit (approximately 190 ft bgs and below). The Deep Sand Units, where encountered, consists of variable sands (i.e., fine-grained sands and silty sands) and appears to be similar in character to the First and Second Sand Units.

1.3 REPORT ORGANIZATION

This Baseline Monitoring Report is organized as follows.

- Section 2 summarizes fieldwork activities, technical issues and strategies during baseline field activities, analytical methods, quality assurance/quality control evaluation, and data validation
- Section 3 presents the results of groundwater level measurements during the baseline monitoring
- Section 4 presents the results of groundwater quality monitoring
- Section 5 presents the results of the soil gas survey monitoring
- Section 6 presents updates and refinements to the CSM
- Section 7 presents the summary and conclusions of the baseline monitoring

- Appendix A presents field sample collection and purge logs
- Appendix B presents chain of custody documentation
- Appendix C presents laboratory analytical results
- Appendix D presents laboratory data validation reports and summary of the QC results
- Appendix E presents land survey data
- Appendix F presents soil vapor probe construction logs
- Appendix G presents well development records for MW-70-POC04
- Appendix H presents plume maps from the Fifth Annual Groundwater Monitoring Report
- Appendix I presents precipitation data from Long Beach Airport and Orange County Well Information
- Appendix J presents Source Area Biobarrier Injection Test Strategy
- Appendix K presents variations from the work plan
- Appendix L presents details of the conceptual site model

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Section 2
BASELINE FIELDWORK ACTIVITIES/QUALITY ASSURANCE/QUALITY CONTROL

This section describes the field activities conducted as part of the baseline monitoring in support of the EISB remediation activities to establish initial groundwater conditions. Baseline monitoring was conducted in accordance with the requirements specified in the RAWP and the sampling and analysis plan (SAP) (ECC/Geosyntec 2008b). Variances from the work plan are summarized in Appendix K.

2.1 FIELDWORK ACTIVITIES

The 2008 baseline groundwater monitoring was conducted in accordance with the requirements specified in the RAWP and SAP (ECC/Geosyntec 2008b). Field activities followed requirements established in the Standard Operating Procedures (SOPs) contained in Attachment B-2 of the SAP and consisted of the following:

- Water level measurements were conducted in 70 baseline monitoring wells (Table 3, Figures 4 through 8). Water levels were measured per SOPs (Attachment B-2, Section B-2.4, ECC/Geosyntec 2008b). Water levels were measured on August 18, 2008 with the exception of wells MW-70-27 and MW-70-28 which were measured on August 21, 2008.

- Measurement of field parameters during groundwater sampling of the 70 baseline monitoring wells was conducted per SOPs (ECC/Geosyntec 2008b). The field parameters are shown in Table 4.

- Groundwater sampling was conducted in 70 baseline monitoring wells and analyzed for VOCs, DHGs, VFAs, anions, TDS, alkalinity, TOC, dissolved hydrogen sulfide, dissolved metals, and deoxyribonucleic acid (DNA) assay sampling for *Dehaloccoccoides* with vinyl chloride reductase gene (*Dhc/VCr*) copies (Table 1, Tables 6 through 17). Groundwater sampling was conducted between August and October 2008.

- A geophysical utility clearance survey was conducted on August 18, 2008 by Spectrum Geophysics to identify underground utilities or other subsurface obstruction in the vicinity of the planned soil vapor probe locations.

- Twelve soil vapor probes were installed in accordance with the SOPs using direct push drilling methods on August 22 and 23, 2008. The probes were set within the vadose zone soils at depths between 5 and 6 ft bgs. The soil vapor probe locations are shown in Figure 3. Construction logs are provided in Appendix F.

- Soil vapor samples were collected on August 26, 2008 in accordance with the SOPs (ECC/Geosyntec 2008b) and analyzed for methane and hydrogen sulfide gases (Figure 13; Table 18).

- A land survey was conducted by Cal Vada Surveying, Inc. on September 12, 2008 to determine and record the coordinates (northings and eastings) and elevations of the newly installed soil vapor probes. Horizontal coordinates were determined relative to the North American Datum of 1983 (NAD83), California Zone VI. Elevations were established relative MSL using the National Geodetic Vertical Datum of 1929 (NGVD29). Land survey results are provided in Appendix E.

Variances to the SOPs described in the RAWP are presented in Appendix K.

The baseline groundwater monitoring well network shown in Figure 2 consists of 70 wells screened within five hydrostrategraphic units designated as: Upper Fines, First Sand, Shell Horizon, Second Sand, and Deep Sand. The majority of these wells were installed in 2007 during the remedial action construction phase of the project (ECC/Geosyntec 2008a) and were sampled for the first time during the baseline monitoring event. Fourteen of the 70 wells in the baseline groundwater monitoring program have been sampled previously (BEI 2006).

2.2 TECHNICAL ISSUES AND STRATEGIES DURING BASELINE FIELD ACTIVITIES

This section describes the following technical issues encountered over the course of the baseline monitoring event and during preparation for the start of EVO/KB-1® injections:

- Source Area Treatment well injection coordination with the ESTCP project

- Source Area Biobarrier Injection Procedure Strategy

- Redevelopment of Well MW-70-POC04

- Land Survey Result Corrections

- Labeling of wells MW-70-MNA12 and MW-70-MNA15

2.2.1 SOURCE AREA TREATMENT WELL INJECTION COORDINATION WITH THE ESTCP PROJECT

During the remedial action construction phase of the project conducted in 2007, 34 of the 57 injection wells planned for the SAT zone were installed. Installation of the remaining 23 wells was placed on hold pending completion of an Environmental Security Technology Certification Program (ESTCP) project planned in the source area to compare and contrast passive and active approaches for the distribution of electron donor and dechlorinating bacteria during large-

scale bioaugmentation (CDM 2007). The presence of two ESTCP test cells within the SAT zone precluded the installation of 23 injection wells during remedial action construction.

In preparation for the injection phase of the project, Insight consulted with Camp, Dresser and McKee (CDM) regarding plans for EVO/KB-1® injections into the 34 SAT wells, and solicited CDM's feedback regarding any other potential impacts to the ESTCP project. CDM identified two wells (IW-70-SAT15 and IW-70-SAT18) that were sufficiently close to the active test cell, which could potentially compromise the ESTCP test. Hence, after further consultation with the Navy and CDM, it was agreed upon to postpone injection activities in the SAT wells until after the ESTCP project is complete in December 2009 (refer to project schedule Figure 32)

2.2.2 SOURCE AREA BIOBARRIER INJECTION TEST STRATEGY

A dual injection strategy utilizing two different procedures for injection of EVO and KB-1® was tested within the SAB to determine the best means of injection to ensure survival and distribution of the amendments into the subsurface.

The two procedures tested include:

- Work Plan Procedure
  - Inject 50 percent of the EVO target volume
  - Verify that appropriate reducing conditions and compliance with KB-1® performance guarantee have been achieved
  - Inject the KB-1® culture
  - Inject the remaining 50 percent of the EVO target volume

- Alternate Procedure
  - Inject 100 percent of the EVO target volume
  - Verify that appropriate reducing conditions and compliance with KB-1® performance guarantee have been achieved
  - Inject the KB-1® culture

Information obtained from the test within the SAB will be used to refine the injection strategy for the remaining biobarriers and/or source area treatment zone. Details of the test are described in the test plan provided in Appendix J. Evaluation of the results is in progress.

Upon discussion of the injection strategy with the Navy, field activities at the Source Area Treatment Grid will be performed last, after CDM completes their demonstration project in the area, to ensure that the IR Site 70 remediation activities do not interfere with the demonstration project results. CDM's project will be completed in December 2009. Therefore, EVO/KB-1® injection at the source area can begin in January 2010 (Figure 32).

Based on the initial projection of completion of bioremediation in each area, the following sequence of injection was selected:

1) Source Area Biobarrier (completed on January 30, 2009)

2) Second Sand Biobarrier (in progress)

3) Shell Horizon Biobarrier 3

4) First Sand Biobarrier 2

5) First Sand 1 Biobarrier 1

6) Shell Horizon Biobarrier 1

7) Source Area Treatment Grid

The project schedule reflects the above sequence (Figure 32).

Performance monitoring results for the injection strategy evaluation that is being conducted at the Source Area Biobarrier are currently being evaluated. At this time the results are not conclusive as to which strategy is preferable regarding KB-1® bacteria survival and distribution of the amendments into the subsurface. While the injection of 100 percent of the EVO prior to injection of the KB-1® is favorable from a production point of view, distribution within the aquifer, may be less than optimum. After consultation with the Navy, a revised injection strategy was agreed upon for the Second Sand Biobarrier, which included injecting 80 percent of the target EVO volume prior to injection of the KB-1®, followed by injecting and flushing the formation with the remaining 20 percent of the EVO.

2.2.3 REDEVELOPMENT OF WELL MW-70-POCO4

During installation of the dedicated bladder pump in well MW-70-POC04, Insight field personnel reported that the pump could not be advanced to the required depth. A sounding of the well total depth (TD equal to 198.68 ft below the top of casing) indicated the presence of approximately 10 ft of sand, silt, and/or bentonite in the bottom of the well casing within the screened interval. A review of the initial well development records indicated high turbidity (260 nephelometric turbidity units [NTU]) at the conclusion of well development. It was therefore hypothesized that the initial well development did not remove all of the suspended solids introduced by the drilling fluid (mud) that subsequently settled in the bottom of the well casing. The well was successfully redeveloped by Insight on October 7, 2008, with a final turbidity measurement equal to 4.8 NTU and a measured TD of 208.48 ft below the top of casing. The dedicated bladder pump was successfully installed and groundwater samples collected on October 14, 2008. The well re-development records for well MW-70-POC04 are presented in Appendix G.

2.2.4 LAND SURVEY WELL ELEVATION CORRECTIONS

The remedial design for EISB of the chlorinated solvent plume in groundwater at IR Site 70 utilizes groundwater wells installed by several contractors between 1997 and 2007. Following installation, the wells were surveyed by land surveyors licensed in the state of California to determine and record the well coordinates (northings and eastings) and the top of casing elevation. Horizontal coordinates were determined relative to the NAD83, California Zone VI. With the exception of eight RDO wells installed in 2005, elevations were established relative to MSL using NGVD29. Elevations of the RDO wells were established using North American Vertical Datum of 1988 (NAVD88).

Groundwater level measurements were collected from 70 wells at IR Site 70 on August 18, 2008 as part of the baseline monitoring program. While converting the depth to groundwater measurements to potentiometric surface elevations, differences of approximately 3.8 ft were noted in the original surveyed top of casing elevation of five wells located within the IR Site 70 source area treatment zone. Following installation of 12 soil vapor probes at IR Site 70 in August 2008, Cal Vada Surveying, Inc. (Cal Vada) conducted a land survey of the newly installed probes. As a first step in reconciling the apparent top of casing elevation discrepancies identified earlier, five existing groundwater monitoring wells were also surveyed by Cal Vada. The existing wells included three installed by Bechtel Environmental, Inc. (BEI) in 2001 and 2003 (MW-70-27, MW-70-28, and MW-70-38), and two installed by Environmental Chemical Corporation (ECC) in 2007 (MW-70-PMW01A and MW-70-PMW02A).

The verification survey results (Appendix E) were compared to the surveys of record (obtained from the formalized well construction logs) for each of the wells. For wells MW-70-27, MW-70-28, and MW-70-38, the top of casing elevations recorded during the verification survey were within $\pm$0.02 ft of the elevations recorded in the surveys of record. For wells MW-70-PMW-1A and MW-70-PMW02A, the survey of record top of casing elevations were 3.81 to 3.83 ft higher than those recorded during the verification survey.

Results of the verification survey and the comparison to the surveys of record were communicated to the Navy, ECC, and Dulin & Boynton (ECC's land surveyor). After reviewing their field notes, Dulin & Boynton reported that they had incorrectly interpreted field data when they established a temporary benchmark that resulted in an elevation error of +3.85 ft for all wells surveyed during the 2007 remedial action construction phase of the project. Updated (corrected) land survey results were obtained from Dulin & Boynton and used by Insight to compute the groundwater potentiometric surface elevations shown in Tables 2 and 3 and Figures 4 through 8. The formalized borehole logs, well construction logs, and survey data were subsequently updated by ECC and reissued as errata pages to the Final Technical Memorandum (ECC/Geosyntec 2009). The corrected survey results are presented in Appendix E.

2.2.5 LABELING OF WELLS MW-70-MNA12 AND MW-70-MNA12 AND MW-70-MNA15

Monitoring wells MW-70-MNA12 and MW-70-MNA15 were installed in 2007 during the remedial action construction phase of the project and are located approximately 22 ft apart. As required by the Work Plan, MW-70-MNA12 was constructed in the First Sand Unit and MW-70-MNA15 in the Second Sand Unit. The formalized well construction logs (ECC/Geosyntec 2008a) correctly reflect this configuration. During installation of the surface completions, brass labels etched with the well number were applied to each well. A land survey was then performed to measure and record the well coordinates and elevations based on the physical labeling of the wells. The results of the survey were then recorded on the formalized borehole and well construction logs.

While collecting baseline groundwater level measurements, Insight field personnel noted that the well labeled MW-70-MNA12 was actually screened within the Second Sand Unit, and the well labeled MW-70-MNA15 was screened within the First Sand Unit. Upon further investigation, it was determined that the brass well labels were inadvertently switched when the surface completions were constructed. Consequently, the coordinates and elevations shown on the formalized borehole and well construction logs were determined to be incorrect. The discrepancy was communicated to the Navy and the remedial action construction contractor, ECC. The brass well labels were subsequently replaced by Insight to reflect the correct well number and configuration, while the borehole and well construction logs were corrected by ECC and reissued as errata pages to the Final Technical Memorandum (ECC/Geosyntec 2009).

2.3 DATA QUALITY ASSURANCE / QUALITY CONTROL SUMMARY

This subsection summarizes quality assurance and quality control findings of the analytical results. Groundwater from 70 monitoring wells selected for baseline monitoring were sampled and analyzed in accordance with the *Final SAP* (ECC/Geosyntec 2008b). All groundwater samples were analyzed by EMAX Laboratories located in Torrance, California, except for DNA assay analysis which was analyzed by SiREM located in Ontario, Canada. Table 1 summarizes laboratory analyses performed on groundwater samples collected from each well at IR Site 70 in August through October 2008, and Tables 6 through 17 present all groundwater results. The results of the baseline groundwater monitoring are summarized in Section 4 and a copy of the analytical report can be found in Appendix C. Appendix D details data usability assessment and data validation reports.

Procedures from following methods were used to analyze groundwater and field quality control samples:

- VOCs were analyzed using U.S. EPA Method 8260B
- DHGs consist of ethane, ethene, and methane and were analyzed using RSK 175
- Anions (bromide, chloride, sulfate, nitrate, nitrite) were analyzed using U.S. EPA Method 300.0

- VFAs (acetate, burtyrate, lactate, propionate) were analyzed using U.S. EPA Method 300.0M
- TOC was analyzed using Standard Method 5310B
- Dissolved Hydrogen Sulfide was analyzed using Standard Method 4500F
- TDS was analyzed using Standard Method 2540C
- Alkalinity was analyzed using Standard Method 2320B
- Dissolved Metals (arsenic, iron, manganese) were analyzed using U.S. EPA Method 6010B
- DNA assay analysis was analyzed using SiREM developed Quantitative Gene-Trac Test

Soil gas vapor samples were collected for analysis of methane and hydrogen sulfide at 11 locations presented in Figures 3 and 13. A twelfth location, originally planned for sampling (SV70-04), was not sampled due to the presence of water in the tubing. Methane vapor samples were analyzed by Columbia Analytical Services using Methods 25C and 3C. Method 3C was run whenever the levels of methane in the samples exceeded what could be measured by Method 25C. When methane concentrations exceeded Method 25Cs reporting limits, Method 3C was used to re-analyze the sample. Hydrogen sulfide vapor samples were analyzed by Columbia Analytical Services using ASTM D5504-01. The purpose of the soil vapor probes and sampling was to monitor migration of methane and hydrogen sulfide in the source area and downgradient of the source area. The results of the soil vapor sampling are summarized in Section 5.

The laboratory's quality assurance oversight involved the performance of a first-level screening of the data and an indication of any deviations from their precision, accuracy, detection limit, or laboratory quality assurance/quality control (QA/QC) criteria. A copy of the laboratory QA/QC analytical results can be found in Appendix C. A representative from the laboratory signed the data sheets, ensuring that the screening described above had been completed. Subsequently, Insight completed data review by comparing chain-of-custody forms, sample receipts, sample log-ins, and laboratory data packages. Review of these summaries confirmed that data quality objectives were met. Additionally, the analytical data, along with the associated laboratory quality control information, were forwarded to Laboratory Data Consultants, Inc. (LDC), an independent data validation service, for data validation. A U.S. EPA Level III data validation was performed on 90 percent of the groundwater samples; the remaining 10 percent of the samples underwent a Level IV data validation. Copies of the chain-of-custody documentation are included in Appendix B.

Data validation includes evaluation of holding times, sample preservation, cooler temperatures, calibrations, blanks, laboratory quality control samples, and field quality control samples. Generally, the results were within analytical criteria with a few minor exceptions, such as calibration outliers of some VOC compounds and detection of TOC in the laboratory blank. Calibration outliers affected VOC compounds that are not constituents of concern of Site 70. All affected compounds were qualified "J" or "UJ". Outliers noted during data validation are summarized in Table D-2 of Appendix D.

QA/QC measurements were taken in the field to ensure that meaningful and representative data sets were generated. Field duplicate samples were collected at a rate of 10 percent of the total number of groundwater monitoring wells sampled and one trip blank sample was included in each cooler that contained volatile organic analysis (VOA) vials. These samples were collected to ensure the consistency and integrity of sample collection methods. Seven field duplicate samples were collected for wells MW-70-MNA01 (Table 6), MW070-10 (Table 7), MW-70-PMW02A (Table 8), MW-70-MNA11 (Table 9), MW-70-PMW07A (Table 10), MW-70-PMW09 (Table 12), and IW-70-SSB109 (Table 14). Field duplicate results are generally similar to the original results and no significant problems were noted. Eleven trip blank samples were shipped and trip blank results are summarized in Appendix D. No VOC contaminant was reported in the trip blanks.

Data were generally found to be acceptable with respect to accuracy, precision, completeness, and comparability criteria. All analytical data presented in Tables 6 through 17 are valid and usable. Most of the validation findings were advisory and findings are detailed in Appendix D.

Section 3
BASELINE GROUNDWATER LEVEL MEASUREMENTS

This section presents the results of groundwater level measurements conducted as part of the baseline monitoring prior to start of EISB activities and in accordance with the RAWP (ECC/Geosyntec, 2008b).

Groundwater level measurements were conducted at 70 wells on August 18, 2008 (Table 3). The horizontal hydraulic gradient and flow direction were determined for each of the five defined hydrostratigraphic units: Upper Fines, First Sand, Shell Horizon, Second Sand, and Deep Sand. Water level elevation contour maps for each of the units is depicted in Figures 4 through 8.

Potential external factors that may influence local horizontal and vertical gradients and groundwater flow direction include the groundwater pumping (regional and agricultural water supply wells) and aquifer recharge (e.g., Alamitos Injection Barrier) activities. Groundwater pumping and aquifer recharge in the Orange County Groundwater Basin cause significant temporal fluctuations in the local groundwater elevations (Geosyntec 2006). Variability in the groundwater behavior at IR Site 70 may be caused by changes in operation of the Alamitos Injection Barrier. The Alamitos Injection Barrier, located to the northwest of IR Site 70 (see Figure I-1, Appendix I), is operated jointly by Los Angeles County Department of Public Works, the Water Replenishment District of Southern California (WRD), and the Orange County Water District (OCWD) as a hydraulic barrier to seawater intrusion. This barrier includes the injection of fresh water at depths as shallow as 27 ft bgs (Geosyntec 2006).

OCWD well production data from municipal and agricultural wells within a 2-mile radius of IR Site 70 were reviewed to determine the possible influence of production wells on IR Site 70 water levels (Appendix I). In addition, precipitation data from January 2005 through November 2008, from the Long Beach airport was collected to determine the influence of precipitation on the water levels and is presented in Appendix I.

3.1 UPPER FINES GROUNDWATER LEVEL ELEVATIONS

Groundwater level elevations were measured in 12 Upper Fines monitoring wells on August 18, 2008. The Upper Fines is the shallowest hydrostratigraphic unit defined from ground surface to approximately 60 ft bgs (Tables 2 and 3; Figure 4).

Groundwater elevations in the Upper Fines baseline monitoring wells ranged from 11.03 ft below MSL in well MW-70-02 to 13.83 ft below MSL in well MW-70-28. Depth to water ranged from 12.51 ft in well MW-70-22 to 22.48 ft in baseline well MW-70-MNA01 (Table 3).

The direction of groundwater flow in August 2008 was to the southeast and northwest towards a groundwater “low” in the vicinity of the Source Area Treatment wells. Comparison of historical data shows similar patterns (BEI 2006). Horizontal hydraulic gradients in the Upper Fines Unit ranged from 0.002 foot/foot in the area northwest of Kitts Highway, to approximately 0.005 foot/foot, in the area southeast of Kitts Highway (Figure 4).

The variable groundwater direction and horizontal hydraulic gradients observed in the Upper Fines Unit is consistent with previous investigations to date. An old stream drainage system may be traced from the area due north of IR Site 70, north of Westminster Boulevard, trending southwest through the current location of IR Site 70, subparallel to the current drainage channel that ultimately flows into Anaheim Bay (BEI 2006). The old drainage system is currently covered with structures at IR Site 70. Previous investigations attribute the variable direction and gradients in the shallowest zone to the presence of the old drainage system (BEI 2006). In addition, a review of the OCWD municipal and agricultural data suggests that injection wells in the area west of IR Site 70, part of the Alamitos Injection Barrier Project, may be influencing the water levels in the shallowest Upper Fines Unit (Appendix I).

3.2 FIRST SAND GROUNDWATER LEVEL ELEVATIONS

Groundwater level elevations were measured in 32 First Sand monitoring wells on August 18, 2008. The First Sand hydrostratigraphic unit is defined from approximately 60 to 105 ft bgs (Tables 2 and 3; Figure 5). The First Sand baseline monitoring wells are further defined spatially based on their proximity to each of the First Sand biobarriers: SAB-1, FSB-1, and FSB-2 (Tables 2 and 3, Figure 5).

Groundwater elevations in the First Sand baseline monitoring wells ranged from 14.04 ft below MSL in well MW-70-POC01 to 21.73 ft below MSL in well MW-70-16. Depth to water ranged from 19.05 ft in well MW-70-PMW04B to 31.49 ft in well MW-70-16 (Table 3). Three First Sand wells including MW-70-PMW04B, MW-70-MNA09, and MW-70-PMW07A, were not contoured due to variance in vertical head and screen intervals compared to surrounding wells. Comparison of water level elevations between adjacent wells MW-70-PMW04A, screened in the shallower portion of the First Sand, between 64 to 75 ft bgs, and MW-PMW04B, screened in the lower portion of the First Sand, between 90 to 100 ft bgs, suggests a slight localized vertical upward hydraulic gradient at this location. Hence, only MW-PMW04A elevation was contoured. Comparison of First Sand wells MW-70-PMW-07A and MW-70-MNA09, screened in the shallower portion of the First Sand between 64 and 75 ft bgs (Tables 2 and 3) show similar water level elevations although they differ from elevations of surrounding wells that either have a greater screen interval or are screened below 70 ft bgs. Hence wells MW-70-PMW-07A and MW-70-MNA09 were not contoured (Tables 2 and 3, Figure 5).

The direction of groundwater flow in the First Sand hydrostratigraphic unit in August 2008 was to the southeast, consistent with previous monitoring results (BEI 2006). Horizontal hydraulic gradients in the First Sand ranged from 0.0007 to 0.009 foot/foot. The steeper horizontal hydraulic gradients are observed directly east of Kitts Highway and west of 3rd Street. Shallower horizontal hydraulic gradients are observed west of Kitts Highway and east of 3rd Street (Figure 5).

3.3 SHELL HORIZON GROUNDWATER LEVEL ELEVATIONS

Groundwater level elevations were measured in 12 Shell Horizon monitoring wells on August 18, 2008. The Shell Horizon hydrostratigraphic unit is defined from approximately 105 to 135 ft bgs (Tables 2 and 3; Figure 6). The Shell Horizon monitoring wells are further defined spatially based on their proximity to each of the Shell Horizon biobarriers: SHB-1 and SHB-3 (Tables 2 and 3, Figure 6).

Groundwater elevations in the Shell Horizon monitoring wells ranged from 16.71 ft below MSL in well IW-70-SHB113 to 22.46 ft below MSL in well MW-70-23. Depth to water ranged from 24.20 ft in well IW-70-SHB113 to 33.63 ft in well MW-70-23 (Table 3). Two Shell Horizon wells were not contoured: IW-70-SHB113 and IW-70-SHB217. The difference in water level elevations in these wells compared to the remaining nine shell horizon wells may be due to the fact that IW-70-SBHB-113 and IW-70-SHB217 have a greater screen interval compared to the remaining nine Shell Horizon monitoring wells. Wells IW-70-SHB113 and IW-70-SHB217 are both screened between 105 and 130 ft bgs, a screen interval of 25 ft., The remainder of the nine shell horizon wells are generally screened at intervals of 10 or 15 ft. The water level elevation in well IW-70-SHB113 was 16.71 ft below MSL. The water level elevations in nearby wells MW-70-PMW09 and MW-70-PMW-10, screened deeper in the shell horizon from 120 to 130 ft bgs, are 19.79 and 19.86 ft below MSL, respectively. These data indicate that the shallower water level elevation in well IW-70-SHB113 may be a result of the shallower screen interval (Table 3, Figure 6).

The direction of groundwater flow in the Shell Horizon hydrostratigraphic unit in August 2008 was to the southeast, consistent with previous monitoring results (BEI 2006). The horizontal hydraulic gradient in the Shell Horizon was approximately 0.001 foot/foot (Figure 6).

3.4 SECOND SAND GROUNDWATER LEVEL ELEVATIONS

Groundwater level elevations were measured in 11 Second Sand monitoring wells on August 18, 2008. The Second Sand hydrostratigraphic unit is defined from approximately 135 to 170 ft bgs (Tables 2 and 3; Figure 7). The Second Sand baseline monitoring wells are further defined spatially based on their proximity to the Second Sand Biobarrier: SSB-1 (Tables 2 and 3, Figure 7).

Groundwater elevations in the Second Sand baseline monitoring wells ranged from 19.9 ft below MSL in well MW-70-PMW13A to 24.82 ft below MSL in well MW-70-21. Depth to water ranged from 26.23 ft in well MW-70-MNA15 to 32.52 ft in well MW-70-21 (Table 3). One Second Sand well, MW-70-MNA15, screened between 140 and 150 ft bgs, which is located in the lower portion of the Second Sand, was not contoured due to differences in elevation in comparison to the remainder of the wells in the Second Sand. Two other Second Sand wells,

MW-70-MNA16 and MW-70-MNA17, screened at the same depths of 140 to 150 ft bgs, are located approximately 800 ft southeast of MW-70-MNA15. Comparison of Second Sand well MW-70-MNA15 with paired well MW-70-MNA12, screened in the First Sand, indicates there may be a slight upward vertical gradient between these units in this area around 4th Street (Table 2, Figures 5 and 7).

The direction of groundwater flow in the Second Sand hydrostratigraphic unit in August 2008 was to the southeast, consistent with previous monitoring results (BEI 2006). The horizontal hydraulic gradient in the Shell Horizon was approximately 0.001 foot/foot (Figure 7).

3.5 DEEP SAND GROUNDWATER LEVEL ELEVATIONS

Groundwater level elevations were measured in 3 Deep Sand POC wells on August 18, 2008. The Deep Sand hydrostratigraphic unit is defined as depths greater than 190 ft bgs (Tables 2 and 3, Figure 8).

Groundwater elevations in the Deep Sand POC wells ranged from 20.36 ft below MSL in well MW-70-POC03 to 26.96 ft below MSL in well MW-70-POC02. Depth to water ranged from 30.00 ft in well MW-70-POC03 to 33.63 ft in well MW-70-POC02 (Table 3).

The direction of groundwater flow in the Deep Sand hydrostratigraphic unit in August 2008 was to the northeast (Figure 8). The horizontal hydraulic gradient in the Deep Sand was approximately 0.002 foot/foot (Figure 8). This is the first time the Deep Sand POC wells were monitored since they were constructed in 2007. The vertical head differences in the Deep Sand POC wells were compared with the Second Sand POC wells. Two of the Deep Sand wells, MW-70-POC03 and MW070-POC04, and paired Second Sand wells, MW-70-36 and MW-70-21, respectively, indicate a localized vertical upward gradient at this location (Figures 7 and 8). Although there is no Second Sand POC well at the location of MW-70-POC02, a comparison may be made with the water level elevation in adjacent Shell Horizon POC well MW-70-23. The vertical head difference of about 4.5 ft in Deep Sand well MW-70-POC02 and Shell Horizon POC well MW-70-23, indicate a downward gradient between the hydrostratigraphic units in this area (Figures 6 and 8). The Deep Sand gradient and direction of groundwater flow may be influenced by municipal and agricultural production wells north and east of the site.

The OCWD well information for the surrounding area indicates that a number of agricultural production wells are screened within or below the Deep Sand interval. The data indicate significant groundwater production (extraction) rates (>12,500 acre-ft between 10/1/2007 and 10/31/2008) in the deep sands to the north, northeast, and east of Site 70. Hence, the horizontal hydraulic gradient and direction of groundwater flow in the Deep Sand POC wells may be influenced by these nearby production wells (Appendix I).

3.6 SUMMARY - GROUNDWATER LEVEL ELEVATIONS

Hydraulic directions and gradients in the hydrostratigraphic units have been generally consistent with previous investigations summarized in the Fifth Annual Monitoring Report and Remedial Design Report (BEI 2006; Geosyntec 2006). Groundwater elevations ranged from 11.03 ft below MSL in Upper Fines POC well MW70-02, to 26.96 in the Deep Sand POC well MW-70-POC02. Horizontal hydraulic gradients ranged from 0.0007 to 0.009. This is the first time the Deep Sand hydrostratigraphic unit has been monitored.

The vertical head difference between hydrogeologic units indicates generally downward vertical gradients of groundwater flow throughout the plume and source areas between the Upper Fines, First Sand, and Shell Horizons. This is consistent with previous observations (Geosyntec 2006). The baseline groundwater monitoring also indicates localized areas of upward gradients particularly between the Second Sand and Shell Horizon wells (e.g. Second Sand well MW-70-MNA15 and Shell Horizon well IW-70-SHB217); between Second Sand (MW-70-MNA15) and First Sand (MW-70-MNA12); and between the Deep Sand and Second Sand (e.g. MW-70-POC04 and MW-70-21). The vertical head differences in the Deep Sand POC wells are compared with the Second Sand POC wells. Two of the Deep Sand wells (MW-70-POC03 and MW-70-POC04) and paired Second Sand wells (MW-70-36 and MW-70-21) indicate an upward gradient (Figures 7 and 8). Although there is no Second Sand POC well at the location of MW-70-POC02, a comparison may be made with the water level elevation in adjacent Shell Horizon POC well MW-70-23. The vertical head difference of about 4.5 ft in Deep Sand well MW-70-POC02 and Shell Horizon POC well MW-70-23, indicate a downward gradient between the hydrostratigraphic units in this area (Figures 6 and 8). The Deep Sand gradient and direction of groundwater flow may be influenced by agricultural production wells north and east of the site. These results are consistent with previous observations as reported in the Final Remedial Design (Geosyntec 2006).

A review of the precipitation data measured from January 2005 through November 2008, for the Long Beach airport indicates that rainfall has declined since 2005, resulting in the lower water levels since the last groundwater monitoring that was conducted in 2005 and presented in the Fifth Annual Groundwater Monitoring Report (BEI 2006). Precipitation data for the Long Beach airport is presented in Appendix I. Seasonal fluctuations in water level elevations ranging up to 7 ft are observed in all units and are consistent with previous observations (Geosyntec 2006). A review of the OCWD municipal and agricultural data suggests that injection wells in the area west of IR Site 70, part of the Alamitos Barrier Injection Project, may be influencing the water levels. In addition, the direction of groundwater flow in the Deep Sand POC wells may be influenced by extraction rates at nearby municipal and agricultural wells (Appendix I).

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Section 4
BASELINE GROUNDWATER QUALITY MONITORING

The results of the baseline groundwater quality monitoring are presented in this section. The primary objective of the baseline monitoring is to establish initial water quality conditions and concentrations of COCs at the wells that will be used to monitor progress and performance of the EISB.

Baseline groundwater monitoring was conducted between August and October 2008 in 70 wells, including 14 POC wells, in the following hydrostratigraphic and EISB areas:

- Source Area Treatment (SAT) located in the Upper Fines Unit
- Upper Fines Unit POC wells
- Source Area Biobarrier (SAB-1) located in the First Sand
- First Sand Biobarrier 1 (FSB-1)
- First Sand Biobarrier 2 (FSB-2)
- First Sand POC wells
- Shell Horizon Biobarrier 1 (SHB-1)
- Shell Horizon Biobarrier 3 (SHB-3)
- Shell Horizon POC well
- Second Sand Biobarrier (SSB-1)
- Second Sand POC wells
- Deep Sand POC wells

Groundwater samples were collected from the 70 baseline monitoring and POC wells and analyzed for alkalinity, TDS, anions, VFAs, dissolved hydrogen sulfide, TOC, dissolved metals (arsenic, iron, and manganese), chlorinated VOCs, DHGs, and *Dhc/Vcr* gene copies Field groundwater quality parameters (pH, DO, ORP, specific conductance, temperature, turbidity) were collected at the time of sampling per SOPs in the RAWP (ECC/Geosyntec 2008b) and are summarized in Table 4. The sampling schedule and analytical methods are presented in Table 1.

The baseline groundwater monitoring results are summarized in Tables 6 through 17 and Figures 9 through 13. These results are compared to TCGs for the primary COCs at IR Site 70: chloroform, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, TCE, and VC. TCGs are presented in Table 5. The additional water chemistry and MNA parameters are also discussed as part of the reference point for initial conditions prior to start of the EISB. The extent of the TCE plume was projected through the hydrostratigraphic units and presented on Figure 14.

Field sample collection and purge logs are presented in Appendix A. Chain of Custody documentation are presented in Appendix B. Laboratory analytical results and data validation

reports are presented in Appendices C and D, respectively. Details on field activities, analytical methods, and Quality Assurance/Quality Control Evaluation are presented in Section 2.

The baseline monitoring results will be used to assess the progress of the EISB remediation activities. They will be compared to similar data collected during the application of the remedy for the following purposes as specified in the RAWP (ECC/Geosyntec 2008b):

- VOCs will be used to quantify the degradation of target chlorinated VOCs
- DHGs will be used to assess degradation products. Ethene and ethane are indicators of complete degradation products. Methane is an indicator of reducing conditions.
- Dissolved metals such as iron, manganese, and arsenic are secondary groundwater quality parameters that may be mobilized due to inducement of reducing conditions in groundwater.
- Inorganic anions such as nitrate/nitrite and sulfate concentrations may be indicative of reducing conditions. Increasing chloride concentrations may be an indicator of reduction of chlorinated VOCs.
- TDS may be used as a bioremediation performance indicator.
- Alkalinity is an indicator of water quality during bioremediation activities.
- Dissolved hydrogen sulfide is an indicator of sulfate reduction and may be a health and safety issue if it forms hydrogen sulfide.
- TOC is an indicator of whether there is a presence of an electron donor.
- VFAs (acetate, butyrate, lactate, propionate) are breakdown products of electron donors and provide a qualitative indicator of the presence of an electron donor.
- *The Dehalococcoides* 16S ribosomal ribonucleic acid (rRNA) gene copies provide a concentration of Dehalococcoides group organisms (Dhc) in groundwater samples. The vinyl chloride reductase (VCr) gene track assay measures expression of the VCr gene, which is responsible for the degradation of cis-1,2-DCE and VC to ethane, within the groundwater sample microbial population. Overall, Dhc/VCr gene copies are indicators of bioaugmented culture establishment and growth.
- Field parameter measurements such as DO and ORP are measures of anaerobic conditions. Other field parameters are measured to ensure that there is no negative effect on secondary groundwater chemistry.

4.1 UPPER FINES/SOURCE AREA TREATMENT GROUNDWATER QUALITY

Baseline groundwater samples were collected from eight Source Area Treatment (SAT) baseline monitoring wells and four Upper Fines POC wells (Tables 6 and 7). The SAT and POC wells are screened between 25 ft and 60 ft bgs. Analytical results for the SAT and POC wells are summarized in Tables 6 and 7 and Figure 9.

4.1.1 VOLATILE ORGANIC COMPOUNDS IN THE UPPER FINES

Baseline groundwater samples were collected from the SAT monitoring wells and Upper Fines POC wells in August and September 2008 and analyzed for VOCs using U.S. EPA Method 8260B (Tables 6 and 7). The VOC results for the SAT baseline monitoring wells were compared to the TCGs. TCGs for all COCs, except chloroform, were exceeded in the eight SAT baseline monitoring wells (Table 6, Figure 9). Additionally, VOCs were compared to U.S. EPA and Cal/EPA MCLs.

VOCs were not reported above detection limits in the four Upper Fines POC wells (Table 7).

Chloroform was reported below the TCG of 100 µg/L in groundwater samples collected from seven of the eight SAT wells. Chloroform concentrations ranged from an estimated value of 0.52J in well MW-70-MNA02 to 39 µg/L in well MW-70-27. Chlroform was not reported above the detection limit in well MW-70-MNA03.

1,1-DCE was reported above the TCG of 6 µg/L in groundwater samples collected from four of the eight SAT wells: MW-70-27, MW-70-28, MW070-PMW01A, and MW070-PMW01B. 1,1-DCE concentrations in groundwater ranged from 0.68 µg/L in well MW-70-MNA02 to 16 µg/L in well MW-70-PMW01A. 1,1-DCE was not reported above the detection limit in well MW-70-MNA03.

Cis-1,2-DCE was reported above the TCG of 6 µg/L in groundwater samples collected from seven of the eight SAT wells. Cis-1,2-DCE concentrations in groundwater ranged from 2.8 µg/L in well MW-70-MNA03 to 4,600 µg/L in well MW-70-27.

Trans-1,2-DCE was reported above the TCG of 10 µg/L in groundwater samples collected from five of the eight SAT wells. Trans-1,2-DCE concentrations in groundwater ranged from an estimated value of 0.21J in well MW-70-MNA03 to 44 µg/L in well MW-70-PMW01A.

TCE was reported above the TCG of 5 µg/L in groundwater samples collected from seven of the eight SAT wells. TCE concentrations in groundwater ranged from an estimated value of 1.3J in MW-70-MNA03 to 11,000 µg/L in well MW-70-PMW01A. TCE was not reported above detection limits in any of the four Upper Fines POC wells. TCE concentrations in the SAT and Upper Fines POC wells are plotted and contoured on Figure 9.

VC was reported above the TCG of 0.5 µg/L in groundwater samples collected from six of the eight SAT wells. VC concentrations in groundwater ranged from an estimated value of 0.38J in well MW-70-MNA01 to 32 µg/L in well MW-70-27. VC was not reported above the detection limit in well MW-70-MNA03.

The following VOCs were reported in at least one SAT well above detection limits: 1,1,1-trichloroethane (1,1,1-TCA), 1,1,2-trichloroethane (1,1,2-TCA), 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA), 1,2-dichloropropane, acetone, benzene, carbon disulfide, freon 113, methylene chloride, and tetrachloroethylene (PCE) (Table 6). 1,1-DCA was reported above the U.S. EPA and Cal/EPA primary MCL of 5 µgL in SAT wells MW-70-27, MW-70-MNA02, MW-70-MNA03, and MW-70-PMW01A. 1,2-DCA was reported above the Cal/EPA primary MCL of 0.5 µg/L in SAT wells MW-70-27, MW-70-MNA02, MW-70-MNA03 and MW-70-MNA04. PCE was reported above U.S. EPA and Cal/EPA primary MCL of 5 µg/L in SAT well MW-70-27 and MW-70-PMW01A (Figure 9).

4.1.2 ANIONS, TOTAL ALKALINITY, AND TOTAL DISSOLVED SOLIDS IN THE UPPER FINES

Baseline groundwater samples were collected from the four SAT and four Upper Fines POC wells in August and September 2008 and analyzed for anions (U.S. EPA Method 300.0), total alkalinity (U.S. EPA Method 2320B), and TDS (U.S. EPA Method 2540C) (Tables 6 and 7).

Baseline groundwater sampling for anions consisted of: bromide, chloride, nitrate as nitrogen (nitrate-N), nitrite as nitrogen (nitrite-N), and sulfate. Bromide concentrations in groundwater samples collected from the SAT and Upper Fines POC wells ranged from 0.91 milligrams per liter (mg/L) in POC well MW-70-10 to 55.3 mg/L in POC well MW-70-22. Bromide was not reported above the detection limit in well MW-70-27.

Chloride concentrations in groundwater samples collected from the SAT and Upper Fines POC wells ranged from 293 mg/L in POC well MW-70-02 to 19,900 mg/L in POC well MW-70-22 (Table 7). Well MW-70-22 is located in proximity to the Seal Beach NWR (Figure 9). Chlorine concentrations greater than 19,000 mg/L may be indicative of seawater intrusion. Chlorine concentrations in POC well MW-70-22 are consistent with previous monitoring investigations (BEI 2006). Chlorine was not reported above detection limits in SAT wells MW-70-PMW01A and MW-70-PMW01B.

Nitrate-N concentrations in groundwater samples collected from the SAT and Upper Fines POC wells ranged from 0.396 mg/L in POC well MW-70-28 to 9.63 mg/L in POC well MW-70-02. Nitrate-N was not reported above detection limits in SAT wells MW-70-27 and MW-70-PMW01A, and in POC wells MW-70-10, MW-70-17, and MW-70-22. Nitrite-N was not reported above detection limits in the SAT and Upper Fines POC wells (Tables 6 and 7). Note that nitrate concentrations below 1 mg/L also suggest reducing conditions in the aquifer (AFCEE 2008).

Sulfate concentrations in groundwater samples collected from the SAT and Upper Fines POC wells ranged from 707 mg/L in POC well MW-70-17 to 4,540 mg/L in SAT well MW-70-27 (Tables 6 and 7).

Alkalinity values in groundwater samples collected from the SAT and Upper Fines POC wells ranged from 170 mg/L in POC well MW-70-22 to 720 mg/L in SAT well MW-70-27 (Tables 6 and 7).

TDS concentrations in groundwater samples collected from the SAT and Upper Fines POC wells ranged from 2,420 mg/L in SAT well MW-70-PMW01B to 37,200 mg/L in POC well MW-70-22 (Tables 6 and 7).

4.1.3 TOTAL ORGANIC CARBON IN THE UPPER FINES

Baseline groundwater samples were collected from the four SAT and four Upper Fines POC wells in August and September 2008 and analyzed for TOC (U.S. EPA Method 5310B) (Tables 6 and 7).

TOC concentrations in groundwater samples collected from the SAT and Upper Fines POC wells ranged from 1.45 mg/L in POC well MW-70-22 to 4.12 mg/L in POC well MW-70-02 (Tables 6 and 7). TOC was not reported above the detection limit in SAT wells MW-70-28, MW-70-PMW01A, MW-70-PMW01B.

4.1.4 DISSOLVED HYDROCARBON GASES IN THE UPPER FINES

Baseline groundwater samples were collected from the eight SAT and four Upper Fines POC wells in August and September 2008 and analyzed for DHGs: ethane, ethene, and methane (RSK 175) (Tables 6 and 7).

The DHG concentrations may be indicative of biodegradation and methanogenesis processes occurring in the aquifer. Ethane concentrations in groundwater samples collected from the SAT and Upper Fines POC wells ranged from an estimated value of 0.65J µg/L in SAT well MW-70-MNA03 to 19 µg/L in SAT well MW-70-MNA04 (Tables 6 and 7). Ethane was not reported above the detection limit in SAT wells MW-70-27, MW70-MNA01, and MW-70-PMW01B, and in all four Upper Fines POC wells.

Ethene concentrations in groundwater samples collected from the SAT and Upper Fines POC wells ranged from an estimated value of 0.60J µg/L in SAT well MW-70-28 to an estimated value of 1.9J µg/L in SAT well MW-70-PMW01A (Tables 6 and 7). Ethene was not reported above the detection limit in SAT wells MW-70-27, MW70-MNA01, MW-70-MNA02, MW-70-MNA04, and MW-70-PMW01B, and in all four Upper Fines POC wells.

Methane concentrations in groundwater samples collected from the 8 SAT and 4 Upper Fines POC wells ranged from an estimated value of 1.7J µg/L in POC well MW-70-10 to 450 µg/L in SAT well MW-70-PMW01A (Tables 6 and 7). Methane was not reported above the detection limit in Upper Fines POC well MW70-02. Methanogenesis does appear to be occurring in the SAT or Upper Fines wells.

4.1.5 DISSOLVED METALS IN THE UPPER FINES

Baseline groundwater samples were collected from the four Upper Fines POC wells in August and September 2008 and analyzed for dissolved metals: arsenic, iron, and manganese (U.S. EPA Method 6010B) (Table 7).

Dissolved arsenic and iron were not reported above detection limits in groundwater samples collected from the Upper Fines POC wells. Manganese concentrations in groundwater samples

collected from the Upper Fines POC wells ranged from 0.757 mg/L in well MW-70-10 to 3.29 mg/L in well MW-70-22. No samples were analyzed for dissolved metals from the SAT monitoring wells.

4.1.6 VOLATILE FATTY ACIDS IN THE UPPER FINES

Baseline groundwater samples were collected from four SAT and four Upper Fines POC wells in August and September 2008 and analyzed for VFAs: acetate, butyrate, lactate, propionate (U.S. EPA Method 300.0M) (Tables 6 and 7).

Acetate was reported above detection limits in groundwater samples collected from two SAT wells at estimated values of 0.548J mg/L in well MW-70-27 and 0.550J mg/L in well MW-70-28 (Tables 6 and 7).

Butyrate, lactate, and propionate were not reported above detection limits in any of the groundwater samples collected from the SAT or Upper Fines POC wells.

4.1.7 HYDROGEN SULFIDE IN THE UPPER FINES

Baseline groundwater samples were collected from four Upper Fines POC wells in August and September 2008 and analyzed for dissolved hydrogen sulfide (U.S. EPA Method 4500F) (Table 7). Hydrogen sulfide was not reported above the detection limits in any Upper Fines wells (Table 7).

4.1.8 DEHALOCOCCOIDES IN THE UPPER FINES

Baseline groundwater samples were collected from two SAT monitoring wells (MW-70-27 and MW-70-28) in August 2008 and analyzed for the presence of *Dhc/VCr* gene copies (Table 6). Dhc/VCr gene copies were not detected in the groundwater sample collected from well MW-70-27. The measured level of *Dhc* group organisms in the groundwater sample collected from well MW-70-28 was detected at $7x10^2$ cells per liter (cells/L) but below the sample-specific quantitation limit of $4x10^3$ cells/L. The Gene-Trac-VC assay detected VCr gene copies in the sample collected from MW-70-28 at 8×10^3 cells/L. These results show that the indiginous levels of *Dehalococcoides* are not sufficient to support significant contaminant reduction via reductive dechlorination; however, they do indicate that the aquifer is capable of supporting *Dehalococcoides* group organisms and vinyl chloride reductase activity.

4.1.9 FIELD PARAMETERS IN THE UPPER FINES

Field parameters collected during baseline groundwater sampling in August and September 2008 consisted of: temperature, conductivity, DO, pH, ORP and turbidity (Table 4). DO values were measured at 0.0 mg/L in the SAT and Upper Fines POC wells. The pH values ranged from 6.30 in POC well MW-70-17 to 7.34 in SAT well MW-70-PMW01B. ORP values ranged from -167 millivolts (mV) in SAT well MW-70-MNA03 to 111 mV in SAT well MW-70-PMW01A and POC well MW-70-02. The temperature values ranged from 21.4 to 24.1 degrees Celsius (^oC). The conductivity values ranged from 1,700 microsiemens/centimeter (µS/cm) in SAT well MW-70-27 to 53,500 µS/cm in Upper Fines POC well MW-70-22. The elevated conductivity in well

MW-70-22 is likely the result of seawater intrusion due to the wells proximity to the Seal Beach NWR. Turbidity values ranged from 0 in wells MW-70-02, MW-70-22, and MW-70-MNA03 to 723 nephelometric turbidity units (NTU) in well MW-70-27.

4.2 FIRST SAND GROUNDWATER QUALITY

Baseline groundwater samples were collected from 28 First Sand baseline monitoring wells and four First Sand POC wells (Tables 8 through 10). The First Sand wells are screened between 60 ft and 105 ft bgs. Analytical results for the groundwater samples collected from the First Sand wells are summarized in Tables 8 through 11 and Figure 10.

4.2.1 VOLATILE ORGANIC COMPOUNDS IN THE FIRST SAND

Baseline groundwater samples were collected from the First Sand Biobarrier (SAB-1, FSB-1, and FSB-2) and POC wells in August and September 2008 and analyzed for VOCs using U.S. EPA Method 8260B (Tables 8 through 11). The VOC results for the First Sand baseline monitoring wells were compared to the TCGs (Table 5).

Chloroform was reported below the TCG of 100 µg/L in groundwater samples collected from 2 of the 28 First Sand Biobarrier and four First Sand POC wells. Chloroform concentrations were reported at an estimated concentration of 0.25J in well IW-70-SAB06 and at an estimated value of 0.30J in well MW-70-PMW05B. Chlroform was not reported above detection limits in the other 26 First Sand Biobarrier wells and in any First Sand POC wells.

1,1-DCE was reported above the TCG of 6 µg/L in groundwater samples collected from four of the 28 First Sand Biobarrier wells: IW-70-FSB118, MW-70-38, MW-70-PMW05B, and MW-70-PMW06A. 1,1-DCE concentrations in groundwater ranged from an estimated value of 0.22J µg/L in well RDO-05 to 10 µg/L in well MW-70-PMW06A. 1,1-DCE was not reported above detection limits in First Sand Biobarrrier wells IW-70-FSB216, MW-70-MNA05, MW-70-MNA09, MW-70-MNA11, MW-70-PMW07A, and MW-70-PMW08A, and in any of the First Sand POC wells.

Cis-1,2-DCE was reported above the TCG of 6 µg/L in groundwater samples collected from 22of the 28 First Sand Biobarrier wells. Cis-1,2-DCE concentrations in groundwater ranged from an estimated value of 0.92J µg/L in well MW-70-MNA11to 2,500 µg/L in well MW-70-PMW06A. Cis-1,2-DCE was not reported above the detection limit in First Sand Biobarrier well MW-70-PMW07A, and in POC wells MW-70-16, and MW-70-POC01.

Trans-1,2-DCE was reported above the TCG of 10 µg/L in groundwater samples collected from four of the 28 First Sand Biobarrier wells. Trans-1,2-DCE concentrations in groundwater ranged from an estimated value of 0.22J µg/L in well IW-70-FSB108 to 47 µg/L in well MW-70-MNA12. Trans-1,2-DCE was not reported above detection limits in First Sand Biobarrier wells MW-70-MNA05, MW-70-MNA09, MW-70-MNA11, and MW-70-PMW07A, and in the four First Sand POC wells.

TCE was reported above the TCG of 5 µg/L in groundwater samples collected from 25 of the 28 First Sand Biobarrier wells. TCE concentrations in groundwater ranged from an estimated value of 0.45J µg/L in POC well MW-70-35 to 4,100 µg/L in well IW-70-FSB118. TCE was not reported above detection limits in First Sand Biobarrier well MW-70-PMW07A, and in POC wells MW-70-11, MW-70-16, and MW-70-POC01. TCE concentrations in the First Sand wells are plotted and contoured on Figure 10.

VC was reported above the TCG of 0.5 µg/L in groundwater samples collected from 13 of the 28 First Sand Biobarrier wells. VC concentrations in groundwater ranged from an estimated value of 0.30J µg/L in well MW-70-PMW02A to 5.6 µg/L in well MW-70-MNA08. VC was not reported above detection limits in nine First Sand Biobarrier wells and in any of the First Sand POC wells.

The following VOCs were reported in at least one First Sand well above detection limits: 1,1-1,1-DCA, bromomethane, carbon disulfide, and chloromethane (Tables 8 through 11).

VOCs were not reported above detection limits in two First Sand POC wells MW-70-16 and MW-70-POC01 (Table 11).

4.2.2 ANIONS, TOTAL ALKALINITY, AND TOTAL DISSOLVED SOLIDS IN THE FIRST SAND

Baseline groundwater samples were collected from 19 First Sand Biobarrier and four First Sand POC wells in August and September 2008 and analyzed for anions (U.S. EPA Method 300.0), total alkalinity (U.S. EPA Method 2320B), and TDS (U.S. EPA Method 2540C) (Tables 8 through 11).

Baseline groundwater sampling for anions consisted of: bromide, chloride, nitrate-N, nitrite-N, and sulfate. Bromide concentrations in groundwater samples collected from the First Sand wells ranged from an estimated value of 0.312 mg/L in well IW-70-FSB108 to 23.6 mg/L in well MW-70-PMW08A.

Chloride concentrations in groundwater samples collected from the First Sand wells ranged from 87.8 mg/L in POC well MW-70-POC01 to 8,260 mg/L in POC well MW-70-PMW08A.

Nitrate concentrations below 1 mg/L also suggest reducing conditions in the aquifer (AFCEE 2008). Nitrate-N concentrations in groundwater samples were reported in two First Sand wells: an estimated value of 0.0734J mg/L was reported in well MW-70-PMW05B and a concentration of 7.67 mg/L was reported in POC well MW-70-16. Nitrate-N concentrations were not reported above detection limits in the remainder of the First Sand wells (Tables 8 through 11).

Sulfate concentrations in groundwater samples collected from the First Sand wells ranged from 69.2 mg/L in POC well MW-70-16 to 1,430 mg/L in First Sand well MW-70-PMW08A (Tables 8 through 11).

Alkalinity values in groundwater samples collected from the First Sand wells ranged from 148 mg/L in POC well MW-70-POC01 to 320 mg/L in well MW-70-PMW07A (Tables 8 through 11).

TDS concentrations in groundwater samples collected from the First Sand wells ranged from 530 mg/L in well IW-70-FSB108 to an estimated value of 16,400J mg/L in well MW-70-PMW08A (Tables 8 through 11).

4.2.3 TOTAL ORGANIC CARBON IN THE FIRST SAND

Baseline groundwater samples were collected from 19 First Sand Biobarrier and four POC wells in August and September 2008 and analyzed for TOC (U.S. EPA Method 5310B) (Tables 8 through 11).

TOC concentrations in groundwater samples collected from the First Sand wells ranged from 0.549 mg/L in POC well MW-70-POC01 to 8.24 mg/L in POC well MW-70-16. TOC was not reported above the detection limit in seven First Sand wells (Tables 8 through 11).

4.2.4 DISSOLVED HYDROCARBON GASES IN THE FIRST SAND

Baseline groundwater samples were collected from 28 First Sand Biobarrier and four POC wells in August and September 2008 and analyzed for DHGs: ethane, ethene, and methane (RSK 175) (Tables 8 through 11).

The DHG may be indicative of biodegradation and methanogenesis processes occurring in the aquifer. Ethane was reported in groundwater samples collected from First Sand well MW-70-MNA08 at an estimated concentration of 0.86J µg/L, and from wells IW-70-FSB118 and MW-70-PMW06A at an estimated concentration of 1.0J µg/L. Ethane was not reported above the detection limit in the remainder of the First Sand wells (Tables 8 through 11).

Ethene was reported in one groundwater sample collected from First Sand well MW-70-MNA10 at an estimated concentration of 0.84J µg/L. Ethene was not reported above the detection limit in the remainder of the First Sand wells (Tables 8 through 11).

Methane concentrations in groundwater samples collected from First Sand wells ranged from 2.4 µg/L in well MW-70-MNA06 to 49 µg/L in well MW-70-MNA10 (Tables 8 through 11). Methane was not reported above the detection limit in POC well MW-70-16.

4.2.5 DISSOLVED METALS IN THE FIRST SAND

Baseline groundwater samples were collected from 15 First Sand Biobarrier and four POC wells in August and September 2008 and analyzed for dissolved metals: arsenic, iron, and manganese (U.S. EPA Method 6010B) (Tables 8 through 11).

Dissolved arsenic was reported below detection limits in groundwater samples collected from all First Sand wells. Iron concentrations in groundwater samples collected from the First Sand wells ranged from an estimated value of 0.0566J mg/L in well MW-70-PMW04A to 3.86 mg/L in well MW-70-PMW07A. Manganese concentrations in groundwater samples collected from First Sand wells ranged from an estimated value of 0.0151J mg/L in POC well MW-70-16 to 3.08 mg/L in well MW-70-PMW07A.

4.2.6 VOLATILE FATTY ACIDS IN THE FIRST SAND

Baseline groundwater samples were collected from 19 First Sand Biobarrier and four POC wells in August and September 2008 and analyzed for VFAs: acetate, butyrate, lactate, propionate (U.S. EPA Method 300.0M) (Tables 8 through 11).

Acetate was reported above detection limits in groundwater samples collected from three First Sand Biobarrier wells at concentrations ranging from an estimated value of 0.533J mg/L in well MW-70-PMW03B to 0.738 in well MW-70-PMW02B (Tables 8 through 11).

Butyrate, lactate, and propionate were not reported above detection limits in any of the groundwater samples collected from the First Sand wells.

4.2.7 HYDROGEN SULFIDE IN THE FIRST SAND

Baseline groundwater samples were collected from 15 First Sand Biobarrier and four POC wells in August and September 2008 and analyzed for hydrogen sulfide (U.S. EPA Method 4500F) (Tables 8 through 11).

Hydrogen sulfide was reported in one groundwater sample collected from well MW-70-PMW07A at 3.66 mg/L. Hydrogen sulfide was not reported above the detection limit in any other First Sand wells (Tables 8 through 11).

4.2.8 DEHALOCOCCOIDES IN THE FIRST SAND

Baseline groundwater samples were collected from four First Sand Biobarrier wells in August 2008 and tested for *Dhc*/VCr gene copies (Tables 8 through 10). *Dhc*/VCr gene copies were not detected in the groundwater samples collected from SAB-1 well IW-70-SAB06 or FSB-2 well IW-70-FSB216 at a sample-specific quantitation limit of $4x10^3$ cells/L. The measured level of *Dhc* group organisms in the groundwater sample collected from FSB-1 wells IW-70-FSB108 and IW-70-FSB118 were $8x10^3$ cells/L and $3x10^4$ cells/L, respectively. The Gene-Trac-VC assay detected VCr gene copies in both IW-70-FSB108 and IW-70-FSB118 but below the sample-specific quantitation limit of 4 $x10^3$ per liter. These results show that indiginous levels of *Dehalococcoides* are not sufficient to support significant contaminant reduction via reductive dechlorination and are randomly distributed at the site.

4.2.9 FIELD PARAMETERS IN THE FIRST SAND

Field parameters collected during baseline groundwater sampling in August and September 2008 consisted of: temperature, conductivity, DO, pH, ORP and turbidity (Table 4). Field temperature values ranged from 21.1 to 25.8 ^oC. Field conductivity values ranged from 930 µS/cm to 29,500 µS/cm. DO values ranged from 0.0 mg/L to 3.83 mg/L. The pH values ranged from 6.27 to 7.63. ORP values ranged from -199 mV to 64 mV. Turbidity values ranged from 0 to 62.9 NTU.

4.3 SHELL HORIZON GROUNDWATER QUALITY

Baseline groundwater samples were collected from 12 Shell Horizon Biobarrier wells (Tables 12 through 14). The Shell Horizon wells are screened between 105 ft and 135 ft bgs. Analytical results for the groundwater samples collected from the Shell Horizon wells are summarized in Tables 12 through 14 and Figure 11.

4.3.1 VOLATILE ORGANIC COMPOUNDS IN THE SHELL HORIZON

Baseline groundwater samples were collected from the Shell Horizon Biobarrier wells in August and September 2008 and analyzed for VOCs using U.S. EPA Method 8260B (Tables 12 through 14). The VOC results for the Shell Horizon wells were compared to the TCGs (Table 5).

Chloroform was not reported above detection limits in any Shell Horizon wells.

1,1-DCE was reported at the TCG of 6 µg/L in a groundwater sample collected from IW-70-SHB113. 1,1-DCE concentrations in groundwater ranged from an estimated value of 0.47J µg/L in well MW-70-MNA13 to 6 µg/L in well IW-70-SHB113. 1,1-DCE was not reported above the detection limit in well MW-70-MNA14 and POC well MW-70-23.

Cis-1,2-DCE was reported above the TCG of 6 µg/L in groundwater samples collected from 10 of the 11 Shell Horizon wells. Cis-1,2-DCE concentrations in groundwater ranged from an estimated value of 0.85J µg/L in well MW-70-MNA14 to 300 µg/L in well IW-70-SHB310. Cis-1,2-DCE was not reported above the detection limit in POC well MW-70-23.

Trans-1,2-DCE was reported above the TCG of 10 µg/L in groundwater samples collected from four of the 11 Shell Horizon. Trans-1,2-DCE concentrations in groundwater ranged from an estimated value of 0.90J µg/L in well MW-70-MNA13 to 60 µg/L in well IW-70-SHB310. Trans-1,2-DCE was not reported above the detection limit in Shell Horizon well MW-70-MNA14 and POC well MW-70-23.

TCE was reported above the TCG of 5 µg/L in groundwater samples collected from 10 of the 11 Shell Horizon wells. TCE concentrations in groundwater ranged from an estimated value of 0.99J µg/L in well MW-70-MNA14 to 4,300 µg/L in well IW-70-SHB113. TCE was not reported above the detection limit in POC well MW-70-23. TCE concentrations in the Shell Horizon wells are plotted and contoured on Figure 11.

VC was reported above the TCG of 0.5 µg/L in groundwater samples collected from 8 of the 11 Shell Horizon wells. VC concentrations in groundwater ranged from an estimated value of 0.47J µg/L in well MW-70-PMW11A to 4.4 µg/L in well IW-70-SHB113. VC was not reported above detection limits in wells MW-70-MNA13, MW-70-MNA14, and MW-70-23.

The following VOCs were reported in at least one Shell Horizon well above detection limits: 1,1-DCA and carbon disulfide (Tables 12 through 14).

4.3.2 ANIONS, TOTAL ALKALINITY, AND TOTAL DISSOLVED SOLIDS IN THE SHELL HORIZON

Baseline groundwater samples were collected from eight Shell Horizon Biobarrier wells and one POC well in August and September 2008 and analyzed for anions (U.S. EPA Method 300.0), total alkalinity (U.S. EPA Method 2320B), and TDS (U.S. EPA Method 2540C) (Tables 12 through 14).

Baseline groundwater sampling for anions consisted of: bromide, chloride, nitrate-N, nitrite-N, and sulfate. Bromide concentrations in groundwater samples collected from the Shell Horizon wells ranged from an estimated value of 0.301J mg/L in well MW-70-PMW09 to 11.7 mg/L in well MW-70-PMW11A. Bromide was not reported above detection limits in wells IW-70-SHB113 and MW-70-PMW10 and POC well MW-70-23.

Chloride concentrations in groundwater samples collected from the Shell Horizon wells ranged from 190 mg/L in well MW-70-PMW09 to 3,470 mg/L in well MW-70-PMW11A.

Nitrate-N and nitrite-N were not reported above detection limits in any of the Shell Horizon wells (Tables 12 through 14).

Sulfate concentrations in groundwater samples collected from the Shell Horizon wells ranged from 198 mg/L in well MW-70-PMW09 to 533 mg/L in well MW-70-23 (Tables 12 through 14).

Alkalinity values in groundwater samples collected from the Shell Horizon wells ranged from 158 mg/L in well MW-70-PMW11A to 210 mg/L in well IW-70-SHB310 (Tables 12 through 14).

TDS concentrations in groundwater samples collected from the Shell Horizon wells ranged from 860 mg/L in well MW-70-PMW09 to an estimated value of 6,720J mg/L in well MW-70-PMW11A (Tables 12 through 14).

4.3.3 TOTAL ORGANIC CARBON IN THE SHELL HORIZON

Baseline groundwater samples were collected from eight Shell Horizon wells and one POC well in August and September 2008 and analyzed for TOC (U.S. EPA Method 5310B) (Tables 12 through 14).

TOC concentrations in groundwater samples collected from the Shell Horizon wells ranged from an estimated value of 0.585J mg/L in well MW-70-23 to 1.80 mg/L in well IW-70-SHB310 (Tables 12 through 14).

4.3.4 DISSOLVED HYDROCARBON GASES IN THE SHELL HORIZON

Baseline groundwater samples were collected from 11 Shell Horizon Biobarrier wells and one POC well in August and September 2008 and analyzed for DHGs: ethane, ethene, and methane (RSK 175) (Tables 12 through 14).

Ethane was reported in one groundwater sample collected from Shell Horizon well IW-70-SHB113 at an estimated concentration of 0.65J µg/L. Ethane was not reported above the detection limit in the remainder of the Shell Horizon wells (Tables 12 through 14).

Ethene concentrations were reported in nine groundwater samples collected from Shell Horizon wells. Ethene concentrations in groundwater samples ranged from an estimated concentration of 0.63J µg/L in well MW-70-PMW12A to 4.5 µg/L in well MW-70-MNA14. Ethene was not reported above the detection limit in wells IW-70-SHB113 and MW-70-PMW12B (Tables 12 through 14).

Methane concentrations in groundwater samples collected from First Sand wells ranged from 8.3 µg/L in well MW-70-23 a to 460 µg/L in well MW-70-PMW10 (Tables 12 through 14).

4.3.5 DISSOLVED METALS IN THE SHELL HORIZON

Baseline groundwater samples were collected from six Shell Horizon wells and one POC well in August and September 2008 and analyzed for dissolved metals: arsenic, iron, and manganese (U.S. EPA Method 6010B) (Tables 8 through 11).

Dissolved arsenic concentrations were reported in two Shell Horizon wells at estimated values of 0.00531J mg/L in well MW-70-PMW09 and 0.00582J mg/L in well MW-70-PMW10. Iron concentrations in groundwater samples collected from the Shell Horizon wells ranged from of 0.201 mg/L in well MW-70-PMW09 to 2.46 mg/L in well MW-70-PMW11A. Manganese concentrations in groundwater samples collected from Shell Horizon wells ranged from an estimated value of 0.17J mg/L in well MW-70-PMW09 to 1.24 mg/L in well MW-70-PMW11A.

4.3.6 VOLATILE FATTY ACIDS IN THE SHELL HORIZON

Baseline groundwater samples were collected from eight Shell Horizon wells and one POC well in August and September 2008 and analyzed for VFAs: acetate, butyrate, lactate, propionate (U.S. EPA Method 300.0M) (Tables 12 through 14).

Acetate was reported above detection limits in groundwater samples collected from two Shell Horizon Biobarrier wells at 1.55 mg/L in well MW-70-PMW11A to 2.93 mg/L 0.738 in well MW-70-PMW11B (Table 13).

Butyrate, lactate, and propionate were not reported above detection limits in any of the groundwater samples collected from the Shell Horizon wells.

4.3.7 HYDROGEN SULFIDE IN THE SHELL HORIZON

Baseline groundwater samples were collected from six Shell Horizon Biobarrier wells and one POC well in August and September 2008 and analyzed for dissolved hydrogen sulfide (U.S. EPA Method 4500F) (Tables 12 through 14).

Hydrogen sulfide was not reported above the detection limits in any Shell Horizon wells.

4.3.8 DEHALOCOCCOIDES IN THE SHELL HORIZON

Baseline groundwater samples were collected from two Shell Horizon Biobarrier wells in August 2008 and tested for *Dhc*/VCr gene copies. The measured levels of *Dhc* group organisms in the groundwater sample collected from SHB-1 well IW-70-SHB113 was $7x10^3$ cells/L. VCr gene copies were detected in IW-70-SHB113 but were below the sample-specific quantitation limit of

4 x10^3 cells/liter. *Dhc*/VCr gene copies were not detected in the groundwater sample collected from SHB-3 well IW-SHB310 at a sample-specific quantitation limit of 4x10^3 cells/L. Consistent with the *Dhc*/VCr analyses performed on samples collected from the Upper Fines and First Sand Units, the results show that indiginous levels of *Dehalococcoides* are randomly distributed at the site and not present at sufficient levels to support significant contaminant reduction via reductive dechlorination.

4.3.9 FIELD PARAMETERS IN THE SHELL HORIZON

Field parameters collected during baseline groundwater sampling in August and September 2008 consisted of: temperature, conductivity, DO, pH, ORP and turbidity (Table 4). Field temperature values ranged from 20.7 to 23.3 ^oC. Field conductivity values ranged from 2,300 µS/cm to 31,000 µS/cm. DO values ranged from 0.0 mg/L to 0.03 mg/L. The pH values ranged from 6.62 to 7.68. ORP values ranged from -202 mV to -97 mV. Turbidity values ranged from 0 to 4.1 NTU.

4.4 SECOND SAND GROUNDWATER QUALITY

Baseline groundwater samples were collected from nine Second Sand Biobarrier and two Second Sand POC wells (Tables 15 and 16). The Second Sand wells are screened between 135 ft and 170 ft bgs. Analytical results for the groundwater samples collected from the Second Sand wells are summarized in Tables 15 and 16, and Figure 12.

4.4.1 VOLATILE ORGANIC COMPOUNDS IN THE SECOND SAND

Baseline groundwater samples were collected from the Second Sand Biobarrier and POC wells in August and September 2008 and analyzed for VOCs using U.S. EPA Method 8260B (Tables 15 and 16). The VOC results for the Shell Horizon wells were compared to the TCGs (Table 5).

Chloroform was not reported above detection limits in any Second Sand wells.

1,1-DCE was reported below the TCG of 6 µg/L in all groundwater samples collected from Second Sand wells. 1,1-DCE concentrations in groundwater ranged from 0.58 µg/L in well IW-70-SSB109 to 4.1 µg/L in well MW-70-MNA16. 1,1-DCE was not reported above the detection limit in Second Sand Biobarrier wells MW-70-15 and MW-70-MNA17, and in the two Second Sand POC wells.

Cis-1,2-DCE was reported above the TCG of 6 µg/L in groundwater samples collected from seven of the nine Second Sand Biobarrier wells. Cis-1,2-DCE concentrations in groundwater ranged from an estimated value of 0.21J µg/L in POC well MW-70-36 to 1,100 µg/L in well MW-70-MNA16.

Trans-1,2-DCE was reported above the TCG of 10 µg/L in groundwater samples collected from seven of the nine Second Sand Biobarrier wells. Trans-1,2-DCE concentrations in groundwater ranged from 12 µg/L in well IW-70-SSB109 to 39 µg/L in well MW-70-MNA16. Trans-1,2-DCE

was not reported above detection limits in Second Sand Biobarrier wells MW-70-15 and MW-70-MNA17, and in the two Second Sand POC wells.

TCE was reported above the TCG of 5 µg/L in groundwater samples collected from seven of the nine Second Sand Biobarrier wells. TCE concentrations in groundwater ranged from an estimated value of 0.21J in well MW-70-MNA17 to 1,100 µg/L in well MW-70-PMW14A. TCE was not reported above the detection limit in the two Second Sand POC wells. TCE concentrations in the Second Sand wells are plotted and contoured on Figure 12.

VC was reported above the TCG of 0.5 µg/L in groundwater samples collected from five of the nine Second Sand Biobarrier wells. VC concentrations in groundwater ranged from an estimated value of 0.34J µg/L in well IW-70-SSB109 to 410 µg/L in well MW-70-PMW13A. VC was not reported above detection limits in Second Sand Biobarrier wells MW-70-15, MW-70-MNA15, and MW-70-MNA17, and in the two Second Sand POC wells.

The following VOCs were reported in at least one Second Sand Biobarrier or POC well above detection limits: 1,1- 1,1-DCA, carbon disulfide, and tetrachloroethylene (Tables 15 and 16).

4.4.2 ANIONS, TOTAL ALKALINITY, AND TOTAL DISSOLVED SOLIDS IN THE SECOND SAND

Baseline groundwater samples were collected from five Second Sand Biobarrier and two Second Sand POC wells in August and September 2008 and analyzed for anions (U.S. EPA Method 300.0), total alkalinity (U.S. EPA Method 2320B), and TDS (U.S. EPA Method 2540C) (Tables 15 and 16).

Baseline groundwater sampling for anions consisted of: bromide, chloride, Nitrate-N, Nitrite-N, and sulfate. Bromide concentrations in groundwater samples collected from the Second Sand wells ranged from 3.30 mg/L in well MW-70-PMW13A to 27.9 mg/L in POC well MW-70-21. Chloride concentrations in groundwater samples collected from the Second Sand wells ranged from 1,480 mg/L in well MW-70-PMW14A to 8,740 mg/L in well MW-70-21. Nitrate-N and Nitrite-N were not reported above detection limits in any of the Second Sand wells (Tables 15 and 16).

Sulfate concentrations in groundwater samples collected from the Second Sand wells ranged from 345 mg/L in well MW-70-PMW13A to 1,190 mg/L in well MW-70-21 (Tables 15 and 16).

Alkalinity values in groundwater samples collected from the Shell Horizon wells ranged from 178 mg/L in well MW-70-2 and IW-70-SSB109 (duplicate sample) to 225 mg/L in well MW-70-PMW13A (Tables 15 and 16).

TDS concentrations in groundwater samples collected from the Second Sand wells ranged from 735 mg/L in well MW-70-PMW14B to 18,300 mg/L in Second Sand POC well MW-70-21 (Tables 15 and 16). POC well MW-70-21 is located adjacent to the Seal Beach NWR (Figure 12).

4.4.3 TOTAL ORGANIC CARBON IN THE SECOND SAND

Baseline groundwater samples were collected from five Second Sand Biobarrier wells and two Second Sand POC wells in August and September 2008 and analyzed for TOC (U.S. EPA Method 5310B) (Tables 15 and 16). TOC concentrations in groundwater samples collected from the Second Sand wells ranged from 1.23 mg/L in well MW-70-21 to 2.08 mg/L in well MW-70-PMW14A (Tables 15 and 16).

4.4.4 DISSOLVED HYDROCARBON GASES IN THE SECOND SAND

Baseline groundwater samples were collected from nine Second Sand Biobarrier and three POC wells in August and September 2008 and analyzed for DHGs: ethane, ethene, and methane (RSK 175) (Tables 15 and 16).

Ethane was reported in one groundwater sample collected from Second Sand well MW-70-PMW14B at an estimated concentration of 0.88J µg/L. Ethane was not reported above the detection limit in the remainder of the Second Sand Biobarrier and POC wells (Tables 15 and 16).

Ethene concentrations were reported in groundwater samples collected from five of the nine Second Sand Biobarrier wells. Ethene concentrations in groundwater samples ranged from an estimated concentration of 1.6J µg/L in well IW-70-SSB109 to 18 µg/L in well MW-70-PMW13A. Ethene was not reported above the detection limit in Second Sand Biobarrier wells MW-70-15, MW-70-MNA15, MW-70-MNA16, and MW-70-MNA17, and in the two Second Sand POC wells (Tables 15 and 16).

Methane concentrations in groundwater samples collected from Second Sand wells ranged from 4.8 µg/L in Second Sand POC well MW-70-21 to 680 µg/L in well MW-70-PMW13A (Tables 15 and 16).

4.4.5 DISSOLVED METALS IN THE SECOND SAND

Baseline groundwater samples were collected from four Second Sand Biobarrier and two Second Sand POC wells in August and September 2008 and analyzed for dissolved metals: arsenic, iron, and manganese (U.S. EPA Method 6010B) (Tables 14 through 15).

Dissolved arsenic was reported in one Second Sand Biobarrier well and one POC well at estimated concentrations of 0.00624J mg/L in well MW-70-21 and 0.0123J mg/L in well MW-70-PMW14B. Iron concentrations in groundwater samples collected from the Second Sand wells ranged from of 0.751 mg/L in well MW-70-21 to 3.42 mg/L in well MW-70-PMW13B. Manganese concentrations in groundwater samples collected from Second Sand wells ranged from 0.59 mg/L in well MW-70-21 to 2.19 mg/L in well MW-70-PMW14A.

4.4.6 VOLATILE FATTY ACIDS IN THE SECOND SAND

Baseline groundwater samples were collected from five Second Sand Biobarrier and two Second Sand POC wells in August and September 2008 and analyzed for VFAs: acetate, butyrate, lactate, propionate (U.S. EPA Method 300.0M) (Tables 15 and 16).

Acetate, butyrate, lactate, and propionate were not reported above detection limits in any of the groundwater samples collected from the Second Sand Biobarrier and POC wells.

4.4.7 HYDROGEN SULFIDE IN THE SECOND SAND

Baseline groundwater samples were collected from four Second Sand Biobarrier and two Second Sand POC wells in August and September 2008 and analyzed for dissolved hydrogen sulfide (U.S. EPA Method 4500F) (Tables 15 and 16).

Hydrogen sulfide was not reported above the detection limits in any Second Sand wells.

4.4.8 DEHALOCOCCOIDES IN THE SECOND SAND

Baseline groundwater samples were collected from one Second Sand monitoring well in August 2008 and tested for *Dhc*/VCr gene copies. The measured level of *Dhc* group organisms in the groundwater sample collected from SSB-1 well IW-70-SSB109 was $5x10^3$ cells/L. However, *Dhc* group organisms were not detected in the duplicate sample collected from well IW-70-SSB109 at a sample-specific quantitation limit of 4 $x10^3$ per liter. VCr gene copies were detected in well IW-70-SSB109 at an estimated value of 2 $x10^3$ per liter below the sample-specific quantitation limit of 4 $x10^3$ per liter. Consistant with the *Dhc*/VCr analyses performed in samples collected from the other units, the results show that indiginous levels of *Dehalococcoides* are randomly distributed at the site and not present at sufficient levels to support significant contaminant reduction via reductive dechlorination.

4.4.9 FIELD PARAMETERS IN THE SECOND SAND

Field parameters collected during baseline groundwater sampling in August and September 2008 consisted of: temperature, conductivity, DO, pH, ORP and turbidity (Table 4). Field temperature values ranged from 20.7 to 22.3 ^oC. Field conductivity values ranged from 1,160 µS/cm to 38,900 µS/cm. DO values were 0.0 mg/L. The pH values ranged from 6.46 to 7.19. ORP values ranged from -254 mV to -87 mV. Turbidity values ranged from 0 to 65 NTU.

4.5 DEEP SAND GROUNDWATER QUALITY

Baseline groundwater samples were collected from three Deep Sand POC wells (Table 17). The Deep Sand wells are screened between 190 ft and 205 ft bgs. Analytical results for the groundwater samples collected from the Deep Sand wells are summarized in Table 17.

4.5.1 VOLATILE ORGANIC COMPOUNDS IN THE DEEP SAND

Baseline groundwater samples were collected from the Deep Sand POC wells in September and October 2008 and analyzed for VOCs using U.S. EPA Method 8260B (Tables 17). The VOC results for the Deep Sand wells were compared to the TCGs (Table 5). Only one VOC was reported in one of the Deep Sand POC wells. Toluene, a common laboratory contaminant, was reported at an estimated concentration of 0.45J µg/L in Deep Sand POC well MW-70-POC04. No other VOCs were reported in Deep Sand POC wells (Table 17).

4.5.2 ANIONS, TOTAL ALKALINITY, AND TOTAL DISSOLVED SOLIDS IN THE DEEP SAND

Baseline groundwater samples were collected from three Deep Sand POC wells in September and October 2008 and analyzed for anions (U.S. EPA Method 300.0), total alkalinity (U.S. EPA Method 2320B), and TDS (U.S. EPA Method 2540C) (Table 17).

Baseline groundwater sampling for anions consisted of: bromide, chloride, nitrate-N, nitrite-N, and sulfate. Bromide concentrations in groundwater samples collected from the Deep Sand wells ranged from 0.53 mg/L in well MW-70-POC02 to 38.4 mg/L in well MW-70-POC04.

Chloride concentrations in groundwater samples collected from the Deep Sand wells ranged from 174 mg/L in well MW-70-POC02 to 11,900 mg/L in well MW-70-POC04.

Nitrate-N concentrations in groundwater were reported in one groundwater sample collected from well MW-70-POC04 at an estimated value of 0.0915J mg/L. Nitrite-N was not reported above detection limits in any of the Deep Sand POC wells (Table 17).

Sulfate concentrations in groundwater samples collected from the Deep Sand wells ranged from 64 mg/L in well MW-70-POC02 to 1,650 mg/L in well MW-70-POC04 (Table 17).

Alkalinity values in groundwater samples collected from the Deep Sand wells ranged from 138 mg/L in well MW-70-POC03 to 203 mg/L in well MW-70-P0C02 (Table 17).

TDS concentrations in groundwater samples collected from the Deep Sand wells ranged from 605 mg/L in well MW-70-POC02 to 20,600 mg/L in well MW-70-POC04 (Table 17).

4.5.3 TOTAL ORGANIC CARBON

Baseline groundwater samples were collected from three Deep Sand POC wells in September and October 2008 and analyzed for TOC (U.S. EPA Method 5310B) (Tables 17).

TOC concentrations in groundwater samples collected from the Deep Sand wells ranged from an estimated value of 0.63J mg/L in well MW-70-POC02 to 2.75 mg/L in well MW-70-POC04 (Table 17).

4.5.4 DISSOLVED HYDROCARBON GASES IN THE DEEP SAND

Baseline groundwater samples were collected from three Deep Sand POC wells in September and October 2008 and analyzed for DHGs: ethane, ethene, and methane (RSK 175) (Table 17).

The DHG concentrations may be indicative of biodegradation and methanogenesis processes occurring in the aquifer. Ethane and ethene were not reported above detection limits in the Deep Sand POC wells (Table 17). Methane concentrations in groundwater samples collected from Deep Sand wells ranged from 2.7 µg/L in well MW-70-POC02 to 5.5 µg/L in well MW-70-POC03 (Tables 17).

4.5.5 DISSOLVED METALS IN THE DEEP SAND

Baseline groundwater samples were collected from three Deep Sand POC wells in September and October 2008 and analyzed for dissolved metals: arsenic, iron, and manganese (U.S. EPA Method 6010B) (Tables 17).

Dissolved arsenic was not reported above detection limits in the groundwater samples collected from the Deep Sand POC wells. Iron concentrations in groundwater samples collected from the Deep Sand wells ranged from of 0.282 mg/L in well MW-70-POC02 to 4.11 mg/L in well MW-70-POC04. Manganese concentrations in groundwater samples collected from Deep Sand wells ranged from an estimated value of 0.0577J mg/L in well MW-70-POC02 to 2.1 mg/L in well MW-70-POC04.

4.5.6 VOLATILE FATTY ACIDS IN THE DEEP SAND

Baseline groundwater samples were collected from three Deep Sand POC wells in September and October 2008 and analyzed for VFAs: acetate, butyrate, lactate, propionate (U.S. EPA Method 300.0M) (Table 17).

Acetate was reported in one groundwater sample collected from Deep Sand POC well MW-70-POC04 at a concentration of 9.34 mg/L. Butyrate, lactate, and propionate were not reported above detection limits in any of the groundwater samples collected from the Deep Sand POC wells.

4.5.7 HYDROGEN SULFIDE IN THE DEEP SAND

Baseline groundwater samples were collected from three Deep Sand POC wells in September and October 2008 and analyzed for hydrogen sulfide (U.S. EPA Method 4500F) (Table 18).

Hydrogen sulfide was not reported above detection limits in any Deep Sand wells.

4.5.8 FIELD PARAMETERS IN THE DEEP SAND

Field parameters collected during baseline groundwater sampling in September and October 2008 consisted of: temperature, conductivity, DO, pH, ORP and turbidity (Table 4). Field temperature values ranged from 20.7 to 21.7 ^{o}C. Field conductivity values ranged from 1,030 µS/cm to 37,200 µS/cm. DO values ranged from 0.0 mg/L to 0.2 mg/L. The pH values ranged from 7.15 to 7.34. ORP values ranged from -195 mV to -127 mV. Turbidity values ranged from 0 to 8.4 NTU.

4.6 SUMMARY OF BASELINE GROUNDWATER QUALITY

A projected map displaying the extent of TCE concentrations in the five hydrostratigraphic units is shown on Figure 14. The results of the baseline groundwater quality monitoring are consistent with analytical results presented in previous investigations (BEI 2006). These results form the basis of initial conditions and concentrations at the wells to monitor progress and performance of the EISB activities.

VOCs were not reported in any of the Deep Sand wells, except for one reported value of toluene (0.45J µg/L), a possible lab contaminant. Chloroform was not reported above TCGs in any of the groundwater samples collected from the 70 baseline groundwater monitoring wells. The COCs 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, TCE, and VC were reported above TCGs in all hydrostratigraphic units except the Deep Sand (Figures 9 through 12; Tables 6 through 17). 1,1-DCA, 1,2-DCA, and PCE were reported above U.S. EPA and/or Cal/EPA primary MCLs in Source Area wells screened in the Upper Fines Unit.

Baseline groundwater samples collected from nine monitoring wells in August 2008 were tested for the presence of *Dhc*/VCr gene copies. *Dhc*/VCr were reportedly not detected in groundwater samples collected from four of the nine wells at sample-specific quantitation limits of $4x10^3$ cells/L. Measured levels of *Dhc*/VCr in the other five wells ranged from $7x10^2$ cells/L to a maximum of $3x10^4$ cells/L. Performance criteria provided as part of the RAWP indicate that optimal EISB performance includes observation of *Dehalococcoides* when *Dhc*/VCr concentrations exceed 10^7 cells/L, and distribution of these bacteria throughout the active treatment zones.

Baseline groundwater sampling results for DHGs, dissolved metals, anions, TDS, alkalinity, dissolved hydrogen sulfide, TOC, VFAs, *Dhc*/Vcr, and field parameters collected during August and October 2008 will be used to assess performance monitoring of the EISB injection strategy and its degradation products. The next performance monitoring results are scheduled in August 2009 (Figure 32), which is about one year after EISB injection has been completed.

Section 5
SOIL VAPOR SAMPLING RESULTS

This section discusses the results of the baseline soil vapor sampling conducted at IR Site 70 on August 26, 2008.

Electron donor in the form of EVO acts to reduce the ORP of the aquifer as it is consumed through biological reactions in the subsurface. When the aquifer becomes sufficiently reduced, sulfate reduction and methanogenic reactions can occur. These reactions result in the production of methane and hydrogen sulfide gases (ECC/Geosyntec 2008b).

Twelve soil vapor probes were installed at the locations shown in Figure 3 to monitor methane and hydrogen sulfide gases within the vadose zone soils. These locations were chosen to correspond with areas containing potentially high concentrations of electron donor and which are present near active buildings or underground utility corridors. Soil vapor probes were also installed around the source area and downgradient to monitor for migration of these gases as required by the RAWP (ECC/Geosyntec 2008b).

Monitoring of these gases over the course of the remedial action at IR Site 70 is important for the protection of onsite workers including those engaged in the remedial action as well as the many tenants/occupants of the surrounding facilities. Pertinent flammability and health hazard information associated with methane and hydrogen sulfide gases are presented in Table 19.

Soil gas samples were collected from 11 soil vapor probes installed at IR Site 70 and analyzed for methane and hydrogen sulfide gases. Originally, 12 soil vapor probe locations were installed for sampling. However, soil vapor probe location SV-70-04 was not sampled due to presence of water in the sample tubing. The analytical results are shown in Table 18 and Figure 13 and discussed in further detail below.

A methane monitoring plan was prepared (Insight 2009). As part of this plan, selected locations throughout the RT&E Area will be monitored for the presence of methane gas over the course of the EISB. Locations to be monitored will be selected based on analytical results from soil gas probes installed within the vadose zone soils and the proximity of the probes to nearby utility corridors, buildings, and groundwater wells. The following locations have been selected for initial methane monitoring based on the analytical results from the baseline soil vapor samples (Figure 3:

- Inside Buildings 118, 121, 123 (northwest corner), and 124.
- Utility corridors west of the tank farm and east of soil gas probes SV-70-02 and -05.

A hand-held multi-gas monitor equipped with methane and oxygen sensors (RKI Eagle or equivalent) will be used to monitor for the presence of explosive vapors and oxygen levels

within the selected areas. The Navy has notified building tenants/occupants of the potential for methane intrusion into the buildings. The Navy also notified CDM of the soil gas results in the vicinity of the passive test cell so appropriate precautionary measures can be taken during their operations.

Insight, per Navy direction, will coordinate with Station personnel to post warning, no smoking, and no parking signs throughout the RT&E Area as necessary, and to identify appropriate locations for designated smoking areas.

5.1 METHANE SOIL VAPOR RESULTS

Methane was reported in all samples and ranged from 35 parts per million by volume (ppmV) at SV-70-11 (east of Building 122) to 739,000 ppmV at SV-70-05 (southwest of Building 118). As shown in Table 19, the lower explosive limit (LEL) for methane in air is 5 percent while the upper explosive limit (UEL) in air is 15 percent. Methane was reported in two samples (SV-70-02 and -05) at concentrations above the UEL and in one sample (SV-70-09) at a concentration between the UEL and LEL. The concentration of methane reported in one other sample (SV-70-08) was slightly above one half the LEL. The two highest concentrations of methane reported during the baseline sampling event (SV-70-02 and -05) were measured in samples collected from locations immediately adjacent to the passive test cell established by CDM as part of the ESTCP project (CDM 2007). The extent to which that project may have influenced the methane concentrations reported in the baseline soil gas samples is not known.

5.2 HYDROGEN SULFIDE SOIL VAPOR RESULTS

Hydrogen sulfide was reported in 7 of 11 samples and ranged from 3.3 parts per billion by volume (ppbV) at SV-70-08 (north of Building 124) to 990 ppbV at SV-70-05 (southwest of Building 118). These concentrations are well below the LEL of 4 percent and the OSHA health based time-weighted average (TWA) permissible exposure limit (PEL) of 10 ppm in air.

5.3 SUMMARY OF SOIL VAPOR RESULTS

The two highest concentrations of methane reported in the baseline soil gas samples (SV-70-02 and -05) are located adjacent to the CDM passive test cell and in close proximity to underground utility corridors. Although these concentrations are above the UEL, it is reasonable to assume that the methane could migrate from the vadose zone soils to the surface through cracks in the asphalt and/or to nearby utility corridors through preferential pathways in the subsurface. When mixed with air, concentrations of methane within the explosive range could be produced. Similarly, the methane concentration reported above the LEL at SV-70-09 is in close proximity to Building 121 and could pose a similar threat to occupants of the building. The concentrations of hydrogen sulfide reported in soil gas samples during the baseline event do not appear to pose an explosive or human health hazard.

5.3.1 MEASURES TAKEN TO PROTECT ONSITE WORKERS

The following precautionary measures have been instituted to protect onsite workers from the effects of methane gas production during remedial action at IR Site 70.

- Instituted a methane monitoring program to monitor and document methane levels within utility corridors and buildings where methane concentrations could accumulate in air above the LEL.
- Notified building tenants/occupants of the potential methane intrusion.
- Notified CDM of the soil gas results so appropriate precautionary measures can be taken when accessing wells or conducting other work within the test cells.
- Posted warning signs throughout the area and on entrances to utility corridors to warn of the potential presence of flammable vapors.
- Posted no smoking and no parking signs in areas that could potentially present an explosive hazard.
- Designated specific smoking areas that are well outside areas of potential explosive hazard.

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Section 6
CONCEPTUAL SITE MODEL

The purpose of the baseline updated CSM is to provide a 3-dimensional analysis and visualization of both the subsurface hydrogeology and dissolved-phase TCE plume morphology utilizing the baseline groundwater monitoring information. Over several CSM iterations, both the hydrogeology and the contaminant spatial distribution have been improved and refined. The baseline CSM update includes the following:

- The platform for the CSM was converted from Environmental Visualization System (EVS) to Earth Vision®. During the conversion process, the Earth Vision CSM was compared to the EVS CSM at each stage. First, the hydrogeology parameters were entered into Earth Vision and compared to the EVS CSM. Then, the aggregate contaminant data set, referenced in the Final Technical Memorandum - Installation of EISB System (ECC/Geosyntec 2008a), was used to generate TCE plume morphology figures which were compared to the EVS outputs. These steps were used to validate the Earth Vision CSM prior to entering the baseline 2008 groundwater data set. The details and validation of the Earth Vision model with the previous model are presented in Appendix L.

- Groundwater sampling results from the Fall 2008 baseline groundwater monitoring event were incorporated into the CSM. These data were input in the CSM as a stand alone data set to establish the baseline conditions prior to implementing the EISB system.

- The updated CSM model is depicted with elevation data in ft referenced to MSL for assistance in comparison of lithologic and contaminant layers.

6.1 UPDATES TO THE BASELINE CONCEPTUAL SITE MODEL

This section describes the primary refinements and updates to the CSM in terms of the lithologic interpretation and TCE plume morphology based on the 2008 baseline groundwater monitoring results.

6.1.1 LITHOLOGIC CONCEPTUAL SITE MODEL UPDATE

No new lithographic information was gathered during the baseline groundwater sampling in August 2008. As such, the hydrogeology of IR Site 70 in the CSM was compiled primarily from geology logged during the EISB well installation (ECC/Geosyntec 2008a) and augmented with the geologic conceptual model developed in the Remedial Design (Geosyntec 2006). The cross sections for the baseline updated CSM are shown in Figures 15 through 24.

In terms of the subsurface hydrogeology, the CSM is comprised of six separate hydrostratigraphic units and the results of the updated baseline CSM remains generally

consistent with the previous interpretation (Geosyntec 2006; ECC/Geosyntec 2008a) and are identified as follows:

- **Upper Fines Unit (below the fill to approximately 60 ft bgs [-48 ft MSL]).** The Upper Fines Unit is comprised of the following five subunits.
    - **Clay 1:** The unit consists of predominantly clayey soils from below the fill to a depth of approximately 20 ft bgs [-8 ft MSL] (i.e., "surficial fines");
    - **Sand 1:** Starting approximately at a depth of 20 ft bgs [-8 ft MSL], a predominantly fine-grained sand is intercepted that ranges in thickness from 2 to 17 ft thick (i.e., "20 ft sand");
    - **Clay 2:** Starting approximately at a depth of 30 to 38 ft bgs [-18 to -26 ft MSL], a predominantly clayey unit is intercepted that ranges in thickness from approximately 3 to 10 ft thick (i.e., "30 ft fines");
    - **Sand 2:** Starting at a depth of 38 to 57 ft bgs [-26 to -45 ft MSL], a fine- to medium-grained sand unit is intercepted that ranges in thickness from 13 to 20 ft thick (i.e., "40 ft sand"); and
    - **Clay 3:** Starting at a depth of approximately 57 to 60 ft bgs [-45 to -48 ft MSL], a silty clay to clay layer is intercepted that ranges in thickness from 2 to 3 ft thick (i.e., "60 ft clay").
- **First Sand Unit (approximately 60 to 105 ft bgs [-48 to -93 ft MSL]).** The First Sand Unit consists of interbedded fine-grained and medium-grained sands and silty sands. A coarse sand/fine gravel layer was encountered in several borings between 80 and 95 ft bgs [-68 to -83 ft MSL], and localized clays layers were noted between 80 to 90 ft bgs [-68 to -88 ft MSL] in several SAB injection wells. The First Sand Unit varies in thickness from approximately 30 to 50 ft.
- **Shell Horizon Unit (approximately 105 to 135 ft bgs [-93 to -123 ft MSL]).** The Shell Horizon Unit consists of a sequence of interbedded clays, silts, sands, and gravels with laterally discontinuous interbeds of dense shells and shell fragments. In the source area, this unit is comprised of a sequence of interbedded clays, silts, sands, and gravels. The unit transition to predominantly fine grained sand near remedial design optimization (RDO) well RDO-6A/B between 1st and 2nd Street in the dissolved-phase plume area. Within the CSM, the Shell Horizon has been subdivided into the Shell Horizon Clays (interbedded) and Shell Horizon Sand (fine-grained) to reflect differences in the hydrogeologic characteristics and potential plume migration behavior.
- **Second Sand Unit (approximately 135 to 170 ft bgs [-123 to -158 ft MSL]).** Similar in character to the First Sand Unit, however, this lower unit appears to be slightly coarser in its upper section.
- **Deep Clay Unit (approximately 170 to 190 ft bgs).** The Deep Clay Unit consists of upper clay to silty clay horizon and an underlying clayey silt, silt, sandy silt, or sandy clay layer. The upper clay to silty clay horizon appears to be a continuous low-permeability unit that is encountered at depths ranging between 164 to 176 ft bgs. The upper clay to silty clay unit grades downward to clayey silt, silt, sandy silt, or sandy clay. This underlying layer is 3 to 20 ft thick, extending to depths of 175 to 188 ft bgs. Below the clayey silt, silt, sandy silt, or sandy clay layer is a silty sand and sand layer, up to 6 ft thick, which has been found to a depth of 191 ft bgs in ERSE borings at NAVWPNSTA Seal Beach.

- **Deep Sand Unit (approximately 190 ft bgs and below).** The Deep Sand Units has fine-grained sands and silty sands and appears to be similar in character to the First and Second Sand Units. It should be noted that the Deep Sand Unit has been logged in only a few boreholes on NAVWPNSTA Seal Beach [BNI 2002].

Cross-sections A-A', B-B', and C-C' depict the hydrostratigraphic interpretation underlying the Source Area through the six units (Figures 15 through 17). Within the Upper Fines Unit, underlying the Source Area, the baseline updated CSM supports the previous definition of the distinct hydrostratigraphy of the alternating clays and sands: Clay 1/Sand 1/Clay 2/Sand 2/Clay 3 (Figures 15 through 17). In addition, similar to the previous model, the baseline updated CSM captures the depression below the tank farm seen in the borehole lithology as well as the increases and decreases in the thicknesses of Clay 2 and Clay 3 within the Upper Fines Unit.

Cross-section D-D' presents the lithologic interpretation at the location of the FSB-1 (Figure 18). The lithologic interpretation at the location of FSB-1 is generally consistent with the previous CSM through the First Sand. The primary difference in the updated baseline CSM, compared to the previous CSM, is the interpretation in the western edge of the D-D' cross-section within the Shell Horizon. The inferred interbedded clays (queried) near FSB-101 in the previous interpretation (ECC/Geosyntec 2008a) were interpreted as a clay stringer in the updated baseline CSM. In addition, on the eastern side of cross-section D-D', the updated CSM presents a Shell Horizon Clay layer (SH Clay 2) that is not depicted in the previous CSM interpretation (Figure 18).

The remaining cross sections (E-E', F-F', G-G', H-H', and I-I') present lithologic interpretations through the biobarriers FSB-2, SHB-1, SHB-3, and SSB-1 (Figures 19 – 23). The interpretations of the lithologic units between the updated baseline CSM and the previous CSM are generally similar. The primary difference between the updated baseline CSM and the previous CSM, are the interpretation of the interbedded clay layers within the Shell Horizon.

Cross-section J-J' presents a northwest-southeast trending cross-section oriented parallel to the general longitudinal axis of the dissolved-phase TCE plume (Figure 24). The refinement of the lithology in the source area at approximately -90 ft MSL [100 ft bgs] is shown in the updated baseline CSM where the Shell Horizon begins with an interbedded clay. This is consistent with the description of the units presented in the Final Technical Memorandum (ECC/Geosyntec 2008a) where this clay layer transitions to a fine sand near well RDO-6A/B. However, this interpretation differs in the similar transect presented in the previous CSM.

Overall, the interpretation of hydrostratigraphic units in the updated baseline CSM did not change when compared to the previous CSM.

6.1.2 TCE PLUME CONCEPTUAL SITE MODEL UPDATE

The baseline groundwater data from Fall 2008 was imported into the updated baseline CSM as a separate, stand alone dataset. This differentiation between the aggregate contaminant data

set (ECC/Geosyntec 2008a) and the updated baseline 2008 data allowed for the development of a time specific TCE plume extent. Furthermore, by evaluating the TCE plume using only the 2008 data set, potential data gaps could be assessed and additional wells to be monitored could be recommended (Figures 25-31).

The updated interpretation of the lateral extent of the TCE plume 1,000 µg/L iso-concentration contour in the Source Area is shown in plan view on Figures 25 and 26. In the source area, the 2-D slices at 35 ft bgs [-23 ft MSL] and 50 ft bgs [-38 ft MSL] of the 3-Dimensional interpretation of the Upper Fines Unit TCE plume show the 1,000 µg/L isoconcentration centers around wells MW-70-27, MW-70-28, MW-70-PMW01A, and MW-70-PMW01B which are located in the vicinity of the tank farm depression. The 35 ft bgs slice of the 1,000 µg/L TCE plume presented as part of this updated baseline CSM (Figure 25), has a similar footprint compared to the aggregate data set presented in the previous CSM, although the updated baseline CSM does show a slightly greater plume extent (ECC/Geosyntec 2008a). The 50 ft bgs slice of the 1,000 µg/L TCE plume presented as part of this updated baseline CSM (Figure 26), does show a greater TCE foot print compared with the 35 ft bgs slice as well as the previous CSM. One possible explanation is that as dense non-aqueous phase liquid (DNAPL) migrates vertically downward through an aquifer due to its specific gravity, which is greater than one, it is expected that the 50 ft bgs slice would show the affects of the residual DNAPL associated with the Clay 3 layer.

Figures 27 and 28 present cross sections A-A' and B-B', showing the lithology in the Source Area with the 250 µg/L TCE plume. Figure 30 presents the lithology with the 250 µg/L TCE plume on cross-section J-J' oriented parallel to the general longitudinal axis of the dissolved-phase TCE plume. Three-dimensional oblique views of the 250 µg/L TCE plume are presented on Figure 29.

For cross section A-A' (Figure 27), the TCE concentrations in the Upper Fines Unit range from 46 to 11,000 µg/L. It should be noted that concentrations of 5,000 µg/L, which are in excess of 1 percent of the solubility of TCE, suggest that NAPL TCE may still be present at the site. Based on the lithology presented in the cross section, the tank farm depression could be the location where the NAPL originally pooled, and migrated into the Sand 2 layer of the Upper Fines Unit. This location could continue today to serve as the predominant TCE source. The CSM model of the baseline data set shows the top of the TCE plume constrained by the groundwater table and the base of the plume extended to a depth of -60 ft MSL.

For cross section B-B' (Figure 28), the updated baseline CSM shows the extent of TCE within the Upper Fines Unit and the First Sands Unit perpendicular to the A-A' cross section. In the First Sands Unit, the TCE concentrations range from 56 to 350 µg/L.

Plan, oblique, and profile views of the 250 µg/L TCE plume are shown in Figure 29. The baseline data shows a narrow 250 µg/L TCE plume footprint. The baseline TCE data in the base of the Shell Horizon Unit at well MW-70-PMW14A is at a concentration of 1,100 µg/L, and

Second Sand Biobarrier monitoring wells reported TCE concentrations from 300 to 530 µg/L. Downgradient 116 ft at well MW-70-MNA16, TCE was reported at and estimated value of 140J µg/L. Based on these SSB-1 monitoring wells, the leading edge of the TCE plume has been extended an additional 100 ft to the southeast.

Generally, the TCE plume morphology is consistent with the previous CSM where the termination of fine-grained horizons causes a downward "stair casing" of the plume as it migrates laterally.

6.2 INTEGRATED CONCEPTUAL SITE MODEL

A comprehensive view of the contaminant plume, integrating the conceptual hydrogeologic site model and the conceptual plume morphology is presented in Figures 30 and 31. In cross section J-J' (Figure 30), the length of the plume is spanned and integrated with the hydrogeology. The updated baseline data CSM output shows the dissolved-phase plume mitigating through the coarse-grain units with the interbedded clay layers slowing the vertical movement of the plume. TCE concentrations of 500 µg/L extend through the First Sand Unit and migrate through the Shell Horizon Sands and Clays to reach the Second Sand layer at the toe of the plume. Figure 31 presents the integrated CSM and incorporates the locations of the biobarrier injection wells. Based on the 2008 baseline groundwater data, the source area treatment and biobarrier wells are located appropriately to address the objectives of the remedial design.

6.3 CSM DATA GAPS AND RECOMMENDATIONS

Part of the goal of the updated baseline CSM, is to determine any potential data gaps in the CSM.

The following wells, some of which were previously monitored, may assist further refinement of the CSM in the future:

- Well MW-70-37, screened between 89 to 109 ft bgs, and located in the Source Area is recommended to be added to the next groundwater monitoring event (Appendices H and L). The addition of well MW-70-37 will help with definition of the plume within the First Sand Unit in the Source Area and provide information on the connectivity of the plume between the Upper Fines Unit and First Sands Unit and improve the interpretation of cross sections A-A' and B-B'. In addition, well MW-70-37 was part of the aggregate data set presented in the previous CSM and validated and depicted in Appendix L. To support this addition to the monitoring well network, the aggregate data set was compared to the baseline 2008 data set. For the aggregate data set, the plume in the both cross sections A-A' and B-B' extended to a depth of -90 ft MSL. This difference in plume depth is a result of well MW-70-37 influence on the source area. Although well MW-70-37 is downgradient of the cross section A-A', the well is screened from 89-109 ft bgs and exerts an influence upgradient in the First Sands Units. Moreover, well MW-70-

37 is part of cross section B-B' in the aggregate data set. In 2005, a TCE concentration of 9,100 µg/L was observed in well MW-70-37 (BEI 2006).

- Well MW-70-14, screened between 160-170 ft bgs, on the northeastern edge of plume is also recommended to be added to the next monitoring event (Figure 14; Appendices H and L). Within the Second Sand Unit, the previous CSM produces a narrow plume width. Well MW-70-14 helped to expand the plume for the aggregate data set. Well 70-14 is also included in the recommendation of wells proposed for inclusion of the next monitoring event.

- Wells MW-70-39, screened between 143-153 ft bgs, and MW-70-40, screened between 135 to 145 ft bgs, in the Source Area are recommended to be added to the next monitoring event (Appendices H and L). These wells would also provide additional upgradient controls to further define the TCE plume at depth.

Section 7
SUMMARY AND RECOMMENDATIONS

Hydraulic directions and gradients in each of the hydrostratigraphic units determined during the baseline event are generally consistent with previous investigations summarized in the Fifth Annual Groundwater Monitoring Report (BEI 2006) and Remedial Design Report (Geosyntec 2006). This is the first time the Deep Sand hydrostratigraphic unit has been monitored, showing a direction of groundwater flow generally to the northeast, based on three Deep Sand POC wells. The Deep Sand gradient and direction of groundwater flow may be influenced by agricultural production wells north and east of the site.

The vertical head difference between hydrogeologic units indicates generally downward vertical gradients of groundwater flow throughout the plume and source areas between the Upper Fines, First Sand, and Shell Horizons. This is consistent with previous observations (Geosyntec 2006). However, vertical head differences in localized areas indicate an upward gradient in groundwater.

A review of the OCWD municipal and agricultural data suggests that injection wells in the area west of IR Site 70, part of the Alamitos Barrier Injection Project, may be influencing the water levels and direction of groundwater flow in the shallow upper fines interval northwest of the source area. In addition, the direction of groundwater flow in the Deep Sand POC wells may be influenced by the extraction rates of nearby agricultural wells and municipal drinking water wells to the north and east of the site (Appendix I).

The results of the baseline groundwater monitoring are consistent with analytical results presented in previous investigations (BEI 2006). These results form the basis of initial conditions and concentrations at the wells to monitor progress and performance of the EISB activities.

VOCs were not reported in any of the Deep Sand wells, except for one reported value of toluene (0.45J µg/L), a possible lab contaminant. Chloroform was not reported above its TCG in any of the groundwater samples collected from the 70 baseline groundwater monitoring wells. The COCs 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, TCE, and VC were reported above TCGs in all hydrostratigraphic units except the Deep Sand (Figures 9 through 12; Tables 6 through 17). 1,1-DCA, 1,2-DCA, and PCE were reported above U.S. EPA and/or Cal/EPA primary MCLs in Source Area wells screened in the Upper Fines Unit. The baseline monitoring analytical results indicate that the TCE plume has been relatively stable since the conclusion of the previous groundwater monitoring program in July 2005 (BEI 2006). The extent of the TCE plume is projected through the different hydrostratigraphic units and presented on Figure 14.

Baseline groundwater samples collected from nine monitoring wells in August 2008 were tested for the presence of *Dhc*/VCr gene copies. *Dhc*/VCr were reportedly not detected in groundwater samples collected from four of the nine wells at sample-specific quantitation limit. Performance criteria provided as part of the RAWP indicate that optimal EISB performance includes

observation of *Dhc*/VCr bacteria to concentrations exceeding 10^7 cells/L, and distribution of these bacteria throughout the active treatment zones.

The next complete round of performance monitoring results is scheduled for about a year after EISB injection has been completed in August 2009.

Methane gas was reported in three of the eleven baseline soil gas samples at concentrations above the LEL (Figure 13). It is reasonable to assume that the methane could migrate from the vadose zone soils to the surface through cracks in the asphalt and/or to nearby utility corridors through preferential pathways in the subsurface. When mixed with air, concentrations of methane within the explosive range could be produced. Precautionary measures have been instituted to protect onsite workers from the effects of methane gas production during remedial action at IR Site 70.

The concentrations of hydrogen sulfide reported in soil gas samples during the baseline event do not appear to pose an explosive or human health hazard.

The results of the updated baseline CSM are generally in agreement with the previous CSM as presented in the Final Technical Memorandum, Installation Restoration Program IR Site 70, Installation of Enhanced *In Situ* Bioremediation System (ECC/Geosyntec 2008b), with some additional refinements as a result of additional monitoring data collected during the baseline sampling. The purpose of the baseline updated CSM is to provide a 3-dimensional analysis and visualization of both the subsurface hydrogeology and dissolved-phase TCE plume morphology utilizing the baseline groundwater monitoring information.

Generally, the TCE plume morphology is consistent with the previous CSM where the termination of fine-grained horizons causes a downward “stair casing” of the plume as it migrates laterally.

The updated interpretation of the lateral extent of the TCE plume 1,000 µg/L iso-concentration contour in the Source Area, as depicted by the updated baseline CSM does show a slightly larger Source Area. In addition, based on the SSB-1 monitoring wells, the leading edge of the TCE plume has been extended an additional 100 ft to the southeast.

Other major differences in the updated baseline CSM are the different interpretations in the lithology of the interbedded clays within the Shell Horizon.

Upon review of the data points comprising the baseline monitoring well locations and the extent of the TCE plume and the CSM, three existing wells are proposed to be added to the future monitoring well network (Table 20). The rationale for the selection of each of the wells is included in Table 20 and Figure 14.

Section 8
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Table 1
Baseline Groundwater Monitoring Schedule

Well Identifier and Hydrostratigraphic Zone	Screen Interval (feet bgs)	Field Parameters[a]	Volatile Organic Compounds (8260B)[b]	Dissolved Hydrocarbon Gases[c] (RSK 175)	Anions[d] (300.0)	Total Dissolved Solids (2540C)	Alkalinity (2320B)	Volatile Fatty Acids[e] (300.0M)	Total Organic Carbon (5310B)	Dissolved Hydrogen Sulfide (4500F)	Dissolved Metals[f] (6010B)	Dhc/VCr (qPCR)	Methane Gas (25C/3C)	Hydrogen Sulfide Gas (ASTM D5504)
Source Area Vadose Zone Soils														
SV-70-01	5-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	√	√
SV-70-02	5-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	√	√
SV-70-03	5-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	√	√
SV-70-04	5-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SV-70-05	5-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	√	√
SV-70-06	5-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	√	√
SV-70-07	5-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	√	√
SV-70-08	5-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	√	√
SV-70-09	5-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	√	√
SV-70-10	5-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	√	√
SV-70-11	5-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	√	√
SV-70-12	5-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	√	√
Source Area Treatment/Upper Fines														
MW-70-PMW01A	25-35	√	√	√	√	√	√	√	√	NA	NA	NA	NA	NA
MW-70-PMW01B	45-55	√	√	√	√	√	√	√	√	NA	NA	NA	NA	NA
MW-70-27	26-36	√	√	√	√	√	√	√	√	NA	NA	√	NA	NA
MW-70-28	50-60	√	√	√	√	√	√	√	√	NA	NA	√	NA	NA
MW-70-MNA01	40-50	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-70-MNA02	35-45	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-70-MNA03	35-45	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-70-MNA04	35-45	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Source Area Biobarrier/First Sand														
MW-70-PMW02A	71-81	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-PMW02B	90-100	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
IW-70-SAB06	65-80/85-105	√	√	√	√	√	√	√	√	NA	NA	√	NA	NA
MW-70-MNA05	70-80	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-70-PMW03A	70-80	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-PMW03B	90-100	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
First Sand Biobarrier 1														
MW-70-38	80-100	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
IW-70-FSB118	60-105	√	√	√	√	√	√	√	√	NA	NA	√	NA	NA
MW-70-PMW06A	70-80	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-PMW06B	91-101	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-PMW04A	70-80	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-PMW04B	90-100	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
IW-70-FSB108	60-105	√	√	√	√	√	√	√	√	NA	NA	√	NA	NA
MW-70-PMW05A	70-80	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-PMW05B	90-100	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
RDO-5	65-105	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-70-MNA08	80-90	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-70-MNA06	80-90	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-70-MNA11	80-90	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-70-MNA07	90-100	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
First Sand Biobarrier 2														
MW-70-PMW07A	65-75	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-PMW07B	85-95	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
IW-70-FSB216	65-100	√	√	√	√	√	√	√	√	NA	NA	√	NA	NA
MW-70-PMW08A	65-75	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-PMW08B	85-95	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-MNA09	64-74	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-70-MNA10	75-85	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-70-MNA12	75-85	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 1 (continued)

Well Identifier and Hydrostratigraphic Zone	Screen Interval (feet bgs)	Field Parameters[a]	Volatile Organic Compounds (8260B)[b]	Dissolved Hydrocarbon Gases[c] (RSK 175)	Anions[d] (300.0)	Total Dissolved Solids (2540C)	Alkalinity (2320B)	Volatile Fatty Acids[e] (300.0M)	Total Organic Carbon (5310B)	Dissolved Hydrogen Sulfide (4500F)	Dissolved Metals[f] (6010B)	Dhc/VCr (qPCR)	Methane Gas (25C/3C)	Hydrogen Sulfide Gas (ASTM D5504)
Shell Horizon Biobarrier 1														
MW-70-PMW09	120-130	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
IW-70-SHB113	105-130	√	√	√	√	√	√	√	√	NA	NA	√	NA	NA
MW-70-PMW10	120-130	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
IW-70-SHB217	105-130	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-70-MNA13	115-125	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shell Horizon Biobarrier 3														
MW-70-PMW11A	85-95	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-PMW11B	115-125	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
IW-70-SHB310	80-95/105-130	√	√	√	√	√	√	√	√	NA	NA	√	NA	NA
MW-70-PMW12A	85-95	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-PMW12B	115-125	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-MNA14	115-125	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Second Sand Biobarrier 1														
MW-70-PMW13A	125-135	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-PMW13B	145-155	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
IW-70-SSB109	126-166	√	√	√	√	√	√	√	√	NA	NA	√	NA	NA
MW-70-PMW14A	128-138	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-PMW14B	149-159	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-MNA16	141-151	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-70-MNA17	140-150	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-70-MNA15	140-150	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-70-15	161-171	√	√	√	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Point of Compliance/Upper Fines														
MW-70-02	20-30	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-10	30-40	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-17	30-40	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-22	20-30	√	0	√	√	√	√	√	√	√	√	NA	NA	NA
Point of Compliance/First Sand														
MW-70-POC01	80-90	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-11	80-100	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-35	90-100	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-16	95-105	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
Point of Compliance/Shell Horizon														
MW-70-23	110-130	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
Point of Compliance/Second Sand														
MW-70-36	150-160	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-21	150-170	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
Point of Compliance/Deep Sand														
MW-70-POC02	190-200	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-POC03	190-200	√	√	√	√	√	√	√	√	√	√	NA	NA	NA
MW-70-POC04	195-205	√	√	√	√	√	√	√	√	√	√	NA	NA	NA

Notes:

[a] field parameters consist of pH, dissolved oxygen, oxidation-reduction potential, specific conductance, temperature, turbidity, and depth to water
[b] analytical method shown in parentheses
[c] dissolved hydrocarbon gases consist of ethane, ethene, and methane
[d] anions consist of bromide, chloride, sulfate, nitrate, and nitrite
[e] volatile fatty acids consist of acetate, burtyrate, lactate, and proponiate
[f] dissolved metals consist of iron, manganese, and arsenic

Acronyms/Abbreviations:

bgs - below ground surface
Dhc/VCr - *Dehalococcoides*/vinyl chloride reductase
NA - not analyzed
qPCR - quantitative polymerase chain reaction
TDS - total dissolved solids
√ - analyzed

Table 2
Well Construction Summary

	Well Installation			Construction Depths (feet bgs)					Construction Elevations (feet MSL, NGVD29)						Screen Dimensions			Well Maintenance		
		Coordinates (feet NAD83)			Filter Pack		Screen Interval				Filter Pack		Screen Interval						Well Depth	
Well Number	Date Installed	Northing	Easting	Borehole Depth	Top	Bottom	Top	Bottom	TOC	Ground Surface	Top	Bottom	Top	Bottom	Length (feet)	Diameter (inches)	Slot Size (inches)	Date Last Developed	Date Measured	Measurement (feet below TOC)
Upper Fines																				
MW-70-PMW01A	02/26/07	2224162.70	6005948.30	37.00	20.00	37.00	25.00	35.00	8.23	8.51	-11.49	-28.49	-16.49	-26.49	10.00	4	0.020	03/19/07	03/19/07	35.67
MW-70-PMW01B	02/27/07	2224163.30	6005952.70	57.00	41.90	57.00	45.00	55.00	8.21	8.49	-33.41	-48.51	-36.51	-46.51	10.00	4	0.020	03/19/07	03/19/07	55.08
MW-70-27	07/03/01	2224170.00	6005991.20	36.00	23.00	36.00	25.50	35.50	8.25	8.80	-14.20	-27.20	-16.70	-26.70	10.00	4	0.010	08/21/01	07/09/01	35.90
MW-70-28	07/03/01	2224165.50	6005991.20	62.00	45.00	62.00	50.30	60.30	8.30	8.65	-36.35	-53.35	-41.65	-51.65	10.00	4	0.010	08/21/01	07/09/01	60.70
MW-70-MNA01	02/21/07	2224281.90	6006003.20	57.00	38.00	57.00	40.00	50.00	8.36	8.76	-29.24	-48.24	-31.24	-41.24	10.00	4	0.020	03/15/07	03/15/07	50.42
MW-70-MNA02	02/13/07	2224020.70	6006052.90	47.00	33.00	46.00	35.00	45.00	8.51	8.78	-24.22	-37.22	-26.22	-36.22	10.00	4	0.020	03/06/07	03/06/07	45.58
MW-70-MNA03	02/26/07	2224096.50	6006104.80	47.00	31.00	47.00	35.00	45.00	9.18	9.47	-21.53	-37.53	-25.53	-35.53	10.00	4	0.020	03/06/07	03/06/07	45.42
MW-70-MNA04	02/14/07	2224052.60	6005800.60	47.00	32.00	46.00	35.00	45.00	8.39	8.65	-23.35	-37.35	-26.35	-36.35	10.00	4	0.020	03/05/07	03/05/07	45.66
Source Area Biobarrier/First Sand																				
MW-70-PMW02A	02/15/07	2223909.80	6005902.30	82.00	67.84	82.00	70.50	80.50	8.35	8.56	-59.28	-73.44	-61.94	-71.94	10.00	4	0.020	03/01/07	03/01/07	81.33
MW-70-PMW02B	02/21/07	2223912.10	6005905.70	102.00	86.75	102.00	90.00	100.00	8.38	8.57	-78.18	-93.43	-81.43	-91.43	10.00	4	0.020	03/05/07	03/05/07	100.25
IW-70-SAB06 (Screen 1)	02/06/07	2223875.40	6005927.30	117.00	60.00	106.00	65.00	80.00	8.07	8.25	-51.75	-97.75	-56.75	-71.75	15.00	4	0.020	02/27/07	02/27/07	106.08
(Screen 2)	02/06/07	2223875.40	6005927.30	117.00			85.00	105.00	8.07	8.25	8.25	8.25	-76.75	-96.75	20.00	4	0.020	02/27/07	02/27/07	106.08
MW-70-MNA05	01/25/07	2224052.70	6005796.70	87.00	67.00	82.00	70.00	80.00	8.46	8.67	-58.33	-73.33	-61.33	-71.33	10.00	4	0.020	02/07/07	02/07/07	81.45
MW-70-PMW03A	02/20/07	2223867.80	6005930.10	82.00	66.00	82.00	70.00	80.00	7.94	8.21	-57.79	-73.79	-61.79	-71.79	10.00	4	0.020	03/01/07	03/01/07	80.75
MW-70-PMW03B	02/21/07	2223870.30	6005933.40	102.00	87.00	102.00	90.00	100.00	7.88	8.21	-78.79	-93.79	-81.79	-91.79	10.00	4	0.020	02/28/07	02/28/07	100.91
First Sand Biobarrier 1																				
MW-70-38	09/17/03	2223522.20	6006119.80	101.50	75.00	101.50	80.00	100.00	6.85	4.37	-70.63	-97.13	-75.63	-95.63	20.00	4	0.010	09/24/03	09/16/03	102.98
IW-70-FSB118	05/03/07	2223552.40	6006128.70	107.00	55.00	107.00	60.00	105.00	4.42	4.60	-50.40	-102.40	-55.40	-100.40	45.00	4	0.020	05/15/07	05/15/07	105.45
MW-70-PMW06A	05/09/07	2223556.00	6006088.30	82.00	65.25	80.00	69.50	79.50	4.14	4.60	-60.65	-75.40	-64.90	-74.90	10.00	4	0.020	05/21/07	05/21/07	79.70
MW-70-PMW06B	05/10/07	2223550.60	6006086.30	102.00	85.00	102.00	91.00	101.00	4.16	4.60	-80.40	-97.40	-86.40	-96.40	10.00	4	0.020	05/14/07	05/14/07	101.30
MW-70-PMW04A	05/07/07	2223422.50	6005948.00	92.00	65.00	82.00	70.00	80.00	4.52	5.00	-60.00	-77.00	-65.00	-75.00	10.00	4	0.020	05/21/07	05/21/07	80.10
MW-70-PMW04B	05/08/07	2223422.40	6005942.80	102.00	85.00	99.00	90.00	100.00	4.53	5.00	-80.00	-94.00	-85.00	-95.00	10.00	4	0.020	05/22/07	05/22/07	100.59
IW-70-FSB108	04/17/07	2223375.30	6005955.70	107.00	56.00	107.00	60.00	105.00	4.64	4.90	-51.10	-102.10	-55.10	-100.10	45.00	4	0.020	05/01/07	05/01/07	106.35
MW-70-PMW05A	07/24/07	2223356.40	6005957.40	82.00	64.00	82.00	70.00	80.00	4.21	4.60	-59.40	-77.40	-65.40	-75.40	10.00	4	0.020	08/07/07	08/07/07	80.30
MW-70-PMW05B	05/15/07	2223355.70	6005965.60	102.00	87.00	102.00	90.00	100.00	4.34	4.90	-82.10	-97.10	-85.10	-95.10	10.00	4	0.020	05/23/07	05/23/07	100.35
RDO-5	08/16/05	2223283.80	6005966.40	107.00	61.00	107.00	65.00	105.00	6.01	4.00	-57.00	-103.00	-61.00	-101.00	40.00	4	0.020	08/19/05	08/19/05	103.39
MW-70-MNA08	03/29/07	2223428.50	6006211.90	92.00	75.00	92.00	80.00	90.00	7.66	8.00	-67.00	-84.00	-72.00	-82.00	10.00	4	0.020	04/19/07	04/19/07	90.10
MW-70-MNA06	05/03/07	2223223.90	6005822.00	92.00	74.50	91.00	80.00	90.00	3.95	4.30	-70.20	-86.70	-75.70	-85.70	10.00	4	0.020	05/08/07	05/08/07	92.00
MW-70-MNA11	03/28/07	2223538.80	6006673.90	94.00	75.00	94.00	80.00	90.00	8.30	8.80	-66.20	-85.20	-71.20	-81.20	10.00	4	0.020	04/18/07	04/18/07	89.90
MW-70-MNA07	05/10/07	2223353.50	6006032.70	102.00	86.00	102.00	90.00	100.00	4.63	5.00	-81.00	-97.00	-85.00	-95.00	10.00	4	0.020	05/17/07	05/17/07	99.70
First Sand Biobarrier 2																				
MW-70-PMW07A	03/22/07	2223191.90	6006440.40	77.00	61.00	77.00	65.00	75.00	7.89	8.10	-52.90	-68.90	-56.90	-66.90	10.00	4	0.020	04/04/07	04/04/07	75.40
MW-70-PMW07B	03/27/07	2223194.30	6006445.20	97.00	80.00	97.00	85.00	95.00	7.52	8.00	-72.00	-89.00	-77.00	-87.00	10.00	4	0.020	04/04/07	04/04/07	95.60
IW-70-FSB216	03/06/07	2223174.70	6006453.10	102.00	61.00	102.00	65.00	100.00	8.34	8.60	-52.40	-93.40	-56.40	-91.40	35.00	4	0.020	04/09/07	04/05/07	99.70
MW-70-PMW08A	03/28/07	2223146.80	6006447.80	77.00	60.00	77.00	65.00	75.00	9.04	9.20	-50.80	-67.80	-55.80	-65.80	10.00	4	0.020	04/05/07	04/05/07	75.50
MW-70-PMW08B	03/28/07	2223144.40	6006442.70	97.00	80.00	97.00	85.00	95.00	9.08	9.20	-70.80	-87.80	-75.80	-85.80	10.00	4	0.020	04/09/07	04/05/07	95.50
MW-70-MNA09	03/05/07	2222951.70	6006103.60	87.00	60.00	76.00	64.25	74.25	6.82	7.10	-52.90	-68.90	-57.15	-67.15	10.00	4	0.020	04/18/07	04/18/07	73.80
MW-70-MNA10	03/27/07	2223077.90	6006534.00	87.00	71.50	87.00	74.50	84.50	7.01	7.40	-64.10	-79.60	-67.10	-77.10	10.00	4	0.020	05/18/07	05/18/07	84.40
MW-70-MNA12	03/29/07	2222706.20	6006650.50	87.00	70.00	87.00	75.00	85.00	5.85	6.10	-63.90	-80.90	-68.90	-78.90	10.00	4	0.020	04/18/07	04/18/07	85.30
Shell Horizon Biobarrier 1																				
MW-70-PMW09	07/02/07	2223253.90	6006226.30	132.00	117.00	132.00	120.00	130.00	6.82	7.00	-110.00	-125.00	-113.00	-123.00	10.00	4	0.020	07/10/07	07/10/07	130.59
IW-70-SHB113	05/29/07	2223226.40	6006218.10	132.00	100.00	132.00	105.00	130.00	7.49	7.60	-92.40	-124.40	-97.40	-122.40	25.00	4	0.020	06/27/07	06/27/07	130.80
MW-70-PMW10	07/03/07	2223215.80	6006247.20	132.00	116.00	132.00	120.00	130.00	6.60	7.00	-109.00	-125.00	-113.00	-123.00	10.00	4	0.020	07/09/07	07/09/07	130.70
IW-70-SHB217	05/24/07	2222624.90	6006709.50	137.00	100.00	137.00	105.00	130.00	8.67	8.70	-91.30	-128.30	-96.30	-121.30	25.00	4	0.020	07/12/07	07/12/07	130.50
MW-70-MNA13	07/17/07	2222951.30	6006096.90	128.00	113.00	128.00	115.00	125.00	6.64	6.90	-106.10	-121.10	-108.10	-118.10	10.00	4	0.020	07/30/07	07/30/07	120.15

Table 2 (continued)

	Well Installation			Construction Depths (feet bgs)					Construction Elevations (feet MSL, NGVD29)						Screen Dimensions			Well Maintenance		
		Coordinates (feet NAD83)			Filter Pack		Screen Interval				Filter Pack		Screen Interval						Well Depth	
Well Number	Date Installed	Northing	Easting	Borehole Depth	Top	Bottom	Top	Bottom	TOC	Ground Surface	Top	Bottom	Top	Bottom	Length (feet)	Diameter (inches)	Slot Size (inches)	Date Last Developed	Date Measured	Measurement (feet below TOC)
Shell Horizon Biobarrier 3																				
MW-70-PMW11A	08/14/07	2222552.20	6007015.00	97.00	81.00	95.00	85.00	95.00	8.13	8.40	-72.60	-86.60	-76.60	-86.60	10.00	4	0.020	09/07/07	09/07/07	95.95
MW-70-PMW11B	08/23/07	2222545.80	6007013.60	127.00	110.00	127.00	115.00	125.00	7.95	8.30	-101.70	-118.70	-106.70	-116.70	10.00	4	0.020	09/06/07	09/06/07	125.30
IW-70-SHB310 (Screen 1)	07/31/07	2222448.00	6006980.50	137.00	77.00	96.00	80.00	95.00	8.73	9.11	-67.89	-86.89	-70.89	-85.89	15.00	4	0.020	08/27/07	08/27/07	130.70
(Screen 2)	07/31/07	2222448.00	6006980.50	137.00	103.00	130.00	105.00	130.00	8.73	9.11	-93.89	-120.89	-95.89	-120.89	25.00	4	0.020	08/27/07	08/27/07	130.70
MW-70-PMW12A	08/14/07	2222526.80	6007058.10	97.00	79.00	97.00	85.00	95.00	7.86	8.20	-70.80	-88.80	-76.80	-86.80	10.00	4	0.020	09/05/07	09/05/07	94.90
MW-70-PMW12B	08/10/07	2222518.10	6007051.40	127.00	110.00	127.00	115.00	125.00	8.09	8.30	-101.70	-118.70	-106.70	-116.70	10.00	4	0.020	08/22/07	08/21/07	125.50
MW-70-MNA14	07/13/07	2222157.30	6007254.70	130.00	110.00	130.00	115.00	125.00	8.86	9.20	-100.80	-120.80	-105.80	-115.80	10.00	4	0.020	07/30/07	07/30/07	125.70
Second Sand Biobarrier 1																				
MW-70-PMW13A	08/20/07	2222293.80	6007163.20	137.00	119.00	137.00	125.00	135.00	7.47	4.60	-114.40	-132.40	-120.40	-130.40	10.00	4	0.020	09/06/07	09/06/07	135.60
MW-70-PMW13B	08/16/07	2222303.10	6007169.20	157.00	139.00	157.00	145.00	155.00	7.48	4.70	-134.30	-152.30	-140.30	-150.30	10.00	4	0.020	09/05/07	09/05/07	155.15
IW-70-SSB109	08/23/07	2222230.90	6007162.80	167.00	120.00	167.00	125.75	165.75	7.96	8.10	-111.90	-158.90	-117.65	-157.65	40.00	4	0.020	08/20/07	08/20/07	165.81
MW-70-PMW14A	08/22/07	2222253.70	6007203.50	140.00	123.00	140.00	128.00	138.00	7.64	8.00	-115.00	-132.00	-120.00	-130.00	10.00	4	0.020	09/05/07	09/05/07	139.35
MW-70-PMW14B	08/23/07	2222270.90	6007216.30	160.00	138.00	160.00	149.00	159.00	7.92	8.20	-129.80	-151.80	-140.80	-150.80	10.00	4	0.020	09/04/07	09/04/07	159.15
MW-70-MNA16	07/09/07	2222145.30	6007245.60	155.00	135.50	155.00	140.50	150.50	8.65	9.22	-126.28	-145.78	-131.28	-141.28	10.00	4	0.020	07/26/07	07/26/07	150.60
MW-70-MNA17	06/06/07	2222026.20	6007015.40	167.00	135.00	152.00	140.00	150.00	6.80	7.00	-128.00	-145.00	-133.00	-143.00	10.00	4	0.020	06/19/07	06/18/07	140.35
MW-70-MNA15	06/05/07	2222721.20	6006633.90	160.00	136.00	151.00	140.00	150.00	5.96	6.00	-130.00	-145.00	-134.00	-144.00	10.00	4	0.020	06/18/07	06/18/07	151.10
MW-70-15	03/23/98	2221994.30	6008038.90	175.00	155.00	175.00	160.80	170.30	9.41	7.14	-147.86	-167.86	-153.66	-163.16	9.50	5	0.010	03/30/98	04/08/98	172.82
Point of Compliance/Upper Fines																				
MW-70-02	07/21/97	2224602.60	6005708.20	32.00	17.00	32.00	20.00	30.00	7.85	5.90	-11.10	-26.10	-14.10	-24.10	10.00	4	0.010	08/04/97	07/21/97	33.95
MW-70-10	04/13/00	2223724.30	6007203.10	41.50	27.00	41.50	30.10	40.10	10.10	8.37	-18.63	-33.13	-21.73	-31.73	10.00	4	0.010	04/24/00	04/24/00	42.28
MW-70-17	04/14/00	2222804.90	6005569.00	41.50	27.00	41.50	30.00	40.00	4.58	2.85	-24.15	-38.65	-27.15	-37.15	10.00	4	0.010	05/01/00	05/01/00	42.10
MW-70-22	04/17/00	2221971.60	6007067.40	32.00	17.00	32.00	20.00	30.00	10.21	8.67	-8.33	-23.33	-11.33	-21.33	10.00	4	0.010	05/03/00	05/03/00	32.09
Point of Compliance/First Sand																				
MW-70-POC01	09/21/07	2224584.60	6005713.40	96.00	77.00	96.00	80.00	90.00	8.88	6.41	-70.59	-89.59	-73.59	-83.59	10.00	4	0.020	10/02/07	10/02/07	93.50
MW-70-11	04/21/00	2223726.20	6007217.50	102.00	67.80	102.00	80.00	100.00	11.07	8.56	-59.24	-93.44	-71.44	-91.44	20.00	5	0.010	04/24/00	04/24/00	101.70
MW-70-35	03/01/02	2222536.90	6005190.60	103.00	84.00	103.00	90.00	100.00	6.31	3.67	-80.33	-99.33	-86.33	-96.33	10.00	4	0.010	03/04/02	05/02/02	103.50
MW-70-16	03/26/98	2222003.60	6008020.10	110.00	89.50	110.00	94.70	104.70	9.76	7.19	-82.31	-102.81	-87.51	-97.51	10.00	5	0.010	04/01/98	04/09/98	107.22
Point of Compliance/Shell Horizon																				
MW-70-23	04/18/00	2223145.60	6008894.60	132.00	103.90	132.00	110.00	130.00	11.17	8.46	-95.44	-123.54	-101.54	-121.54	20.00	5	0.010	04/21/00	04/21/00	132.00
Point of Compliance/Second Sand																				
MW-70-36	03/04/02	2221672.00	6006269.80	170.00	143.00	170.00	150.00	160.00	9.04	6.71	-136.29	-163.29	-143.29	-153.29	10.00	4	0.010	03/08/02	05/23/02	163.23
MW-70-21	04/25/00	2221200.70	6008513.60	172.00	143.00	172.00	150.00	170.00	7.70	5.33	-137.67	-166.67	-144.67	-164.67	20.00	5	0.010	04/27/00	04/27/00	170.20
Point of Compliance/Deep Sand																				
MW-70-POC02	09/19/07	2223170.00	6008885.30	240.00	186.00	202.00	190.00	200.00	8.25	8.68	-177.32	-193.32	-181.32	-191.32	10.00	4	0.020	10/03/07	10/03/07	200.50
MW-70-POC03	09/11/07	2221664.30	6006260.90	205.00	187.00	205.00	190.00	200.00	9.64	7.19	-179.81	-197.81	-182.81	-192.81	10.00	4	0.020	10/03/07	10/03/07	203.30
MW-70-POC04	10/18/07	2221192.20	6008511.20	210.00	191.00	210.00	195.00	205.00	8.50	5.87	-185.13	-204.13	-189.13	-199.13	10.00	4	0.020	10/07/08	10/07/08	208.48

Acronyms/Abbreviations:
bgs - below ground surface
MSL - mean sea level
NA - not available
NAD83 - North American Datum of 1983
NGVD29 - National Geodetic Vertical Datum of 1929
TOC - top of casing

Table 3
Groundwater Level Data

Well Number	Screen Interval (feet bgs)[a]	TOC Elevation (feet above MSL)	8/18/08		
			Time	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)
Upper Fines					
MW-70-PMW01A	25-35	8.23	18:20	20.31	-12.08
MW-70-PMW01B	45-55	8.21	18:21	22.02	-13.81
MW-70-27[b]	26-36	8.25	NA	21.70	-13.45
MW-70-28[b]	50-60	8.30	NA	22.13	-13.83
MW-70-MNA01	40-50	8.36	18:25	22.48	-14.12
MW-70-MNA02	35-45	8.51	18:11	22.23	-13.72
MW-70-MNA03	35-45	9.18	18:08	20.90	-11.72
MW-70-MNA04	35-45	8.39	18:01	20.52	-12.13
Source Area Biobarrier/First Sand					
MW-70-PMW02A	71-81	8.35	17:48	23.06	-14.71
MW-70-PMW02B	90-100	8.38	17:49	23.11	-14.73
IW-70-SAB06	65-80/85-105	8.07	17:53	22.81	-14.74
MW-70-MNA05	70-80	8.46	18:03	22.90	-14.44
MW-70-PMW03A	70-80	7.94	17:54	22.72	-14.78
MW-70-PMW03B	90-100	7.88	17:55	22.69	-14.81
First Sand Biobarrier 1					
MW-70-38	80-100	6.85	17:26	22.20	-15.35
IW-70-FSB118	60-105	4.42	17:31	19.71	-15.29
MW-70-PMW06A	70-80	4.14	17:38	19.42	-15.28
MW-70-PMW06B	91-101	4.16	17:36	19.50	-15.34
MW-70-PMW04A	70-80	4.52	17:14	19.90	-15.38
MW-70-PMW04B	90-100	4.53	17:17	19.05	-14.52
IW-70-FSB108	60-105	4.64	17:09	20.02	-15.38
MW-70-PMW05A	70-80	4.21	17:06	19.65	-15.44
MW-70-PMW05B	90-100	4.34	17:07	19.80	-15.46
RDO-5	65-105	6.01	17:00	21.55	-15.54
MW-70-MNA08	80-90	7.66	16:15	23.27	-15.61
MW-70-MNA06	80-90	3.95	16:53	19.48	-15.53
MW-70-MNA11	80-90	8.30	16:10	24.55	-16.25
MW-70-MNA07	90-100	4.63	17:20	20.18	-15.55
First Sand Biobarrier 2					
MW-70-PMW07A	65-75	7.89	16:02	24.43	-16.54
MW-70-PMW07B	85-95	7.52	16:05	26.44	-18.92
IW-70-FSB216	65-100	8.34	15:56	26.89	-18.55
MW-70-PMW08A	65-75	9.04	16:36	26.77	-17.73
MW-70-PMW08B	85-95	9.08	16:35	28.26	-19.18
MW-70-MNA09	64-74	6.82	15:17	23.30	-16.48
MW-70-MNA10	75-85	7.01	15:07	26.67	-19.66
MW-70-MNA12	75-85	5.85	14:51	26.22	-20.37
Shell Horizon Biobarrier 1					
MW-70-PMW09	120-130	6.82	15:30	26.61	-19.79
IW-70-SHB113	105-130	7.49	15:46	24.20	-16.71
MW-70-PMW10	120-130	6.60	15:29	26.46	-19.86
IW-70-SHB217	105-130	8.67	14:37	29.97	-21.30
MW-70-MNA13	115-125	6.64	15:20	26.42	-19.78

Table 3 (continued)

Well Number	Screen Interval (feet bgs)[a]	TOC Elevation (feet above MSL)	8/18/08		
			Time	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)
Shell Horizon Biobarrier 3					
MW-70-PMW11A	85-95	8.13	14:08	28.81	-20.68
MW-70-PMW11B	115-125	7.95	14:07	28.51	-20.56
IW-70-SHB310	80-95/105-130	8.73	14:17	29.37	-20.64
MW-70-PMW12A	85-95	7.86	14:01	28.54	-20.68
MW-70-PMW12B	115-125	8.09	14:03	28.65	-20.56
MW-70-MNA14	115-125	8.86	11:09	30.02	-21.16
Second Sand Biobarrier 1					
MW-70-PMW13A	125-135	7.47	13:41	27.37	-19.90
MW-70-PMW13B	145-155	7.48	13:42	27.44	-19.96
IW-70-SSB109	126-166	7.96	13:40	28.82	-20.86
MW-70-PMW14A	128-138	7.64	12:02	27.62	-19.98
MW-70-PMW14B	149-159	7.92	11:50	28.13	-20.21
MW-70-MNA16	141-151	8.65	11:04	29.79	-21.14
MW-70-MNA17	140-150	6.80	11:38	28.24	-21.44
MW-70-MNA15	140-150	5.96	14:49	26.23	-20.27
MW-70-15	161-171	9.41	10:28	31.48	-22.07
Point of Compliance/Upper Fines					
MW-70-02	20-30	7.85	9:51	18.88	-11.03
MW-70-10	30-40	10.10	14:59	19.33	-9.23
MW-70-17	30-40	4.58	16:47	15.00	-10.42
MW-70-22	20-30	10.21	11:30	12.51	-2.30
Point of Compliance/First Sand					
MW-70-POC01	80-90	8.88	9:55	22.92	-14.04
MW-70-11	80-100	11.07	14:57	28.67	-17.60
MW-70-35	90-100	6.31	16:42	25.53	-19.22
MW-70-16	95-105	9.76	10:23	31.49	-21.73
Point of Compliance/Shell Horizon					
MW-70-23	110-130	11.17	13:54	33.63	-22.46
Point of Compliance/Second Sand					
MW-70-36	150-160	9.04	14:31	29.85	-20.81
MW-70-21	150-170	7.70	10:07	32.52	-24.82
Point of Compliance/Deep Sand					
MW-70-POC02	190-200	8.25	13:53	35.21	-26.96
MW-70-POC03	190-200	9.64	14:10	30.00	-20.36
MW-70-POC04	195-205	8.50	10:06	32.35	-23.85

Notes:

[a] screen interval is rounded to the nearest foot

[b] groundwater levels for wells MW-70-27 and -28 were measured on 8/21/08 since the wells were not accessible during the 8/18/08 measurement event

Acronyms/Abbreviations:

bgs - below ground surface
MSL - mean sea level
NA - not available; the time was not recorded in the field water-level records
TOC - top of casing

Table 4
Field Parameter Data

Well ID	Date	Time	Temperature (°C)	Conductivity (µS/cm)	DO (mg/L)	pH	ORP (mV)	Turbidity (NTU)
Upper Fines								
MW-70-PMW01A	8/20/08	11:45	22.7	6010	0.00	6.56	111	0.9
MW-70-PMW01B	8/20/08	10:10	22.8	3250	0.00	7.34	87	15.6
MW-70-27	8/21/08	13:55	23.6	1700	0.00	6.75	67	723.0
MW-70-28	8/21/08	14:20	22.6	3490	0.00	7.02	-104	101.0
MW-70-MNA01	8/20/08	12:45	22.7	7190	0.00	6.99	-21	2.4
MW-70-MNA02	8/20/08	14:00	21.5	6880	0.00	7.02	-87	12.2
MW-70-MNA03	8/25/08	10:15	21.8	3670	0.00	6.77	-167	0.0
MW-70-MNA04	8/25/08	10:30	24.1	5230	0.00	7.05	-16	6.2
Source Area Biobarrier/First Sand								
MW-70-PMW02A	8/21/08	9:05	23.1	1370	0.00	7.50	-199	4.3
MW-70-PMW02B	8/21/08	11:35	23.0	1480	0.00	7.51	-171	7.8
IW-70-SAB06	8/25/08	12:10	25.8	930	0.00	7.03	-85	0.0
MW-70-MNA05	8/25/08	11:20	24.2	1200	0.00	7.14	-151	0.7
MW-70-PMW03A	8/21/08	10:45	24.0	1300	0.00	7.34	-184	0.0
MW-70-PMW03B	8/21/08	12:40	24.6	1380	0.00	7.09	-170	0.0
First Sand Biobarrier 1								
MW-70-38	8/25/08	12:55	21.9	2340	0.00	7.55	-21	9.5
IW-70-FSB118	8/26/08	10:20	22.0	2450	0.00	7.02	-145	0.6
MW-70-PMW04A	8/22/08	9:10	22.0	1050	0.00	7.63	-160	0.0
MW-70-PMW04B	8/22/08	10:15	22.2	1450	0.86	7.52	-118	2.3
MW-70-PMW06A	8/22/08	11:25	22.7	2000	0.00	7.11	-106	0.0
MW-70-PMW06B	8/22/08	8:45	22.0	1430	0.00	7.38	-138	0.0
IW-70-FSB108	8/25/08	13:35	22.4	1200	0.00	7.14	-151	0.0
MW-70-PMW05A	8/22/08	11:45	22.3	1060	0.00	7.63	-176	0.0
MW-70-PMW05B	8/22/08	12:55	22.3	1000	0.00	7.37	27	0.8
RDO-5	8/25/08	14:20	22.2	990	0.00	7.33	-81	0.0
MW-70-MNA06	8/26/08	12:15	22.0	6430	0.00	6.87	-58	0.0
MW-70-MNA07	8/22/08	12:25	22.4	1030	0.00	7.15	-143	0.0
MW-70-MNA08	8/27/08	9:30	22.2	2280	0.00	7.12	-148	0.2
MW-70-MNA11	8/28/08	7:45	21.1	6300	0.00	6.89	-136	0.6
First Sand Biobarrier 2								
MW-70-PMW07A	8/28/08	8:25	21.3	29500	0.00	6.57	-69	0.4
MW-70-PMW07B	8/28/08	10:00	21.2	10000	0.00	6.86	-114	0.0
IW-70-FSB216	8/27/08	14:25	22.5	11300	0.00	6.80	-89	0.5
MW-70-PMW08A	8/29/08	9:00	21.7	2360	0.00	6.27	-110	NA
MW-70-PMW08B	8/29/08	9:55	22.4	8930	0.00	6.52	-133	NA
MW-70-MNA09	8/27/08	12:10	22.1	2360	0.00	6.28	-105	6.0
MW-70-MNA10	8/29/08	11:05	22.2	5330	0.01	6.62	-158	11.8
MW-70-MNA12	9/4/08	11:45	21.7	8870	0.06	6.67	-135	62.9
Shell Horizon Biobarrier 1								
MW-70-PMW09	8/27/08	10:40	23.3	2420	0.00	7.68	-202	1.3
IW-70-SHB113	8/27/08	13:35	22.5	3790	0.00	7.28	-107	0.0
MW-70-PMW10	8/27/08	11:45	22.8	2300	0.00	7.47	-153	1.1
IW-70-SHB217	8/29/08	10:50	23.1	12700	0.00	6.78	-170	4.1
MW-70-MNA13	8/27/08	11:30	22.2	4860	0.00	6.91	-196	1.6

Table 4 (continued)

Well ID	Date	Time	Temperature (°C)	Conductivity (µS/cm)	DO (mg/L)	pH	ORP (mV)	Turbidity (NTU)
Shell Horizon Biobarrier 3								
MW-70-PMW11A	8/29/08	9:00	22.8	31000	0.00	6.92	-158	0.4
MW-70-PMW11B	8/29/08	9:40	22.7	7700	0.00	6.94	-170	0.0
IW-70-SHB310	8/28/08	12:05	22.9	6500	0.00	6.62	-145	3.8
MW-70-PMW12A	9/2/08	9:45	22.6	9520	0.00	7.36	-127	0.0
MW-70-PMW12B	9/2/08	9:45	22.7	4900	0.02	6.63	-154	0.7
MW-70-MNA14	9/4/08	10:40	22.6	3330	0.03	6.89	-170	1.5
Second Sand Biobarrier 1								
MW-70-PMW13A	9/3/08	9:00	21.1	6110	0.00	6.82	-254	3.8
MW-70-PMW13B	9/3/08	9:45	21.2	1160	0.00	6.73	-207	1.3
IW-70-SSB109	8/28/08	8:20	21.2	1630	0.00	6.61	-169	2.3
MW-70-PMW14A	9/3/08	10:00	21.8	18100	0.00	6.93	-153	0.0
MW-70-PMW14B	9/3/08	9:05	22.2	38900	0.00	6.92	-136	0.0
MW-70-MNA15	9/4/08	12:50	22.1	16400	0.00	6.83	-164	65.0
MW-70-MNA16	8/29/08	13:15	22.3	7600	0.00	6.65	-134	3.7
MW-70-MNA17	8/29/08	13:20	22.1	28800	0.00	6.76	-108	0.0
MW-70-15	9/2/08	14:15	21.4	24900	0.00	6.90	-87	0.0
Point of Compliance/Upper Fines								
MW-70-02	9/3/08	14:15	23.1	7960	0.00	6.32	111	0.0
MW-70-10	8/28/08	10:05	21.4	5530	0.00	6.54	-12	12.1
MW-70-17	8/27/08	9:55	21.5	8910	0.00	6.30	89	0.8
MW-70-22	9/3/08	13:00	21.6	53500	0.00	6.65	7	0.0
Point of Compliance/First Sand								
MW-70-POC01	9/4/08	9:05	22.5	2970	0.00	7.23	-129	0.0
MW-70-11	9/3/08	13:20	22.0	2260	0.00	6.75	-128	NA
MW-70-35	8/27/08	13:10	22.0	990	0.00	6.55	-94	0.6
MW-70-16	9/2/08	13:40	21.4	3960	3.83	6.84	64	NA
Point of Compliance/Shell Horizon								
MW-70-23	8/28/08	12:30	20.7	3220	0.00	7.19	-97	0.0
Point of Compliance/Second Sand								
MW-70-21	9/3/08	12:15	21.1	2550	0.00	6.46	-100	1.5
MW-70-36	9/2/08	11:15	21.8	1630	0.00	6.69	-140	NA
Point of Compliance/Deep Sand								
MW-70-POC02	9/4/08	9:25	21.7	1030	0.00	7.15	-171	8.4
MW-70-POC03	9/2/08	11:10	21.4	13700	0.00	7.34	-127	0.0
MW-70-POC04	10/14/08	10:20	20.7	37200	0.20	7.32	-195	4.7

Abbreviations:

°C – degrees Celsius

mS/cm – microsiemens per centimeter

mg/L – milligrams per liter

mV – millivolt

NA - not analyzed

NTU – nephelometric turbidity unit

Table 5
Target Cleanup Goals

Constituent of Concern	Exposure Rate	Receptor(s)	Target Cleanup Goal (ug/l)
Chloroform	Ingestion	Future residential groundwater users	100
1,1-Dichloroethene	Ingestion	Future residential groundwater users	6
cis-1,2-Dichloroethene	Ingestion	Future residential groundwater users	6
trans-1,2-Dichloroethene	Ingestion	Future residential groundwater users	10
Trichloroethene	Ingestion	Future residential groundwater users	5
Vinyl Chloride	Ingestion	Future residential groundwater users	0.5

Source: ECC/Geosyntec (2008) – RAWP. Target Cleanup Goals (TCGs) are based on ARARs. Reevaluation of the TCGs may be required at a future date, per trends in remedial performance.

Table 6
Upper Fines Analytical Results

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL								
			MW-70-27 8/21/2008 (26-36)	MW-70-28 8/21/2008 (50-60)	MW-70-MNA01 8/20/2008 (40-50)	MW-70-MNA01 (D) 8/20/2008 (40-50)	MW-70-MNA02 8/20/2008 (35-45)	MW-70-MNA03 8/25/2008 (35-45)	MW-70-MNA04 8/25/2008 (35-45)	MW-70-PMW01A 8/20/2008 (25-35)	MW-70-PMW01B 8/20/2008 (45-55)
Wet Chemistry											
TOTAL ALKALINITY	2320B	MG/L	720	348	NA	NA	NA	NA	NA	650	320
TDS	2540C	MG/L	11,000 J	3,300 J	NA	NA	NA	NA	NA	5,150	2,420
BROMIDE	300	MG/L	0.500 U	2.04	NA	NA	NA	NA	NA	2.19	1.14
CHLORIDE-CL	300	MG/L	2,390	811	NA	NA	NA	NA	NA	20.0 U	10.0 U
NITRATE-N	300	MG/L	0.200 U	0.396	NA	NA	NA	NA	NA	0.200 U	5.44
NITRITE-N	300	MG/L	1.00 U	0.200 U	NA	NA	NA	NA	NA	0.200 U	0.200 U
SULFATE	300	MG/L	4,540	774	NA	NA	NA	NA	NA	1,840	746
ACETATE	300.0M	MG/L	0.548 J	0.550 J	NA	NA	NA	NA	NA	1.00 U	1.00 U
BUTYRATE	300.0M	MG/L	1.00 U	1.00 U	NA	NA	NA	NA	NA	1.00 U	1.00 U
LACTATE	300.0M	MG/L	1.00 U	1.00 U	NA	NA	NA	NA	NA	1.00 U	1.00 U
PROPIONATE	300.0M	MG/L	1.00 U	1.00 U	NA	NA	NA	NA	NA	1.00 U	1.00 U
HYDROGEN SULFIDE	4500F	MG/L	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOC	5310B	MG/L	4.1	2.08 U	NA	NA	NA	NA	NA	2.72 U	1.60 U
Dissolved Metals											
ARSENIC	6010B	MG/L	NA	NA	NA	NA	NA	NA	NA	NA	NA
IRON	6010B	MG/L	NA	NA	NA	NA	NA	NA	NA	NA	NA
MANGANESE	6010B	MG/L	NA	NA	NA	NA	NA	NA	NA	NA	NA
VOCs											
1,1,1,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 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-TRICHLOROETHANE	8260B	UG/L	2.7	0.48 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.5
1,1,2,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-TRICHLOROETHANE	8260B	UG/L	0.62 J	0.43 J	1.0 U	1.0 U	0.47 J	1.0 U	1.0 U	1.2	1.0 U
1,1-DICHLOROETHANE	8260B	UG/L	**9.3**	2.7	1.0 U	1.0 U	**24**	**40**	5	**10**	1.0 U
1,1-DICHLOROETHENE	8260B	UG/L	**13**	**6.2**	1.3	1.3	0.68	0.50 U	1.9	**16**	**6.6**
1,1-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DIBROMO-3-CHLOROPROPANE	8260B	UG/L	2.0 UJ	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-DIBROMOETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROETHANE	8260B	UG/L	**1**	0.27 J	0.50 U	0.50 U	**1.8**	**8.5**	**0.75**	0.25 J	0.50 U
1,2-DICHLOROPROPANE	8260B	UG/L	0.47 J	1.0 U	1.0 U	1.0 U	1.6	3.5	0.34 J	1.0 U	1.0 U
1,3,5-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-BUTANONE	8260B	UG/L	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
2-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-HEXANONE	8260B	UG/L	10 UJ	10 UJ	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U
4-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-METHYL-2-PENTANONE	8260B	UG/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
ACETONE	8260B	UG/L	6.4 J	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	8.6 J	24 J
BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.46 J	1.0 U
BROMOBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMODICHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Table 6 (continued)

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL								
			MW-70-27 8/21/2008 (26-36)	MW-70-28 8/21/2008 (50-60)	MW-70-MNA01 8/20/2008 (40-50)	MW-70-MNA01 (D) 8/20/2008 (40-50)	MW-70-MNA02 8/20/2008 (35-45)	MW-70-MNA03 8/25/2008 (35-45)	MW-70-MNA04 8/25/2008 (35-45)	MW-70-PMW01A 8/20/2008 (25-35)	MW-70-PMW01B 8/20/2008 (45-55)
BROMOMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U
CARBON DISULFIDE	8260B	UG/L	0.61 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
CARBON TETRACHLORIDE	8260B	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
CHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CHLOROFORM	8260B	UG/L	39	3.9	5.5	6.1 U	0.52 J	1.0 U	0.68 J	8.5	6.5
CHLOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CIS-1,2-DICHLOROETHENE	8260B	UG/L	**4,600**	**530**	**38**	**40**	**31**	2.8	**270**	**1,300**	**33**
CIS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOCHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DICHLORODIFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U
ETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
FREON113	8260B	UG/L	41 J	35 J	0.59 J	0.60 J	2.9	1.0 UJ	7.5	21	130
HEXACHLOROBUTADIENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
ISOPROPYL BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
M/P-XYLENES	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
METHYLENE CHLORIDE	8260B	UG/L	1.2	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	UG/L	1.0 UJ	1.0 UJ	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
N-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
N-PROPYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
O-XYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
P-ISOPROPYLTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
SEC-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
STYRENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TERT-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TETRACHLOROETHYLENE	8260B	UG/L	**8**	4.7	1.0 U	1.0 U	0.21 J	0.39 J	2	**9.5**	3
TOLUENE	8260B	UG/L	0.28 J	0.20 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRANS-1,2-DICHLOROETHENE	8260B	UG/L	**35**	**13**	**27**	**28**	1.5	0.21 J	**17**	**44**	1.4
TRANS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRICHLOROETHENE	8260B	UG/L	**7,100**	**10,000**	**1,500**	**1,400**	**46**	1.3 J	**250**	**11,000**	**8,500**
TRICHLOROFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	0.25 J	2.0 U	2.0 U	0.26 J	2.0 U
VINYL CHLORIDE	8260B	UG/L	**32**	**18**	0.38 J	0.39 J	**7.1**	0.50 U	**1.8**	**25**	**0.51**
XYLENES (TOTAL)	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dehalococcoides (Dhc)/Vinyl Chloride Reductase (vcrA)											
DEHALOCOCCOIDES	qPCR	per Liter	ND[a]	700	NA	NA	NA	NA	NA	NA	NA
VINYL CHLORIDE REDUCTASE	qPCR	per Liter	NA	8,000[b]	NA	NA	NA	NA	NA	NA	NA
Dissolved Hydrocarbon Gases											
ETHANE	RSK175	UG/L	2.0 U	3.3	2.0 U	2.0 U	5.9	0.65 J	19	18	2.0 U
ETHENE	RSK175	UG/L	2.0 U	0.60 J	2.0 U	2.0 U	2.0 U	0.64 J	2.0 U	1.9 J	2.0 U
METHANE	RSK175	UG/L	26	75	31	30	87	70	190	450	2.4

Notes:

(D) = Duplicate Sample
J = estimated
ug/l = microgram per liter
mg/l = milligrams per liter
NA = Not Analyzed
U = not detected
(25-35) Well Screen Interval - feet below ground surface
Bolded parameters are constituents of concern (COCs) and bolded values are above target cleanup goals (TCGs) or federal/state primary maximum contaminant limits (MCLs).
[a] Not detected: Sample specific quantitation limit is 4000 per liter.
[b] Correction factor applied to correct for non-specific polymerase chain reaction (PCR) amplification products.

Table 7
Upper Fines POC Analytical Results

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL				
			MW-70-02 9/3/2008 (20-30)	MW-70-10 8/28/2008 (30-40)	MW-70-10 (D) 8/28/2008 (30-40)	MW-70-17 8/27/2008 (30-40)	MW-70-22 9/3/2008 (20-30)
Wet Chemistry							
TOTAL ALKALINITY	2320B	MG/L	560	270	273	323	170
TDS	2540C	MG/L	3,210	3,870	3,860	5,430	37,200
BROMIDE	300	MG/L	1.79	0.91	1.07	1.37	55.3
CHLORIDE-CL	300	MG/L	293	1,070	1,080	2,410	19,900
NITRATE-N	300	MG/L	9.63	0.200 U	0.200 U	0.200 U	1.00 U
NITRITE-N	300	MG/L	0.200 U	0.400 U	0.400 U	1.00 U	2.00 U
SULFATE	300	MG/L	1,190	973	972	707	2,610
ACETATE	300.0M	MG/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BUTYRATE	300.0M	MG/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
LACTATE	300.0M	MG/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
PROPIONATE	300.0M	MG/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
HYDROGEN SULFIDE	4500F	MG/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TOC	5310B	MG/L	4.12	1.9	1.85	2.61	1.45
Dissolved Metals							
ARSENIC	6010B	MG/L	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
IRON	6010B	MG/L	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
MANGANESE	6010B	MG/L	1.72	0.757	0.771	1.21	3.29
VOCs							
1,1,1,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-DICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-DICHLOROETHENE	8260B	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DIBROMO-3-CHLOROPROPANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-DIBROMOETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROETHANE	8260B	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U
2-BUTANONE	8260B	UG/L	10 U	10 UJ	10 UJ	10 UJ	10 U
2-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-HEXANONE	8260B	UG/L	10 U	10 U	10 U	10 U	10 U
4-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-METHYL-2-PENTANONE	8260B	UG/L	10 U	10 U	10 U	10 U	10 U
ACETONE	8260B	UG/L	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Table 7 (continued)

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL				
			MW-70-02 9/3/2008 (20-30)	MW-70-10 8/28/2008 (30-40)	MW-70-10 (D) 8/28/2008 (30-40)	MW-70-17 8/27/2008 (30-40)	MW-70-22 9/3/2008 (20-30)
BROMODICHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CARBON DISULFIDE	8260B	UG/L	1.0 U	1.0 UJ	1.0 UJ	1.0 U	1.0 U
CARBON TETRACHLORIDE	8260B	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
CHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CHLOROFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CIS-1,2-DICHLOROETHENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CIS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOCHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DICHLORODIFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U
ETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
FREON113	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U
HEXACHLOROBUTADIENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
ISOPROPYL BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
M/P-XYLENES	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
METHYLENE CHLORIDE	8260B	UG/L	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U
MTBE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
N-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
N-PROPYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
O-XYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
P-ISOPROPYLTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
SEC-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
STYRENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TERT-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TETRACHLOROETHYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRANS-1,2-DICHLOROETHENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRANS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRICHLOROETHENE	8260B	UG/L	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
TRICHLOROFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
VINYL CHLORIDE	8260B	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
XYLENES (TOTAL)	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dissolved Hydrocarbon Gases							
ETHANE	RSK175	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
ETHENE	RSK175	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
METHANE	RSK175	UG/L	2.0 U	1.7 J	2.0 J	6.8	2.1

Notes:

D = Duplicate Sample

J = estimated

ug/l = microgram per liter

mg/l = milligrams per liter

NA = Not Analyzed

POC = Point of Compliance Wells

U = not detected

Bolded parameters are constituents of concern (COCs) and bolded values are above target cleanup goals (TCGs) or federal/state primary maximum contaminant limits (MCLs).

(20-30) Well Screen Interval - feet below ground surface

Table 8
First Sand Source Area Biobarrier Analytical Results

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL						
			IW-70-SAB06 8/25/2008 (65-80/85-105)	MW-70-MNA05 8/25/2008 (70-80)	MW-70-PMW02A 8/21/2008 (71-81)	MW-70-PMW02A (D) 8/21/2008 (71-81)	MW-70-PMW02B 8/21/2008 (90-100)	MW-70-PMW03A 8/21/2008 (70-80)	MW-70-PMW03B 8/21/2008 (90-100)
Wet Chemistry									
TOTAL ALKALINITY	2320B	MG/L	203	NA	203	205	195	205	198
TDS	2540C	MG/L	995	NA	1,010 J	1,020 J	1,110 J	1,210 J	1,130 J
BROMIDE	300	MG/L	0.457 J	NA	0.532	0.529	0.598	0.519	0.526
CHLORIDE-CL	300	MG/L	178	NA	163	162	197	190	191
NITRATE-N	300	MG/L	0.200 U	NA	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
NITRITE-N	300	MG/L	0.200 U	NA	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
SULFATE	300	MG/L	303	NA	268	266	319	328	321
ACETATE	300.0M	MG/L	1.00 U	NA	1.00 U	1.00 U	0.738 J	0.563 J	0.533 J
BUTYRATE	300.0M	MG/L	1.00 U	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
LACTATE	300.0M	MG/L	1.00 U	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
PROPIONATE	300.0M	MG/L	1.00 U	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
HYDROGEN SULFIDE	4500F	MG/L	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TOC	5310B	MG/L	0.828 J	NA	0.967 U	0.894 U	1.04 U	0.865 U	1.17 U
Dissolved Metals									
ARSENIC	6010B	MG/L	NA	NA	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
IRON	6010B	MG/L	NA	NA	0.34	0.343	0.318	0.245	0.285
MANGANESE	6010B	MG/L	NA	NA	0.329	0.317	0.267	0.22	0.23
VOCs									
1,1,1,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-DICHLOROETHANE	8260B	UG/L	0.46 J	0.23 J	0.36 J	0.36 J	0.43 J	0.51 J	0.48 J
1,1-DICHLOROETHENE	8260B	UG/L	0.36 J	0.50 U	0.68	0.68	1.2	0.40 J	1
1,1-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DIBROMO-3-CHLOROPROPANE	8260B	UG/L	2.0 U	2.0 U	2.0 UJ	2.0 UJ	2.0 UJ	2.0 UJ	2.0 UJ
1,2-DIBROMOETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROETHANE	8260B	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-BUTANONE	8260B	UG/L	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
2-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-HEXANONE	8260B	UG/L	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
4-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-METHYL-2-PENTANONE	8260B	UG/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U
ACETONE	8260B	UG/L	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Table 8 (continued)

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL						
			IW-70-SAB06 8/25/2008 (65-80/85-105)	MW-70-MNA05 8/25/2008 (70-80)	MW-70-PMW02A 8/21/2008 (71-81)	MW-70-PMW02A (D) 8/21/2008 (71-81)	MW-70-PMW02B 8/21/2008 (90-100)	MW-70-PMW03A 8/21/2008 (70-80)	MW-70-PMW03B 8/21/2008 (90-100)
BROMODICHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CARBON DISULFIDE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CARBON TETRACHLORIDE	8260B	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
CHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CHLOROFORM	8260B	UG/L	0.25 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CIS-1,2-DICHLOROETHENE	8260B	UG/L	**11**	2.7	**97**	**100**	**170**	**9.2**	**190**
CIS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOCHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DICHLORODIFLUOROMETHANE	8260B	UG/L	2.0 UJ	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
ETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
FREON113	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
HEXACHLOROBUTADIENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
ISOPROPYL BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
M/P-XYLENES	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
METHYLENE CHLORIDE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	UG/L	1.0 U	1.0 U	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ
N-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
N-PROPYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
O-XYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
P-ISOPROPYLTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
SEC-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
STYRENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TERT-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TETRACHLOROETHYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRANS-1,2-DICHLOROETHENE	8260B	UG/L	0.26 J	1.0 U	0.75 J	0.73 J	1.6	0.26 J	1.2
TRANS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRICHLOROETHENE	8260B	UG/L	**200**	**56**	**110**	**120**	**350**	**270**	**110 J**
TRICHLOROFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
VINYL CHLORIDE	8260B	UG/L	0.39 J	0.50 U	0.30 J	0.33 J	**0.68**	0.47 J	**0.56**
XYLENES (TOTAL)	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dehalococcoides (Dhc)/Vinyl Chloride Reductase (vcrA)									
DEHALOCOCCOIDES	qPCR	per Liter	ND[a, b]	NA	NA	NA	NA	NA	NA
VINYL CHLORIDE REDUCTASE	qPCR	per Liter	NA	NA	NA	NA	NA	NA	NA
Dissolved Hydrocarbon Gases									
ETHANE	RSK175	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
ETHENE	RSK175	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
METHANE	RSK175	UG/L	11	8.6	20	18	16	24	22

Notes:

D = Duplicate Sample
J = estimated
ug/l = microgram per liter
mg/l = milligrams per liter
NA = Not Analyzed
U = not detected
Bolded parameters are constituents of concern (COCs) and bolded values are above target cleanup goals (TCGs) or federal/state primary maximum contaminant limits (MCLs).
(70-80) Well Screen Interval - feet below ground surface
[a] Not detected: Sample specific quantitation limit is 4000 per liter.
[b] Sample inhibited testing; this increases the probability that test result is a false negative.

Table 9
First Sand Biobarrier 1 Analytical Results

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL														
			IW-70-FSB108 8/25/2008 (60-105)	IW-70-FSB118 8/26/2008 (60-105)	MW-70-38 8/25/2008 (80-100)	MW-70-MNA06 8/26/2008 (80-90)	MW-70-MNA07 8/22/2008 (90-100)	MW-70-MNA08 8/27/2008 (80-90)	MW-70-MNA11 8/28/2008 (80-90)	MW-70-MNA11 (D) 8/28/2008 (80-90)	MW-70-PMW04A 8/22/2008 (70-80)	MW-70-PMW04B 8/22/2008 (90-100)	MW-70-PMW05A 8/22/2008 (70-80)	MW-70-PMW05B 8/22/2008 (90-100)	MW-70-PMW06A 8/22/2008 (70-80)	MW-70-PMW06B 8/22/2008 (91-101)	RDO-5 8/25/2008 (65-105)
Wet Chemistry																	
TOTAL ALKALINITY	2320B	MG/L	178	208	175	NA	NA	NA	NA	NA	180	193	185	175	195	165	NA
TDS	2540C	MG/L	530	1,740	1,500	NA	NA	NA	NA	NA	680	850	685	620	1,500	1,000	NA
BROMIDE	300	MG/L	0.312 J	0.724	0.759	NA	NA	NA	NA	NA	0.394 J	0.703	0.370 J	0.397 J	0.721	0.534	NA
CHLORIDE-CL	300	MG/L	93.6	411	392	NA	NA	NA	NA	NA	111	223	105	120	338	247	NA
NITRATE-N	300	MG/L	0.200 U	0.200 U	0.200 U	NA	NA	NA	NA	NA	0.200 U	0.200 U	0.200 U	0.0734 J	0.200 U	0.200 U	NA
NITRITE-N	300	MG/L	0.200 U	0.400 U	0.200 U	NA	NA	NA	NA	NA	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	NA
SULFATE	300	MG/L	146	490	436	NA	NA	NA	NA	NA	157	139	169	123	402	217	NA
ACETATE	300.0M	MG/L	1.00 U	4.00 U	1.00 U	NA	NA	NA	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NA
BUTYRATE	300.0M	MG/L	1.00 U	4.00 U	1.00 U	NA	NA	NA	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NA
LACTATE	300.0M	MG/L	1.00 U	4.00 U	1.00 U	NA	NA	NA	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NA
PROPIONATE	300.0M	MG/L	1.00 U	4.00 U	1.00 U	NA	NA	NA	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NA
HYDROGEN SULFIDE	4500F	MG/L	NA	NA	1.00 U	NA	NA	NA	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NA
TOC	5310B	MG/L	0.656 J	1.10 U	1.18	NA	NA	NA	NA	NA	0.680 J	0.917 J	0.807 U	0.874 U	1.08	1.02	NA
Dissolved Metals																	
ARSENIC	6010B	MG/L	NA	NA	0.200 U	NA	NA	NA	NA	NA	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	NA
IRON	6010B	MG/L	NA	NA	0.200 U	NA	NA	NA	NA	NA	0.0566 J	0.0677 J	0.154 J	0.200 U	0.588	0.0609 J	NA
MANGANESE	6010B	MG/L	NA	NA	0.233	NA	NA	NA	NA	NA	0.141 J	0.0646 J	0.127 J	0.0606 J	0.242	0.244	NA
VOCs																	
1,1,1,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 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-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-DICHLOROETHANE	8260B	UG/L	1.0 U	2.3	1.9	1.0 U	0.28 J	2	1.0 U	1.0 U	0.45 J	0.52 J	1.0 U	0.65 J	1.7	1.5	1.0 U
1,1-DICHLOROETHENE	8260B	UG/L	0.39 J	**6.2**	**7.5**	0.59	1.1	3.8	0.50 U	0.50 U	3.4	4.8	0.48 J	**7.3**	**10**	4.6	0.22 J
1,1-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DIBROMO-3-CHLOROPROPANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-DIBROMOETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROETHANE	8260B	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
1,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-BUTANONE	8260B	UG/L	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
2-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-HEXANONE	8260B	UG/L	10 U	10 U	10 UJ	10 U	10 UJ	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 U
4-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-METHYL-2-PENTANONE	8260B	UG/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
ACETONE	8260B	UG/L	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMODICHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 UJ

Table 9 (continued)

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL														
			IW-70-FSB108 8/25/2008 (60-105)	IW-70-FSB118 8/26/2008 (60-105)	MW-70-38 8/25/2008 (80-100)	MW-70-MNA06 8/26/2008 (80-90)	MW-70-MNA07 8/22/2008 (90-100)	MW-70-MNA08 8/27/2008 (80-90)	MW-70-MNA11 8/28/2008 (80-90)	MW-70-MNA11 (D) 8/28/2008 (80-90)	MW-70-PMW04A 8/22/2008 (70-80)	MW-70-PMW04B 8/22/2008 (90-100)	MW-70-PMW05A 8/22/2008 (70-80)	MW-70-PMW05B 8/22/2008 (90-100)	MW-70-PMW06A 8/22/2008 (70-80)	MW-70-PMW06B 8/22/2008 (91-101)	RDO-5 8/25/2008 (65-105)
CARBON DISULFIDE	8260B	UG/L	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 UJ	1.0 U	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 U
CARBON TETRACHLORIDE	8260B	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
CHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CHLOROFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U	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	1.0 U	1.0 U	1.0 U
CHLOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CIS-1,2-DICHLOROETHENE	8260B	UG/L	**10**	**540**	**1,900**	**9.9**	**70**	**390**	0.92 J	0.99 J	**49**	**340**	**18**	**93**	**2,500**	**130**	4.2
CIS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOCHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DICHLORODIFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 UJ	2.0 U	2.0 UJ	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
ETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
FREON113	8260B	UG/L	1.0 UJ	1.0 U	1.0 UJ	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 U
HEXACHLOROBUTADIENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
ISOPROPYL BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
M/P-XYLENES	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
METHYLENE CHLORIDE	8260B	UG/L	1.0 U	1.0 U	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	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
N-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
N-PROPYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
O-XYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
P-ISOPROPYLTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
SEC-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
STYRENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TERT-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TETRACHLOROETHYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRANS-1,2-DICHLOROETHENE	8260B	UG/L	0.22 J	8.7	**29**	0.25 J	1.5	7.9	1.0 U	1.0 U	0.85 J	5	0.65 J	1.3	**21**	**15**	0.23 J
TRANS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRICHLOROETHENE	8260B	UG/L	**120**	**4,100**	**1,500**	**55**	**610**	**3,000**	0.68 J	0.74 J	**790**	**890**	**130**	**1,500**	**180 J**	**3,100**	**38**
TRICHLOROFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
VINYL CHLORIDE	8260B	UG/L	0.50 U	**5.1**	**3.7**	0.50 U	**0.51**	**5.6**	0.50 U	0.50 U	0.34 J	0.47 J	0.50 U	**0.56**	**3.4**	**4.1**	0.50 U
XYLENES (TOTAL)	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dehalococcoides (Dhc)/Vinyl Chloride Reductase (vcrA)																	
DEHALOCOCCOIDES	qPCR	per Liter	8,000	30,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
VINYL CHLORIDE REDUCTASE	qPCR	per Liter	Detected[a]	Detected[a]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Hydrocarbon Gases																	
ETHANE	RSK175	UG/L	2.0 U	1.0 J	2.0 U	2.0 U	2.0 U	0.86 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	1.0 J	2.0 U	2.0 U
ETHENE	RSK175	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
METHANE	RSK175	UG/L	7.4	29	9.4	2.4	23	27	29	22	9.2	7.5	6.7	8.2	23	10	4.5

Notes:
J = estimated
ug/l = microgram per liter
mg/l = milligrams per liter
NA = Not Analyzed
U = not detected
Bolded parameters are constituents of concern (COCs) and bolded values are above target cleanup goals (TCGs) or federal/state primary maximum contaminant limits (MCLs).
(70-80) Well Screen Interval - feet below ground surface
[a] vcrA detected but below specific quantiation limit. The sample specific quantitation limit is 4000 per liter.

Table 10
First Sand Biobarrier 2 Analytical Results

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL								
			IW-70-FSB216 8/27/2008 (65-100)	MW-70-MNA09 8/27/2008 (64-74)	MW-70-MNA10 8/29/2008 (75-85)	MW-70-MNA12 9/4/2008 (75-85)	MW-70-PMW07A 8/28/2008 (65-75)	MW-70-PMW07A (D) 8/28/2008 (65-75)	MW-70-PMW07B 8/28/2008 (85-95)	MW-70-PMW08A 8/29/2008 (65-75)	MW-70-PMW08B 8/29/2008 (85-95)
Wet Chemistry											
TOTAL ALKALINITY	2320B	MG/L	288	NA	NA	NA	320	315	245	275	280
TDS	2540C	MG/L	9,950	NA	NA	NA	14,500	14,400	5,310	16,400 J	5,620 J
BROMIDE	300	MG/L	1.3	NA	NA	NA	18.9	19.4	5.18	23.6	8.39
CHLORIDE-CL	300	MG/L	4,850	NA	NA	NA	7,150	7,060	2,320	8260	2,610
NITRATE-N	300	MG/L	0.200 U	NA	NA	NA	0.200 U	0.200 U	0.200 U	1.00 U	0.200 U
NITRITE-N	300	MG/L	1.00 U	NA	NA	NA	1.00 U	1.00 U	0.400 U	1.00 U	0.400 U
SULFATE	300	MG/L	1120	NA	NA	NA	1,300	1,290	666	1,430	805
ACETATE	300.0M	MG/L	1.00 U	NA	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BUTYRATE	300.0M	MG/L	1.00 U	NA	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
LACTATE	300.0M	MG/L	1.00 U	NA	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
PROPIONATE	300.0M	MG/L	1.00 U	NA	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
HYDROGEN SULFIDE	4500F	MG/L	NA	NA	NA	NA	3.66	3.57	1.00 U	1.00 U	1.00 U
TOC	5310B	MG/L	1.68	NA	NA	NA	1.92	1.73	1.35	1.88	1.53
Dissolved Metals											
ARSENIC	6010B	MG/L	NA	NA	NA	NA	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
IRON	6010B	MG/L	NA	NA	NA	NA	3.86	3.72	0.742	2.26	1.33
MANGANESE	6010B	MG/L	NA	NA	NA	NA	3.08	3.02	0.87	3.02	0.994
VOCs											
1,1,1,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 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-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-DICHLOROETHANE	8260B	UG/L	0.27 J	1.0 U	0.82 J	0.64 J	1.0 U	1.0 U	0.76 J	1.0 U	0.46 J
1,1-DICHLOROETHENE	8260B	UG/L	0.50 U	0.50 U	0.97	2.5	0.50 U	0.50 U	1.2	0.50 U	0.48 J
1,1-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DIBROMO-3-CHLOROPROPANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-DIBROMOETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROETHANE	8260B	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
1,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-DICHLOROPROPANE	8260B	UG/L	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
2-BUTANONE	8260B	UG/L	10 UJ	10 UJ	10 UJ	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
2-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-HEXANONE	8260B	UG/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-METHYL-2-PENTANONE	8260B	UG/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
ACETONE	8260B	UG/L	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Table 10 (continued)

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL								
			IW-70-FSB216 8/27/2008 (65-100)	MW-70-MNA09 8/27/2008 (64-74)	MW-70-MNA10 8/29/2008 (75-85)	MW-70-MNA12 9/4/2008 (75-85)	MW-70-PMW07A 8/28/2008 (65-75)	MW-70-PMW07A (D) 8/28/2008 (65-75)	MW-70-PMW07B 8/28/2008 (85-95)	MW-70-PMW08A 8/29/2008 (65-75)	MW-70-PMW08B 8/29/2008 (85-95)
BROMODICHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOMETHANE	8260B	UG/L	2.0 U	2.0 U	0.27 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 UJ
CARBON DISULFIDE	8260B	UG/L	1.0 U	1.0 U	1.1	1.0 U	1.0 UJ	1.0 UJ	1.0 UJ	1.0 U	0.26 J
CARBON TETRACHLORIDE	8260B	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
CHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CHLOROFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CIS-1,2-DICHLOROETHENE	8260B	UG/L	**7.7**	1.0 J	**100**	**140**	1.0 U	1.0 U	**97**	3.6	**40**
CIS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOCHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DICHLORODIFLUOROMETHANE	8260B	UG/L	2.0 UJ	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
ETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
FREON113	8260B	UG/L	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
HEXACHLOROBUTADIENE	8260B	UG/L	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 UJ
ISOPROPYL BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
M/P-XYLENES	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
METHYLENE CHLORIDE	8260B	UG/L	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
MTBE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
N-BUTYLBENZENE	8260B	UG/L	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 UJ
N-PROPYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
O-XYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
P-ISOPROPYLTOLUENE	8260B	UG/L	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 UJ
SEC-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
STYRENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TERT-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TETRACHLOROETHYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRANS-1,2-DICHLOROETHENE	8260B	UG/L	0.35 J	1.0 U	9.9	**47**	1.0 U	1.0 U	3.1	0.34 J	2.7
TRANS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRICHLOROETHENE	8260B	UG/L	**63**	1.0 J	**510**	**970**	5.0 U	5.0 U	**600**	**20**	**220**
TRICHLOROFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
VINYL CHLORIDE	8260B	UG/L	0.45 J	0.50 U	**2.4**	**2**	0.50 U	0.50 U	**2**	0.50 U	**0.94**
XYLENES (TOTAL)	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dehalococcoides (Dhc)/Vinyl Chloride Reductase (vcrA)											
DEHALOCOCCOIDES	qPCR	per Liter	ND[a, b]	NA	NA	NA	NA	NA	NA	NA	NA
VINYL CHLORIDE REDUCTASE	qPCR	per Liter	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Hydrocarbon Gases											
ETHANE	RSK175	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
ETHENE	RSK175	UG/L	2.0 U	2.0 U	0.84 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
METHANE	RSK175	UG/L	6.9	14	49	10	5.9	5.4	35	9.3	13

Notes:

D = Duplicate Sample
J = estimated
ug/l = microgram per liter
mg/l = milligrams per liter
NA = Not Analyzed
U = not detected
Bolded parameters are constituents of concern (COCs) and bolded values are above target cleanup goals (TCGs) or federal/state primary maximum contaminant limits (MCLs).
(70-80) Well Screen Interval - feet below ground surface
[a] Not detected: Sample specific quantitation limit is 4000 per liter.
[b] Sample inhibited testing; this increases the probability that test result is a false negative.

Table 11
First Sand POC Analytical Results

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL			
			MW-70-11 9/3/2008 (80-100)	MW-70-16 9/2/2008 (95-105)	MW-70-35 8/27/2008 (90-100)	MW-70-POC01 9/4/2008 (80-90)
Wet Chemistry						
TOTAL ALKALINITY	2320B	MG/L	233	260	275	148
TDS	2540C	MG/L	1,880	2,830	5,570	710
BROMIDE	300	MG/L	0.652	2.59	1.48	0.373 J
CHLORIDE-CL	300	MG/L	283	1,120	2,810	87.8
NITRATE-N	300	MG/L	0.200 U	7.67	0.200 U	0.200 U
NITRITE-N	300	MG/L	0.200 U	0.400 U	1.00 U	0.200 U
SULFATE	300	MG/L	517	69.2	605	193
ACETATE	300.0M	MG/L	1.00 U	1.00 U	1.00 U	1.00 U
BUTYRATE	300.0M	MG/L	1.00 U	1.00 U	1.00 U	1.00 U
LACTATE	300.0M	MG/L	1.00 U	1.00 U	1.00 U	1.00 U
PROPIONATE	300.0M	MG/L	1.00 U	1.00 U	1.00 U	1.00 U
HYDROGEN SULFIDE	4500F	MG/L	1.00 U	1.00 U	1.00 U	1.00 U
TOC	5310B	MG/L	1.07	8.24	2.28	0.549 J
Dissolved Metals						
ARSENIC	6010B	MG/L	0.200 U	0.200 U	0.200 U	0.200 U
IRON	6010B	MG/L	0.325	0.200 U	1.48	0.138 J
MANGANESE	6010B	MG/L	0.257	0.0151 J	0.698	0.135 J
VOCs						
1,1,1,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
1,1-DICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	0.34 J	1.0 U
1,1-DICHLOROETHENE	8260B	UG/L	0.50 U	0.50 U	0.50 U	0.50 U
1,1-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DIBROMO-3-CHLOROPROPANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U
1,2-DIBROMOETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROETHANE	8260B	UG/L	0.50 U	0.50 U	0.50 U	0.50 U
1,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
1,3-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
1,4-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
2,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
2-BUTANONE	8260B	UG/L	10 U	10 UJ	10 UJ	10 U
2-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
2-HEXANONE	8260B	UG/L	10 U	10 U	10 U	10 U
4-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
4-METHYL-2-PENTANONE	8260B	UG/L	10 U	10 U	10 U	10 U
ACETONE	8260B	UG/L	10 UJ	10 UJ	10 UJ	10 UJ

Table 11 (continued)

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL			
			MW-70-11 9/3/2008 (80-100)	MW-70-16 9/2/2008 (95-105)	MW-70-35 8/27/2008 (90-100)	MW-70-POC01 9/4/2008 (80-90)
BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
BROMOBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
BROMODICHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
BROMOFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
BROMOMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U
CARBON DISULFIDE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
CARBON TETRACHLORIDE	8260B	UG/L	0.50 U	0.50 U	0.50 U	0.50 U
CHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U
CHLOROFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U
CIS-1,2-DICHLOROETHENE	8260B	UG/L	1.1	1.0 U	1.2	1.0 U
CIS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOCHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
DICHLORODIFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 UJ	2.0 U
ETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
FREON113	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
HEXACHLOROBUTADIENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
ISOPROPYL BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
M/P-XYLENES	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
METHYLENE CHLORIDE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
N-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
N-PROPYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
O-XYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
P-ISOPROPYLTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
SEC-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
STYRENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
TERT-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
TETRACHLOROETHYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
TOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
TRANS-1,2-DICHLOROETHENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
TRANS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U
TRICHLOROETHENE	8260B	UG/L	5.0 U	5.0 U	0.45 J	5.0 U
TRICHLOROFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U
VINYL CHLORIDE	8260B	UG/L	0.50 U	0.50 U	0.50 U	0.50 U
XYLENES (TOTAL)	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U
Dissolved Hydrocarbon Gases						
ETHANE	RSK175	UG/L	2.0 U	2.0 U	2.0 U	2.0 U
ETHENE	RSK175	UG/L	2.0 U	2.0 U	2.0 U	2.0 U
METHANE	RSK175	UG/L	21	2.0 U	15	4.4

Notes:

J = estimated

ug/l = microgram per liter

mg/l = milligrams per liter

NA = Not Analyzed

U = not detected

Bolded parameters are constituents of concern (COCs) and bolded values are above target cleanup goals (TCGs) or federal/state primary maximum contaminant limits (MCLs).

(80-100) Well Screen Interval - feet below ground surface

Table 12
Shell Horizon Biobarrier 1 Analytical Results

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL					
			IW-70-SHB113 8/27/2008 (105-130)	IW-70-SHB217 8/29/2008 (105-130)	MW-70-MNA13 8/27/2008 (115-125)	MW-70-PMW09 8/27/2008 (120-130)	PMW09 (D) 8/27/2008 (120-130)	MW-70-PMW10 8/27/2008 (120-130)
Wet Chemistry								
TOTAL ALKALINITY	2320B	MG/L	198	NA	NA	170	180	193
TDS	2540C	MG/L	1,520	NA	NA	860	920	1,550
BROMIDE	300	MG/L	0.500 U	NA	NA	0.301 J	0.316 J	0.500 U
CHLORIDE-CL	300	MG/L	352	NA	NA	190	197	351
NITRATE-N	300	MG/L	0.200 U	NA	NA	0.200 U	0.0608 J	0.200 U
NITRITE-N	300	MG/L	0.200 U	NA	NA	0.200 U	0.200 J	0.200 U
SULFATE	300	MG/L	415	NA	NA	198	209	405
ACETATE	300.0M	MG/L	1.00 U	NA	NA	1.00 U	1.00 U	1.00 U
BUTYRATE	300.0M	MG/L	1.00 U	NA	NA	1.00 U	1.00 U	1.00 U
LACTATE	300.0M	MG/L	1.00 U	NA	NA	1.00 U	1.00 U	1.00 U
PROPIONATE	300.0M	MG/L	1.00 U	NA	NA	1.00 U	1.00 U	1.00 U
HYDROGEN SULFIDE	4500F	MG/L	NA	NA	NA	1.00 U	1.00 U	1.00 U
TOC	5310B	MG/L	1.03	NA	NA	0.970 J	0.882 J	1.38
Dissolved Metals								
ARSENIC	6010B	MG/L	NA	NA	NA	0.00531 J	0.00614 J	0.00582 J
IRON	6010B	MG/L	NA	NA	NA	0.201	0.223	0.401
MANGANESE	6010B	MG/L	NA	NA	NA	0.170 J	0.170 J	0.303
VOCs								
1,1,1,2-TETRACHLOROETHANE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-TRICHLOROETHANE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-TETRACHLOROETHANE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-TRICHLOROETHANE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-DICHLOROETHANE	8260B	UG/L	2.1 J	0.51 J	1.0 U	0.61 J	0.62 J	1.8
1,1-DICHLOROETHENE	8260B	UG/L	6	2	0.47 J	1.4	1.6	4
1,1-DICHLOROPROPENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROBENZENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROPROPANE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRICHLOROBENZENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRIMETHYLBENZENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DIBROMO-3-	8260B	UG/L	10 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-DIBROMOETHANE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROBENZENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROETHANE	8260B	UG/L	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-DICHLOROPROPANE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-TRIMETHYLBENZENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-DICHLOROBENZENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-DICHLOROBENZENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-DICHLOROPROPANE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-BUTANONE	8260B	UG/L	50 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
2-CHLOROTOLUENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-HEXANONE	8260B	UG/L	50 U	10 U	10 U	10 U	10 U	10 U
4-CHLOROTOLUENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-METHYL-2-PENTANONE	8260B	UG/L	50 U	10 U	10 U	10 U	10 U	10 U
ACETONE	8260B	UG/L	50 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
BENZENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOBENZENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMODICHLOROMETHANE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOFORM	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Table 12 (continued)

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL					
			IW-70-SHB113 8/27/2008 (105-130)	IW-70-SHB217 8/29/2008 (105-130)	MW-70-MNA13 8/27/2008 (115-125)	MW-70-PMW09 8/27/2008 (120-130)	PMW09 (D) 8/27/2008 (120-130)	MW-70-PMW10 8/27/2008 (120-130)
BROMOMETHANE	8260B	UG/L	10 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U
CARBON DISULFIDE	8260B	UG/L	5.0 U	1.4	1.0 U	1.0 U	1.0 U	1.0 U
CARBON TETRACHLORIDE	8260B	UG/L	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
CHLOROBENZENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROETHANE	8260B	UG/L	10 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CHLOROFORM	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROMETHANE	8260B	UG/L	10 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CIS-1,2-DICHLOROETHENE	8260B	UG/L	**270**	**180**	**25**	**130**	**130**	**250**
CIS-1,3-DICHLOROPROPENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOCHLOROMETHANE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOMETHANE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DICHLORODIFLUOROMETHANE	8260B	UG/L	10 UJ	2.0 U	2.0 UJ	2.0 UJ	2.0 UJ	2.0 UJ
ETHYLBENZENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
FREON113	8260B	UG/L	5.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ
HEXACHLOROBUTADIENE	8260B	UG/L	5.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
ISOPROPYL BENZENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
M/P-XYLENES	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
METHYLENE CHLORIDE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
N-BUTYLBENZENE	8260B	UG/L	5.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
N-PROPYLBENZENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
O-XYLENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
P-ISOPROPYLTOLUENE	8260B	UG/L	5.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
SEC-BUTYLBENZENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
STYRENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TERT-BUTYLBENZENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TETRACHLOROETHYLENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TOLUENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRANS-1,2-DICHLOROETHENE	8260B	UG/L	6.9	**48**	0.90 J	3.1	3.2	5.3
TRANS-1,3-DICHLOROPROPENE	8260B	UG/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRICHLOROETHENE	8260B	UG/L	**4,300**	**680**	**44**	**510**	**540**	**2,200**
TRICHLOROFLUOROMETHANE	8260B	UG/L	10 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
VINYL CHLORIDE	8260B	UG/L	**4.4**	**1.2**	0.50 U	**1.5**	**1.7**	**4.3**
XYLENES (TOTAL)	8260B	UG/L	10 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dehalococcoides (Dhc)/Vinyl Chloride Reductase (vcrA)								
DEHALOCOCCOIDES	qPCR	per Liter	7,000	NA	NA	NA	NA	NA
VINYL CHLORIDE REDUCTASE	qPCR	per Liter	Detected[a]	NA	NA	NA	NA	NA
Dissolved Hydrocarbon Gases								
ETHANE	RSK175	UG/L	0.65 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
ETHENE	RSK175	UG/L	2.0 U	3	0.76 J	0.97 J	1.0 J	2
METHANE	RSK175	UG/L	18	12	22	280	260	460

Notes:
J = estimated
ug/l = microgram per liter
mg/l = milligrams per liter
NA = Not Analyzed
U = not detected
Bolded parameters are constituents of concern (COCs) and bolded values are above target cleanup goals (TCGs) or federal/state primary maximum contaminant limits (MCLs).
(105-130) Well Screen Interval - feet below ground surface
[a] vcrA detected but below specific quantitation limit. The sample specific quantitation limit is 4000 per liter.

Table 13
Shell Horizon Biobarrier 3 Analytical Results

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL					
			IW-70-SHB310 8/28/2008 (80-95/105-130)	MW-70-MNA14 9/4/2008 (115-125)	MW-70-PMW11A 8/29/2008 (85-95)	MW-70-PMW11B 8/29/2008 (115-125)	MW-70-PMW12A 9/2/2008 (85-95)	MW-70-PMW12B 9/2/2008 (115-125)
Wet Chemistry								
TOTAL ALKALINITY	2320B	MG/L	210	NA	158	200	163	198
TDS	2540C	MG/L	3,890	NA	6,720 J	2,820 J	2,970	2,930
BROMIDE	300	MG/L	3.47	NA	11.7	3.86	3.63	2.56
CHLORIDE-CL	300	MG/L	1,580	NA	3,470	1,240	1,460	1,260
NITRATE-N	300	MG/L	0.200 U	NA	0.200 U	0.200 U	0.200 U	0.200 U
NITRITE-N	300	MG/L	0.400 U	NA	0.400 U	0.200 U	0.400 U	0.400 U
SULFATE	300	MG/L	453	NA	524	440	207	393
ACETATE	300.0M	MG/L	1.00 U	NA	1.55	2.93	1.00 U	1.00 U
BUTYRATE	300.0M	MG/L	1.00 U	NA	1.00 U	1.00 U	1.00 U	1.00 U
LACTATE	300.0M	MG/L	1.00 U	NA	1.00 U	1.00 U	1.00 U	1.00 U
PROPIONATE	300.0M	MG/L	1.00 U	NA	1.00 U	1.00 U	1.00 U	1.00 U
HYDROGEN SULFIDE	4500F	MG/L	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U
TOC	5310B	MG/L	1.8	NA	0.953 J	1.38	1.23	1.67
Dissolved Metals								
ARSENIC	6010B	MG/L	NA	NA	0.200 U	0.200 U	0.200 U	0.200 U
IRON	6010B	MG/L	NA	NA	2.46	1.25	0.581	1.36
MANGANESE	6010B	MG/L	NA	NA	1.24	0.369	0.632	0.365
VOCs								
1,1,1,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-DICHLOROETHANE	8260B	UG/L	0.50 J	1.0 U	1.0 U	0.44 J	1.0 U	0.46 J
1,1-DICHLOROETHENE	8260B	UG/L	1.7	0.50 U	0.68	1.1	0.56	1.2
1,1-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DIBROMO-3-CHLOROPROPANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-DIBROMOETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROETHANE	8260B	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-DICHLOROPROPANE	8260B	UG/L	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-BUTANONE	8260B	UG/L	10 UJ	10 U	10 UJ	10 UJ	10 UJ	10 UJ
2-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-HEXANONE	8260B	UG/L	10 U	10 U	10 U	10 U	10 U	10 U
4-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-METHYL-2-PENTANONE	8260B	UG/L	10 U	10 U	10 U	10 U	10 U	10 U
ACETONE	8260B	UG/L	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Table 13 (continued)

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL					
			IW-70-SHB310 8/28/2008 (80-95/105-130)	MW-70-MNA14 9/4/2008 (115-125)	MW-70-PMW11A 8/29/2008 (85-95)	MW-70-PMW11B 8/29/2008 (115-125)	MW-70-PMW12A 9/2/2008 (85-95)	MW-70-PMW12B 9/2/2008 (115-125)
BROMOBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMODICHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 UJ	2.0 UJ	2.0 U	2.0 U
CARBON DISULFIDE	8260B	UG/L	1.0 UJ	1.0 U	0.56 J	0.68 J	1	0.51 J
CARBON TETRACHLORIDE	8260B	UG/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
CHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CHLOROFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CIS-1,2-DICHLOROETHENE	8260B	UG/L	**300**	0.85 J	**37**	**70**	**39**	**96**
CIS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOCHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DICHLORODIFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
ETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
FREON113	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
HEXACHLOROBUTADIENE	8260B	UG/L	1.0 U	1.0 U	1.0 UJ	1.0 UJ	1.0 U	1.0 U
ISOPROPYL BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
M/P-XYLENES	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
METHYLENE CHLORIDE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
N-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 UJ	1.0 UJ	1.0 U	1.0 U
N-PROPYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
O-XYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
P-ISOPROPYLTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 UJ	1.0 UJ	1.0 U	1.0 U
SEC-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
STYRENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TERT-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TETRACHLOROETHYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRANS-1,2-DICHLOROETHENE	8260B	UG/L	**60**	1.0 U	4.4	**41**	5.6	**41**
TRANS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRICHLOROETHENE	8260B	UG/L	**580**	0.99 J	**160**	**500**	**170**	**870**
TRICHLOROFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
VINYL CHLORIDE	8260B	UG/L	**1.9**	0.50 U	0.47 J	**1.3**	**3.5**	**1.2**
XYLENES (TOTAL)	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dehalococcoides (Dhc)/Vinyl Chloride Reductase (vcrA)								
DEHALOCOCCOIDES	qPCR	per Liter	ND[a]	NA	NA	NA	NA	NA
VINYL CHLORIDE REDUCTASE	qPCR	per Liter	NA	NA	NA	NA	NA	NA
Dissolved Hydrocarbon Gases								
ETHANE	RSK175	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
ETHENE	RSK175	UG/L	1.5 J	4.5	0.73 J	0.98 J	0.63 J	2.0 U
METHANE	RSK175	UG/L	28	140	26	10	9.2	9.2

Notes:

J = estimated

ug/l = microgram per liter

mg/l = milligrams per liter

NA = Not Analyzed

U = not detected

Bolded parameters are constituents of concern (COCs) and bolded values are above target cleanup goals (TCGs) or federal/state primary maximum contaminant limits (MCLs).

(105-130) Well Screen Interval - feet below ground surface

[a] Not detected: Sample specific quantitation limit is 4000 per liter.

Table 14
Shell Horizon POC Analytical Results

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL MW-70-23 8/28/2008 (110-130)
Wet Chemistry			
TOTAL ALKALINITY	2320B	MG/L	168
TDS	2540C	MG/L	2,200
BROMIDE	300	MG/L	0.500 U
CHLORIDE-CL	300	MG/L	518
NITRATE-N	300	MG/L	0.200 U
NITRITE-N	300	MG/L	0.200 U
SULFATE	300	MG/L	533
ACETATE	300.0M	MG/L	1.00 U
BUTYRATE	300.0M	MG/L	1.00 U
LACTATE	300.0M	MG/L	1.00 U
PROPIONATE	300.0M	MG/L	1.00 U
HYDROGEN SULFIDE	4500F	MG/L	1.00 U
TOC	5310B	MG/L	0.585 J
Dissolved Metals			
ARSENIC	6010B	MG/L	0.200 U
IRON	6010B	MG/L	0.323
MANGANESE	6010B	MG/L	0.242
VOCs			
1,1,1,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U
1,1,1-TRICHLOROETHANE	8260B	UG/L	1.0 U
1,1,2,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U
1,1,2-TRICHLOROETHANE	8260B	UG/L	1.0 U
1,1-DICHLOROETHANE	8260B	UG/L	1.0 U
1,1-DICHLOROETHENE	8260B	UG/L	0.50 U
1,1-DICHLOROPROPENE	8260B	UG/L	1.0 U
1,2,3-TRICHLOROBENZENE	8260B	UG/L	1.0 U
1,2,3-TRICHLOROPROPANE	8260B	UG/L	1.0 U
1,2,4-TRICHLOROBENZENE	8260B	UG/L	1.0 U
1,2,4-TRIMETHYLBENZENE	8260B	UG/L	1.0 U
1,2-DIBROMO-3-CHLOROPROPANE	8260B	UG/L	2.0 U
1,2-DIBROMOETHANE	8260B	UG/L	1.0 U
1,2-DICHLOROBENZENE	8260B	UG/L	1.0 U
1,2-DICHLOROETHANE	8260B	UG/L	0.50 U
1,2-DICHLOROPROPANE	8260B	UG/L	1.0 U
1,3,5-TRIMETHYLBENZENE	8260B	UG/L	1.0 U
1,3-DICHLOROBENZENE	8260B	UG/L	1.0 U
1,4-DICHLOROBENZENE	8260B	UG/L	1.0 U
2,2-DICHLOROPROPANE	8260B	UG/L	1.0 UJ
2-BUTANONE	8260B	UG/L	10 UJ
2-CHLOROTOLUENE	8260B	UG/L	1.0 U
2-HEXANONE	8260B	UG/L	10 U
4-CHLOROTOLUENE	8260B	UG/L	1.0 U
4-METHYL-2-PENTANONE	8260B	UG/L	10 U
ACETONE	8260B	UG/L	10 UJ
BENZENE	8260B	UG/L	1.0 U
BROMOBENZENE	8260B	UG/L	1.0 U
BROMODICHLOROMETHANE	8260B	UG/L	1.0 U

Table 14 (continued)

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL MW-70-23 8/28/2008 (110-130)
BROMOFORM	8260B	UG/L	1.0 U
BROMOMETHANE	8260B	UG/L	2.0 U
CARBON DISULFIDE	8260B	UG/L	1.0 UJ
CARBON TETRACHLORIDE	8260B	UG/L	0.50 U
CHLOROBENZENE	8260B	UG/L	1.0 U
CHLOROETHANE	8260B	UG/L	2.0 U
CHLOROFORM	8260B	UG/L	1.0 U
CHLOROMETHANE	8260B	UG/L	2.0 U
CIS-1,2-DICHLOROETHENE	8260B	UG/L	1.0 U
CIS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U
DIBROMOCHLOROMETHANE	8260B	UG/L	1.0 U
DIBROMOMETHANE	8260B	UG/L	1.0 U
DICHLORODIFLUOROMETHANE	8260B	UG/L	2.0 U
ETHYLBENZENE	8260B	UG/L	1.0 U
FREON113	8260B	UG/L	1.0 U
HEXACHLOROBUTADIENE	8260B	UG/L	1.0 U
ISOPROPYL BENZENE	8260B	UG/L	1.0 U
M/P-XYLENES	8260B	UG/L	1.0 U
METHYLENE CHLORIDE	8260B	UG/L	1.0 U
MTBE	8260B	UG/L	1.0 U
N-BUTYLBENZENE	8260B	UG/L	1.0 U
N-PROPYLBENZENE	8260B	UG/L	1.0 U
O-XYLENE	8260B	UG/L	1.0 U
P-ISOPROPYLTOLUENE	8260B	UG/L	1.0 U
SEC-BUTYLBENZENE	8260B	UG/L	1.0 U
STYRENE	8260B	UG/L	1.0 U
TERT-BUTYLBENZENE	8260B	UG/L	1.0 U
TETRACHLOROETHYLENE	8260B	UG/L	1.0 U
TOLUENE	8260B	UG/L	1.0 U
TRANS-1,2-DICHLOROETHENE	8260B	UG/L	1.0 U
TRANS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U
TRICHLOROETHENE	8260B	UG/L	5.0 U
TRICHLOROFLUOROMETHANE	8260B	UG/L	2.0 U
VINYL CHLORIDE	8260B	UG/L	0.50 U
XYLENES (TOTAL)	8260B	UG/L	2.0 U
Dissolved Hydrocarbon Gases			
ETHANE	RSK175	UG/L	2.0 U
ETHENE	RSK175	UG/L	2.0 U
METHANE	RSK175	UG/L	8.3

Notes:

J = estimated

ug/l = microgram per liter

mg/l = milligrams per liter

NA = Not Analyzed

U = not detected

POC = Point of Compliance Wells

Bolded parameters are constituents of concern (COCs) and bolded values are above target cleanup goals (TCGs) or federal/state primary maximum contaminant limits (MCLs).

(150-170) Well Screen Interval - feet below ground surface

Table 15
Second Sand Analytical Results

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL									
			IW-70-SSB109 8/28/2008 (126-166)	IW-70-SSB109 (D) 8/28/2008 (126-166)	MW-70-15 9/2/2008 (161-171)	MW-70-MNA15 9/4/2008 (140-150)	MW-70-MNA16 8/29/2008 (141-151)	MW-70-MNA17 8/29/2008 (140-150)	MW-70-PMW13A 9/3/2008 (125-135)	MW-70-PMW13B 9/3/2008 (145-155)	MW-70-PMW14A 9/3/2008 (128-138)	MW-70-PMW14B 9/3/2008 (149-159)
Wet Chemistry												
TOTAL ALKALINITY	2320B	MG/L	183	178	NA	NA	NA	NA	225	205	193	208
TDS	2540C	MG/L	10,000	9,980	NA	NA	NA	NA	3,660	8,270	3,820	735
BROMIDE	300	MG/L	3.5	1.70 J	NA	NA	NA	NA	3.3	11.6	4.58	9.51
CHLORIDE-CL	300	MG/L	4,940	4,910	NA	NA	NA	NA	1,610	3,780	1,480	3,190
NITRATE-N	300	MG/L	0.200 U	0.200 U	NA	NA	NA	NA	0.200 U	0.200 U	0.200 U	0.200 U
NITRITE-N	300	MG/L	1.00 U	1.00 U	NA	NA	NA	NA	0.400 U	1.00 U	0.400 U	1.00 U
SULFATE	300	MG/L	719	711	NA	NA	NA	NA	345	634	383	544
ACETATE	300.0M	MG/L	1.00 U	1.00 U	NA	NA	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U
BUTYRATE	300.0M	MG/L	1.00 U	1.00 U	NA	NA	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U
LACTATE	300.0M	MG/L	1.00 U	1.00 U	NA	NA	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U
PROPIONATE	300.0M	MG/L	1.00 U	1.00 U	NA	NA	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U
HYDROGEN SULFIDE	4500F	MG/L	NA	NA	NA	NA	NA	NA	1.00 U	1.00 U	1.00 U	1.00 U
TOC	5310B	MG/L	1.28	1.29	NA	NA	NA	NA	1.87	1.65	2.08	1.72
Dissolved Metals												
ARSENIC	6010B	MG/L	NA	NA	NA	NA	NA	NA	0.200 U	0.200 U	0.200 U	0.0123 J
IRON	6010B	MG/L	NA	NA	NA	NA	NA	NA	0.831	3.42	3.01	3.11
MANGANESE	6010B	MG/L	NA	NA	NA	NA	NA	NA	0.492	0.647	2.19	1.07
VOCs												
1,1,1,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 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-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-DICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	0.31 J	0.25 J	1.0 U	0.26 J	0.56 J	0.33 J	0.58 J
1,1-DICHLOROETHENE	8260B	UG/L	0.58	0.63	0.50 U	1.6	4.1	0.50 U	1.1	2.4	2.1	2.1
1,1-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DIBROMO-3-CHLOROPROPANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-DIBROMOETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROETHANE	8260B	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
1,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-DICHLOROPROPANE	8260B	UG/L	1.0 UJ	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
2-BUTANONE	8260B	UG/L	10 UJ	10 UJ	10 UJ	10 U	10 UJ	10 UJ	10 U	10 U	10 U	10 U
2-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-HEXANONE	8260B	UG/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-METHYL-2-PENTANONE	8260B	UG/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
ACETONE	8260B	UG/L	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMODICHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Table 15 (continued)

Parameters	Method	Unit	IW-70-SSB109 8/28/2008 (126-166)	IW-70-SSB109 (D) 8/28/2008 (126-166)	MW-70-15 9/2/2008 (161-171)	MW-70-MNA15 9/4/2008 (140-150)	MW-70-MNA16 8/29/2008 (141-151)	MW-70-MNA17 8/29/2008 (140-150)	MW-70-PMW13A 9/3/2008 (125-135)	MW-70-PMW13B 9/3/2008 (145-155)	MW-70-PMW14A 9/3/2008 (128-138)	MW-70-PMW14B 9/3/2008 (149-159)
			WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL									
BROMOFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BROMOMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CARBON DISULFIDE	8260B	UG/L	1.0 UJ	1.0 UJ	1.0 U	1.0 U	1.5	1.3 J	0.23 J	1.0 U	1.0 U	0.35 J
CARBON TETRACHLORIDE	8260B	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
CHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CHLOROFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
CIS-1,2-DICHLOROETHENE	8260B	UG/L	**39**	**44**	2	**120**	**1,100**	0.79 J	**63**	**180**	**180**	**130**
CIS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOCHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DIBROMOMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DICHLORODIFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
ETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
FREON113	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
HEXACHLOROBUTADIENE	8260B	UG/L	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
ISOPROPYL BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
M/P-XYLENES	8260B	UG/L	1.0 U	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
METHYLENE CHLORIDE	8260B	UG/L	1.0 U	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	UG/L	1.0 U	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
N-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
N-PROPYLBENZENE	8260B	UG/L	1.0 U	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
O-XYLENE	8260B	UG/L	1.0 U	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
P-ISOPROPYLTOLUENE	8260B	UG/L	1.0 U	1.0	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
SEC-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
STYRENE	8260B	UG/L	1.0 U	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TERT-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TETRACHLOROETHYLENE	8260B	UG/L	1.0 U	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TOLUENE	8260B	UG/L	1.0 U	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRANS-1,2-DICHLOROETHENE	8260B	UG/L	**12**	**14**	1.0 U	**17**	**39**	1.0 U	**18**	**38**	**23**	**28**
TRANS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TRICHLOROETHENE	8260B	UG/L	**300**	**310**	1.6 J	**540**	**140 J**	0.21 J	**320**	**900**	**1,100**	**530**
TRICHLOROFLUOROMETHANE	8260B	UG/L	2.0 U	2.0	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
VINYL CHLORIDE	8260B	UG/L	0.34 J	0.31	0.50 U	0.50 U	**8.3**	0.50 U	**410**	**2.9**	**5.8**	**2**
XYLENES (TOTAL)	8260B	UG/L	2.0 U	2.0	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dehalococcoides (Dhc)/Vinyl Chloride Reductase (vcrA)												
DEHALOCOCCOIDES	qPCR	per Liter	5,000[a]	ND	NA	NA	NA	NA	NA	NA	NA	NA
VINYL CHLORIDE REDUCTASE	qPCR	per Liter	2,000J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Hydrocarbon Gases												
ETHANE	RSK175	UG/L	2.0 U	2.0	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	0.88 J
ETHENE	RSK175	UG/L	1.6 J	1.7	2.0 U	2.0 U	2.0 U	2.0 U	18	2.4	1.7 J	5.9
METHANE	RSK175	UG/L	9.5	9.4	12	18	6.2	7.9	680	16	8.8	12

Notes:

J = estimated
U = not detected
ug/l = microgram per liter
Bolded parameters are constituents of concern (COCs) and bolded values are above target cleanup goals (TCGs) or federal/state primary maximum contaminant limits (MCLs).
mg/l = milligrams per liter
(140-150) Well Screen Interval - feet below ground surface
NA = Not Analyzed
[a] Duplicate sample was not detected. Sample specific quantitation limit is 4000 per liter.
ND = Not Detected

Table 16
Second Sand POC Analytical Results

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL		
			MW-70-21 9/3/2008 (150-170)	MW-70-23 8/28/2008 (110-130)	MW-70-36 9/2/2008 (150-160)
Wet Chemistry					
TOTAL ALKALINITY	2320B	MG/L	178	168	180
TDS	2540C	MG/L	18,300	2,200	9,840
BROMIDE	300	MG/L	27.9	0.500 U	14.4
CHLORIDE-CL	300	MG/L	8,740	518	5,080
NITRATE-N	300	MG/L	0.200 U	0.200 U	0.200 U
NITRITE-N	300	MG/L	1.00 U	0.200 U	1.00 U
SULFATE	300	MG/L	1190	533	771
ACETATE	300.0M	MG/L	1.00 U	1.00 U	1.00 U
BUTYRATE	300.0M	MG/L	1.00 U	1.00 U	1.00 U
LACTATE	300.0M	MG/L	1.00 U	1.00 U	1.00 U
PROPIONATE	300.0M	MG/L	1.00 U	1.00 U	1.00 U
HYDROGEN SULFIDE	4500F	MG/L	1.00 U	1.00 U	1.00 U
TOC	5310B	MG/L	1.23	0.585 J	1.57
Dissolved Metals					
ARSENIC	6010B	MG/L	0.00624 J	0.200 U	0.200 U
IRON	6010B	MG/L	1.42	0.323	0.751
MANGANESE	6010B	MG/L	0.59	0.242	0.978
VOCs					
1,1,1,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,1,1-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,1,2,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,1,2-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,1-DICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,1-DICHLOROETHENE	8260B	UG/L	0.50 U	0.50 U	0.50 U
1,1-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,2,4-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,2,4-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,2-DIBROMO-3-CHLOROPROPANE	8260B	UG/L	2.0 U	2.0 U	2.0 U
1,2-DIBROMOETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,2-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,2-DICHLOROETHANE	8260B	UG/L	0.50 U	0.50 U	0.50 U
1,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,3,5-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,3-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,4-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
2,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 UJ	1.0 U
2-BUTANONE	8260B	UG/L	10 U	10 UJ	10 UJ
2-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
2-HEXANONE	8260B	UG/L	10 U	10 U	10 U
4-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
4-METHYL-2-PENTANONE	8260B	UG/L	10 U	10 U	10 U
ACETONE	8260B	UG/L	10 UJ	10 UJ	10 UJ
BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
BROMOBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
BROMODICHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U

Table 16 (continued)

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/ SCREEN INTERVAL		
			MW-70-21 9/3/2008 (150-170)	MW-70-23 8/28/2008 (110-130)	MW-70-36 9/2/2008 (150-160)
BROMOFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U
BROMOMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U
CARBON DISULFIDE	8260B	UG/L	1.0 U	1.0 UJ	1.0 U
CARBON TETRACHLORIDE	8260B	UG/L	0.50 U	0.50 U	0.50 U
CHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
CHLOROETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U
CHLOROFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U
CHLOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U
CIS-1,2-DICHLOROETHENE	8260B	UG/L	1.0 U	1.0 U	0.21 J
CIS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
DIBROMOCHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
DIBROMOMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
DICHLORODIFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U
ETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
FREON113	8260B	UG/L	1.0 U	1.0 U	1.0 U
HEXACHLOROBUTADIENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
ISOPROPYL BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
M/P-XYLENES	8260B	UG/L	1.0 U	1.0 U	1.0 U
METHYLENE CHLORIDE	8260B	UG/L	1.0 U	1.0 U	1.0 U
MTBE	8260B	UG/L	1.0 U	1.0 U	1.0 U
N-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
N-PROPYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
O-XYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
P-ISOPROPYLTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
SEC-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
STYRENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
TERT-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
TETRACHLOROETHYLENE	8260B	UG/L	1.0 U	1.0 U	2.4
TOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
TRANS-1,2-DICHLOROETHENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
TRANS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
TRICHLOROETHENE	8260B	UG/L	5.0 U	5.0 U	5.0 U
TRICHLOROFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U
VINYL CHLORIDE	8260B	UG/L	0.50 U	0.50 U	0.50 U
XYLENES (TOTAL)	8260B	UG/L	2.0 U	2.0 U	2.0 U
Dissolved Hydrocarbon Gases					
ETHANE	RSK175	UG/L	2.0 U	2.0 U	2.0 U
ETHENE	RSK175	UG/L	2.0 U	2.0 U	2.0 U
METHANE	RSK175	UG/L	4.8	8.3	10

Notes:

J = estimated

ug/l = microgram per liter

mg/l = milligrams per liter

NA = Not Analyzed

U = not detected

POC = Point of Compliance Wells

Bolded parameters are constituents of concern (COCs) and bolded values are above target cleanup goals (TCGs) or federal/state primary maximum contaminant limits (MCLs).

(150-170) Well Screen Interval - feet below ground surface

Table 17
Deep Sand POC Analytical Results

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/SCREEN		
			MW-70-POC02 9/4/2008 (190-200)	MW-70-POC03 9/2/2008 (190-200)	MW-70-POC04 10/14/2008 (195-205)
Wet Chemistry					
TOTAL ALKALINITY	2320B	MG/L	203	138	198
TDS	2540C	MG/L	605	4,500	20,600
BROMIDE	300	MG/L	0.53	6.73	38.4
CHLORIDE-CL	300	MG/L	174	2,190	11,900
NITRATE-N	300	MG/L	0.200 U	0.200 U	0.0915 J
NITRITE-N	300	MG/L	0.200 U	0.400 U	1.00 U
SULFATE	300	MG/L	64	397	1,650
ACETATE	300.0M	MG/L	1.00 U	1.00 U	9.34
BUTYRATE	300.0M	MG/L	1.00 U	1.00 U	1.00 U
LACTATE	300.0M	MG/L	1.00 U	1.00 U	1.00 U
PROPIONATE	300.0M	MG/L	1.00 U	1.00 U	1.00 U
HYDROGEN SULFIDE	4500F	MG/L	1.00 U	1.00 U	1.00 U
TOC	5310B	MG/L	0.630 J	1.09	2.75
Dissolved Metals					
ARSENIC	6010B	MG/L	0.200 U	0.200 U	0.200 U
IRON	6010B	MG/L	0.282	0.555	4.11
MANGANESE	6010B	MG/L	0.0577 J	0.668	2.1
VOCs					
1,1,1,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,1,1-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,1,2,2-TETRACHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,1,2-TRICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,1-DICHLOROETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,1-DICHLOROETHENE	8260B	UG/L	0.50 U	0.50 U	0.50 U
1,1-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,2,3-TRICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,2,4-TRICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,2,4-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,2-DIBROMO-3-CHLOROPROPANE	8260B	UG/L	2.0 U	2.0 U	2.0 U
1,2-DIBROMOETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,2-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,2-DICHLOROETHANE	8260B	UG/L	0.50 U	0.50 U	0.50 U
1,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,3,5-TRIMETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,3-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
1,4-DICHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
2,2-DICHLOROPROPANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
2-BUTANONE	8260B	UG/L	10 U	10 UJ	10 U
2-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
2-HEXANONE	8260B	UG/L	10 U	10 U	10 U
4-CHLOROTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
4-METHYL-2-PENTANONE	8260B	UG/L	10 U	10 U	10 U
ACETONE	8260B	UG/L	10 UJ	10 UJ	10 UJ

Table 17 (continued)

Parameters	Method	Unit	WELL NUMBER/ SAMPLING DATE/SCREEN		
			MW-70-POC02 9/4/2008 (190-200)	MW-70-POC03 9/2/2008 (190-200)	MW-70-POC04 10/14/2008 (195-205)
BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
BROMOBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
BROMODICHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
BROMOFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U
BROMOMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U
CARBON DISULFIDE	8260B	UG/L	1.0 U	0.38 J	1.0 U
CARBON TETRACHLORIDE	8260B	UG/L	0.50 U	0.50 U	0.50 U
CHLOROBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
CHLOROETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U
CHLOROFORM	8260B	UG/L	1.0 U	1.0 U	1.0 U
CHLOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U
CIS-1,2-DICHLOROETHENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
CIS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
DIBROMOCHLOROMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
DIBROMOMETHANE	8260B	UG/L	1.0 U	1.0 U	1.0 U
DICHLORODIFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U
ETHYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
FREON113	8260B	UG/L	1.0 U	1.0 U	1.0 U
HEXACHLOROBUTADIENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
ISOPROPYL BENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
M/P-XYLENES	8260B	UG/L	1.0 U	1.0 U	1.0 U
METHYLENE CHLORIDE	8260B	UG/L	1.0 U	1.0 U	1.0 U
MTBE	8260B	UG/L	1.0 U	1.0 U	1.0 U
N-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
N-PROPYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
O-XYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
P-ISOPROPYLTOLUENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
SEC-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
STYRENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
TERT-BUTYLBENZENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
TETRACHLOROETHYLENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
TOLUENE	8260B	UG/L	1.0 U	1.0 U	0.45 J
TRANS-1,2-DICHLOROETHENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
TRANS-1,3-DICHLOROPROPENE	8260B	UG/L	1.0 U	1.0 U	1.0 U
TRICHLOROETHENE	8260B	UG/L	5.0 U	5.0 U	5.0 U
TRICHLOROFLUOROMETHANE	8260B	UG/L	2.0 U	2.0 U	2.0 U
VINYL CHLORIDE	8260B	UG/L	0.50 U	0.50 U	0.50 U
XYLENES (TOTAL)	8260B	UG/L	2.0 U	2.0 U	2.0 U
Dissolved Hydrocarbon Gases					
ETHANE	RSK175	UG/L	2.0 U	2.0 U	2.0 U
ETHENE	RSK175	UG/L	2.0 U	2.0 U	2.0 U
METHANE	RSK175	UG/L	2.7	5.5	5.2

Notes:

J = estimated

ug/l = microgram per liter

mg/l = milligrams per liter

NA = Not Analyzed

U = not detected

POC = Point of Compliance Wells

Bolded parameters are constituents of concern (COCs) and bolded values are above target cleanup goals (TCGs) or federal/state primary maximum contaminant limits (MCLs).

(190-200) Well Screen Interval - feet below ground surface

Table 18
Soil Vapor Analytical Results

Soil Vapor Probe No.	Concentration	
	Methane (ppmV)	Hydrogen Sulfide (ppbV)
SV-70-01	1,650	4.2 J
SV-70-02	229,000	4.9 J
SV-70-03	330	5.0 U
SV-70-04	NA	NA
SV-70-05	739,000	990
SV-70-06	3,360	5.0 U
SV-70-07	53	4.2 J
SV-70-08	27,100	3.3 J
SV-70-09	93,700	5.0 U
SV-70-10	3,600	4.4 J
SV-70-11	35	3.6 J
SV-70-12	610	5.0 U

Note:
Soil Vapor samples were collected on August 26, 2008.

Acronyms/Abbreviations:
J – estimated value
NA – not applicable; sample was not collected due to the presence of water in sample tubing
ppbV – parts per billion by volume
ppmV – parts per million by volume
U – not detected

Table 19
Summary of Flammability and Health Hazards for Methane and Hydrogen Sulfide Gases

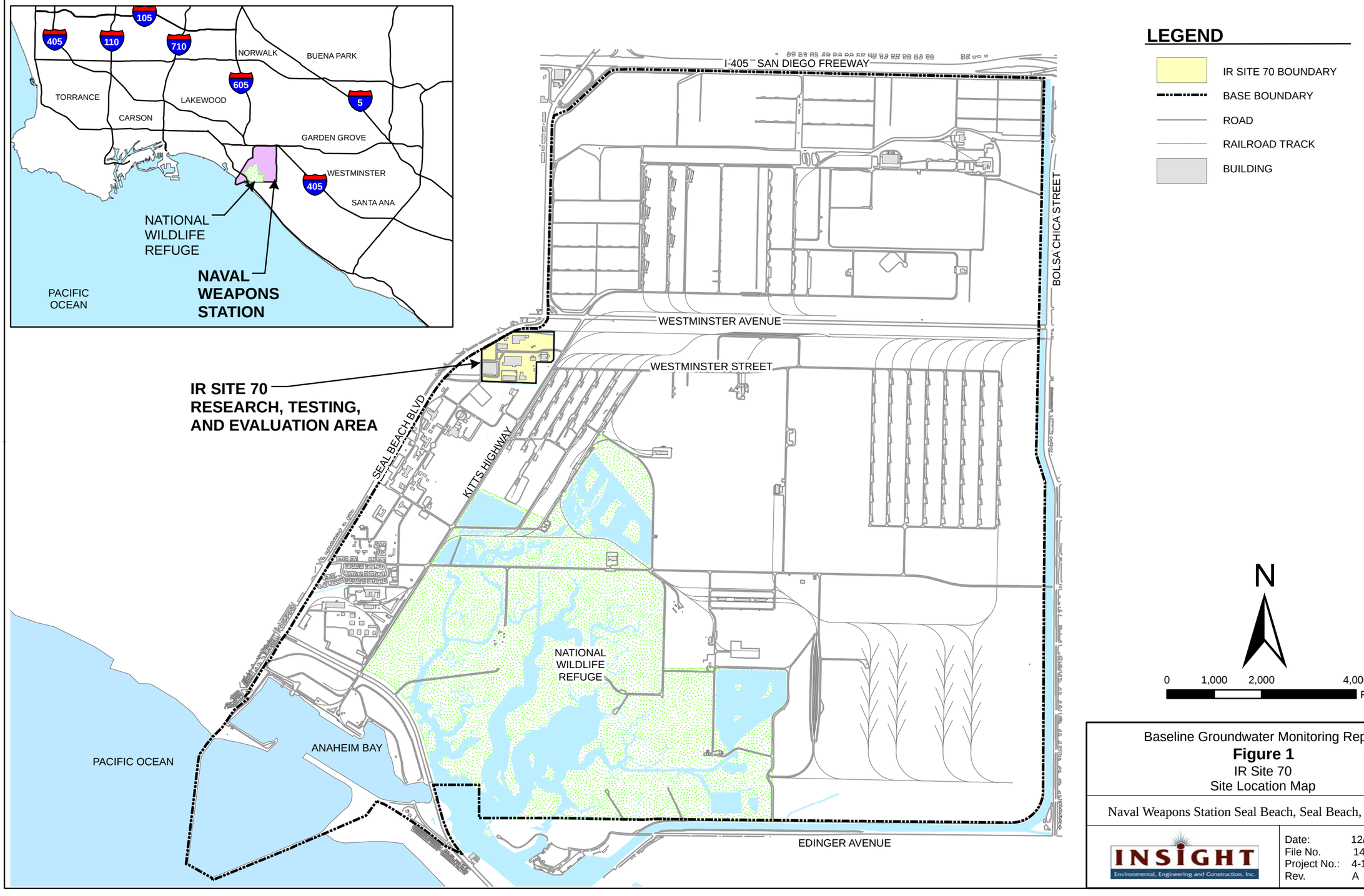
	Flammability Hazards				Exposure Limits in Air						Other
			ATSDR		OSHA PEL			ACGIH TLV			ATSDR
Chemical Name	NFPA Rating	HMIS Rating	LEL (%)	UEL (%)	Ceiling/ Peak (ppm)	TWA (ppm)	STEL (ppm)	TWA (ppm)	STEL (ppm)	IDLH (ppm)	Odor Threshold (ppb)
Methane (CH_4)	4	4	5	15	Methane is a simple asphyxiant. Normal oxygen levels are 20.9% in air and are considered IDLH at levels below 19.5%.						None
Hydrogen sulfide (H_2S)	4	4	4	44	20/50	10	15	10	15	100	0.5 – 1.0

Acronyms/Abbreviations:
- ACGIH – American Conference of Governmental Industrial Hygienists
- ATSDR – Agency for Toxic Substances and Disease Registry (source: Landfill Gas Primer: an Overview for Environmental Health Professionals)
- HMIS – Hazardous Material Identification System
- IDLH – immediately dangerous to life and health
- LEL – lower explosive limit
- NFPA – National fire Protection Association
- OSHA – Occupational Safety and Health Administration
- PEL – permissible exposure limit
- ppb – parts per billion
- ppm – parts per million
- STEL – short-term exposure limit
- TLV – toxicity limit value
- TWA – time-weighted average
- UEL – upper explosive limit

Table 20
Proposed Well Locations for Inclusion in Next Monitoring Event

Well Identifier	Screen Top (feet bgs)	Screen Bottom (feet bgs)	Hydrostratigraphic Zone	Rationale for Well Selection
Existing Well Locations				
MW-70-43A	86	106	FS	Fills in data gap on northeastern extent of plume in the First Sand
MW-70-14	160	170	SS	Fills in data gap on the northeastern extent of plume in the Second Sand
MW-70-43B	136	146	SS	Fills in data gap on northeastern extent of the plume in the Second Sand near SSB-1

Notes:
* Screens are approximate
bgs - below ground surface
FS - 60 to 105 ft bgs
SS - 135 to 170 ft bgs



Baseline Groundwater Monitoring Report

Figure 1

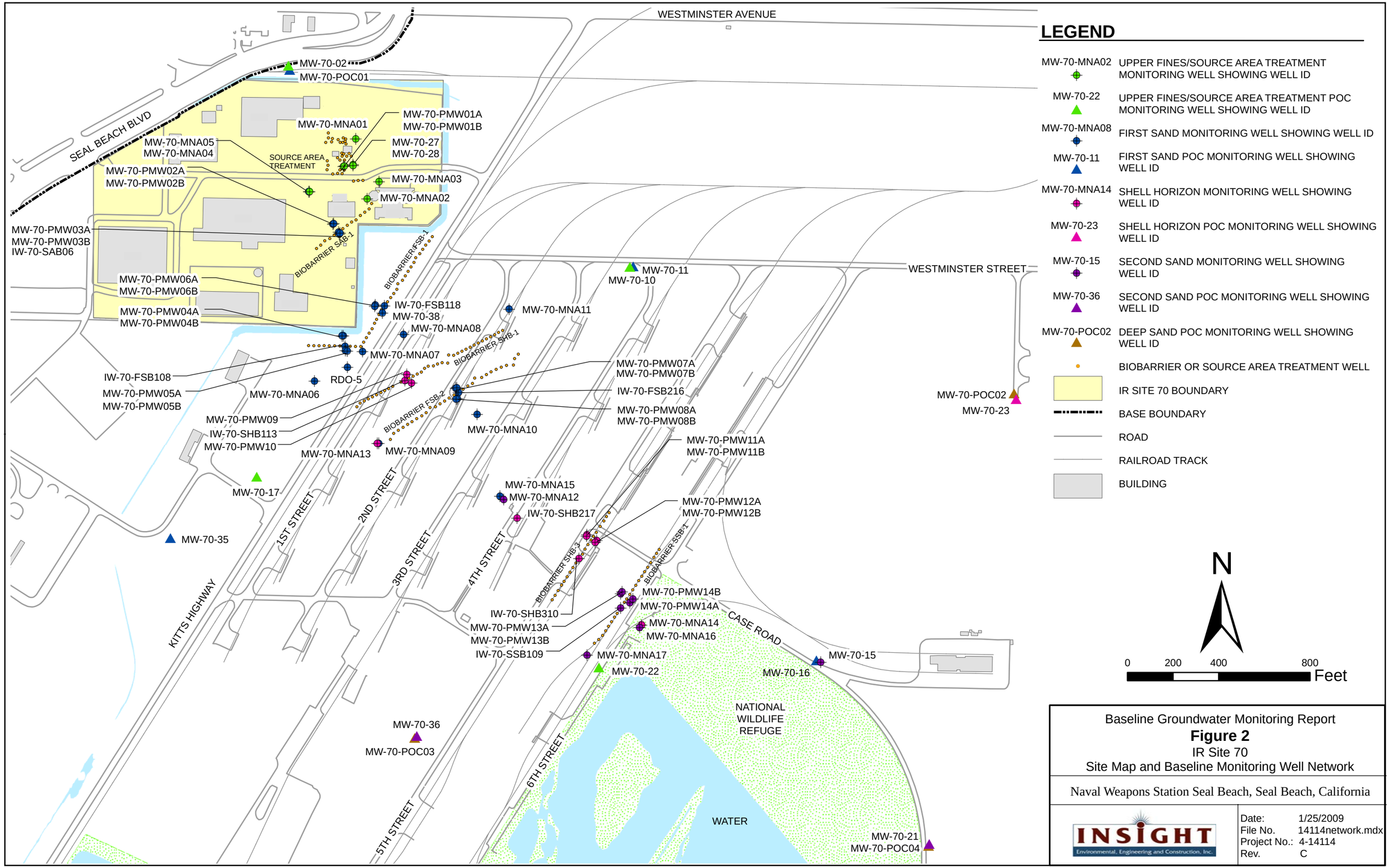
IR Site 70

Site Location Map

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date:	12/14/2008
File No.	14114vic.mdx
Project No.:	4-14114
Rev.	A



LEGEND

- MW-70-MNA02 — UPPER FINES/SOURCE AREA TREATMENT MONITORING WELL SHOWING WELL ID
- MW-70-22 — UPPER FINES/SOURCE AREA TREATMENT POC MONITORING WELL SHOWING WELL ID
- MW-70-MNA08 — FIRST SAND MONITORING WELL SHOWING WELL ID
- MW-70-11 — FIRST SAND POC MONITORING WELL SHOWING WELL ID
- MW-70-MNA14 — SHELL HORIZON MONITORING WELL SHOWING WELL ID
- MW-70-23 — SHELL HORIZON POC MONITORING WELL SHOWING WELL ID
- MW-70-15 — SECOND SAND MONITORING WELL SHOWING WELL ID
- MW-70-36 — SECOND SAND POC MONITORING WELL SHOWING WELL ID
- MW-70-POC02 — DEEP SAND POC MONITORING WELL SHOWING WELL ID
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- BUILDING

N

0 200 400 800 Feet

Baseline Groundwater Monitoring Report

Figure 2

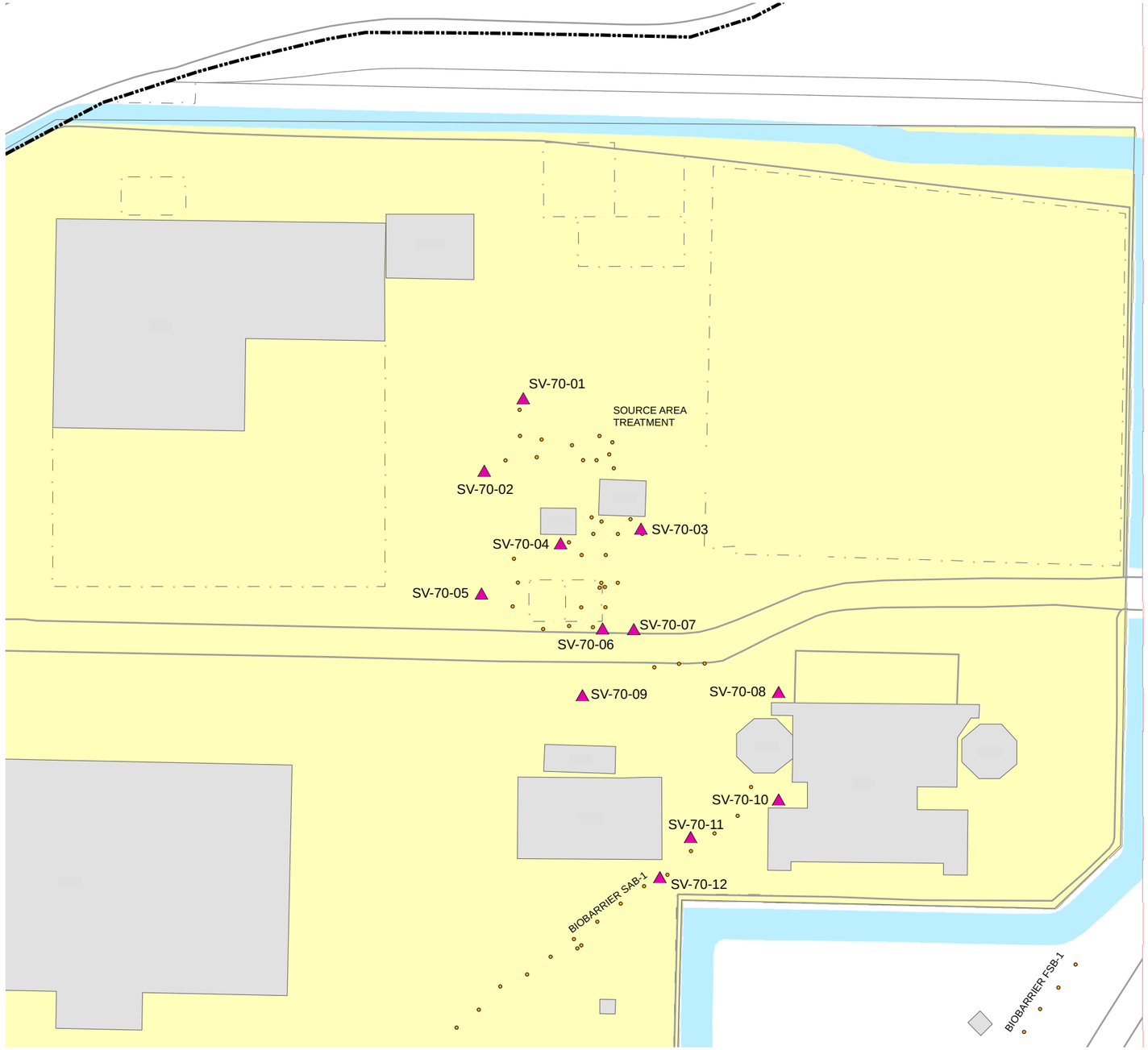
IR Site 70

Site Map and Baseline Monitoring Well Network

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date:	1/25/2009
File No.	14114network.mdx
Project No.:	4-14114
Rev.	C



LEGEND

- SV-70-09 — SOIL VAPOR PROBE LOCATION SHOWING ID
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- FENCE
- BUILDING

N

0 50 100 200 Feet

Baseline Groundwater Monitoring Report

Figure 3

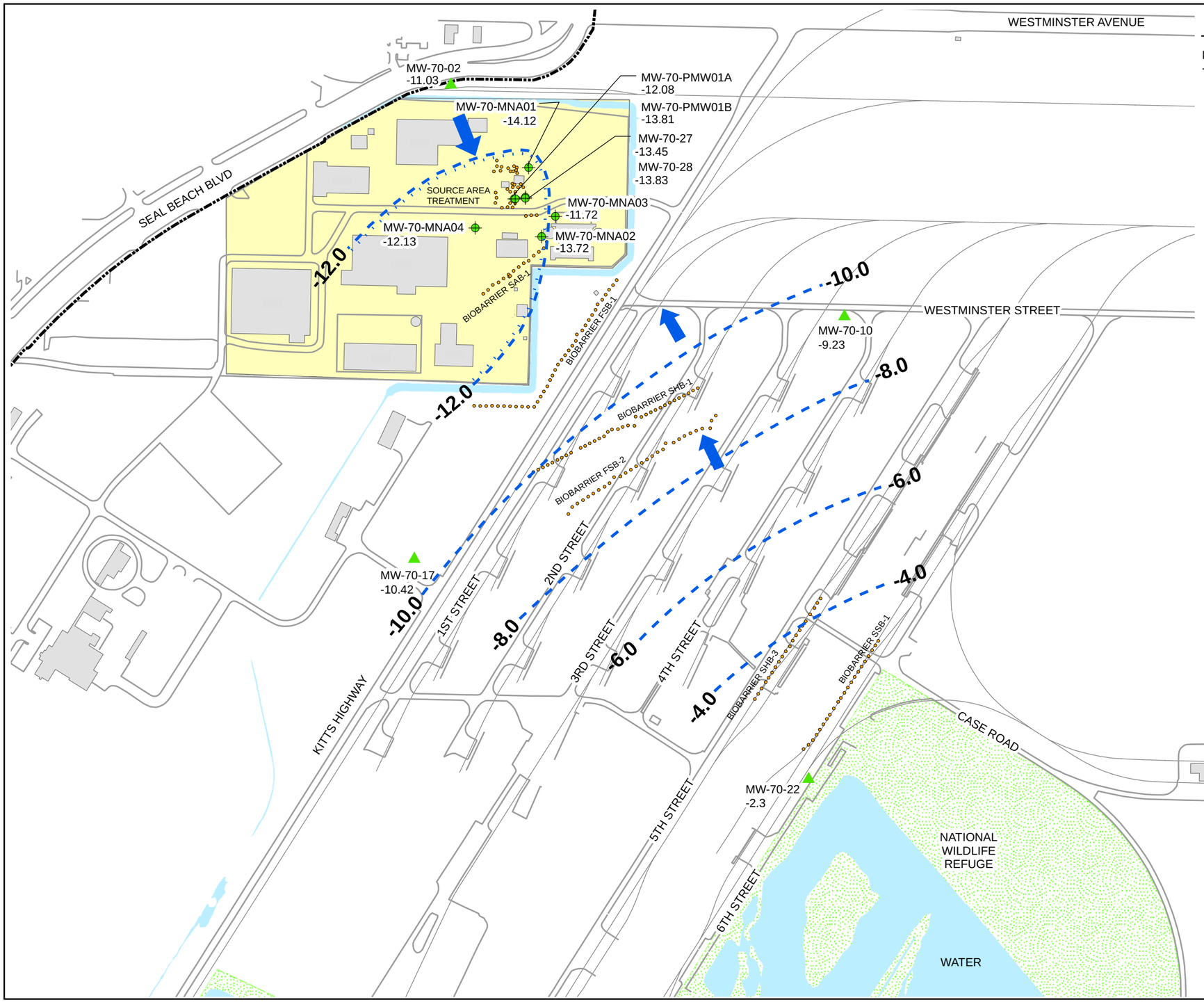
IR Site 70

Soil Vapor Location Map

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date:	1/18/2009
File No.	14114sv.mdx
Project No.:	4-14114
Rev.	B



LEGEND

- MW-70-MNA02 -13.72 — UPPER FINES/SOURCE AREA TREATMENT MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
- MW-70-10 -9.23 — UPPER FINES POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- INFERRED DIRECTION OF GROUNDWATER FLOW, LOCAL VARIATIONS DUE TO SEASONAL, TIDAL, AND AGRICULTURAL INFLUENCES
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- APPROXIMATE GROUNDWATER ELEVATION, IN FEET MEAN SEA LEVEL, HATCH MARKS POINT DOWNGRADIENT
- BUILDING

NOTES:

WATER LEVELS MEASURED ON AUGUST 18, 2008 WITH THE EXCEPTION OF WELLS MW-70-27 AND MW-70-28 WHICH WERE MEASURED ON AUGUST 21, 2008

HORIZONTAL HYDRAULIC GRADIENT VARIES ACROSS THE SITE FROM 0.002 TO 0.005 FOOT/FOOT

Baseline Groundwater Monitoring Report

Figure 4

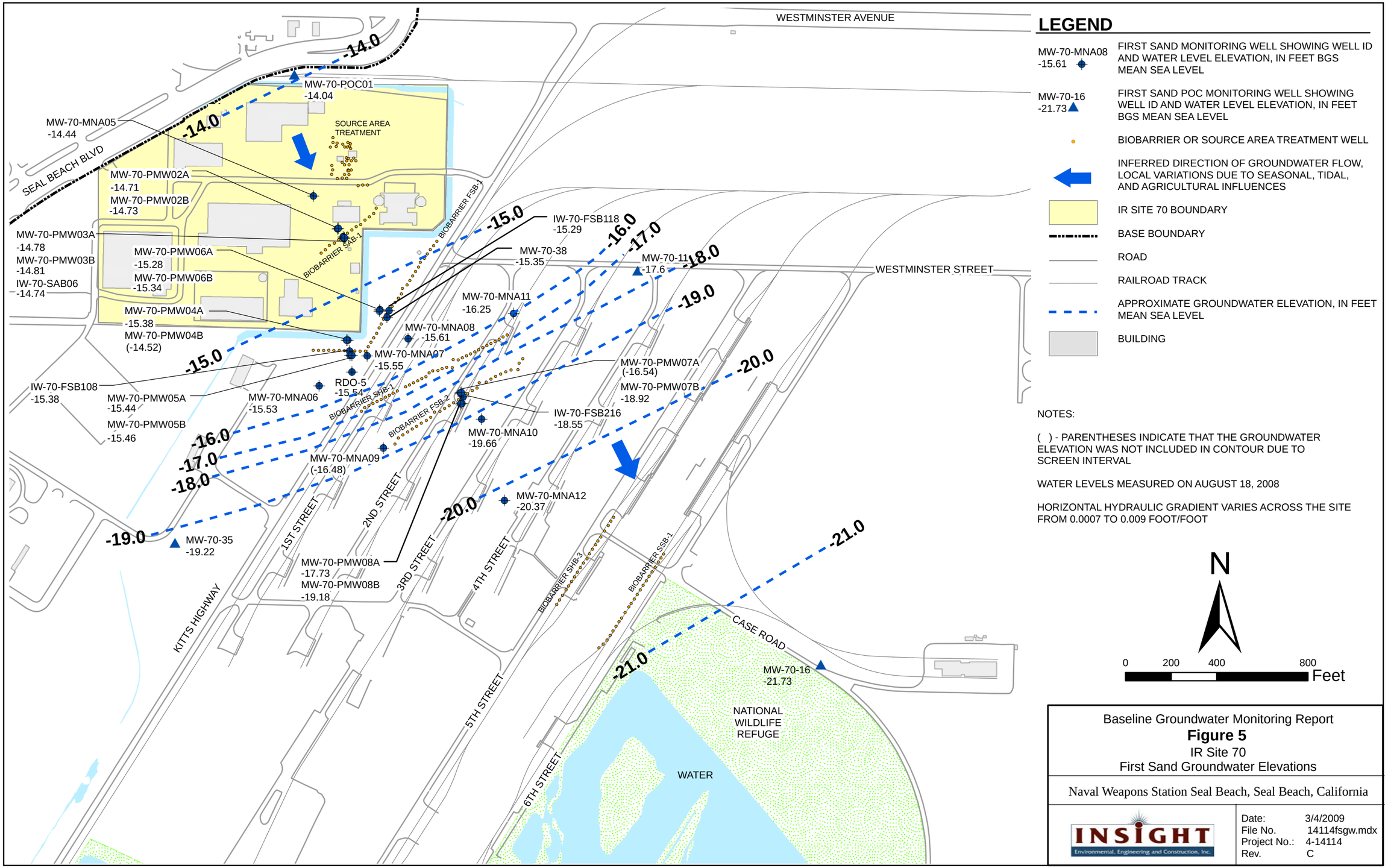
IR Site 70

Upper Fines Groundwater Elevations

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date:	3/4/2009
File No.	14114ufgw.mdx
Project No.:	4-14114
Rev.	C



LEGEND

- MW-70-MNA08 -15.61 — FIRST SAND MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET BGS MEAN SEA LEVEL
- MW-70-16 -21.73 — FIRST SAND POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET BGS MEAN SEA LEVEL
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- INFERRED DIRECTION OF GROUNDWATER FLOW, LOCAL VARIATIONS DUE TO SEASONAL, TIDAL, AND AGRICULTURAL INFLUENCES
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- APPROXIMATE GROUNDWATER ELEVATION, IN FEET MEAN SEA LEVEL
- BUILDING

NOTES:

( ) - PARENTHESES INDICATE THAT THE GROUNDWATER ELEVATION WAS NOT INCLUDED IN CONTOUR DUE TO SCREEN INTERVAL

WATER LEVELS MEASURED ON AUGUST 18, 2008

HORIZONTAL HYDRAULIC GRADIENT VARIES ACROSS THE SITE FROM 0.0007 TO 0.009 FOOT/FOOT

N

0 200 400 800 Feet

Baseline Groundwater Monitoring Report

Figure 5

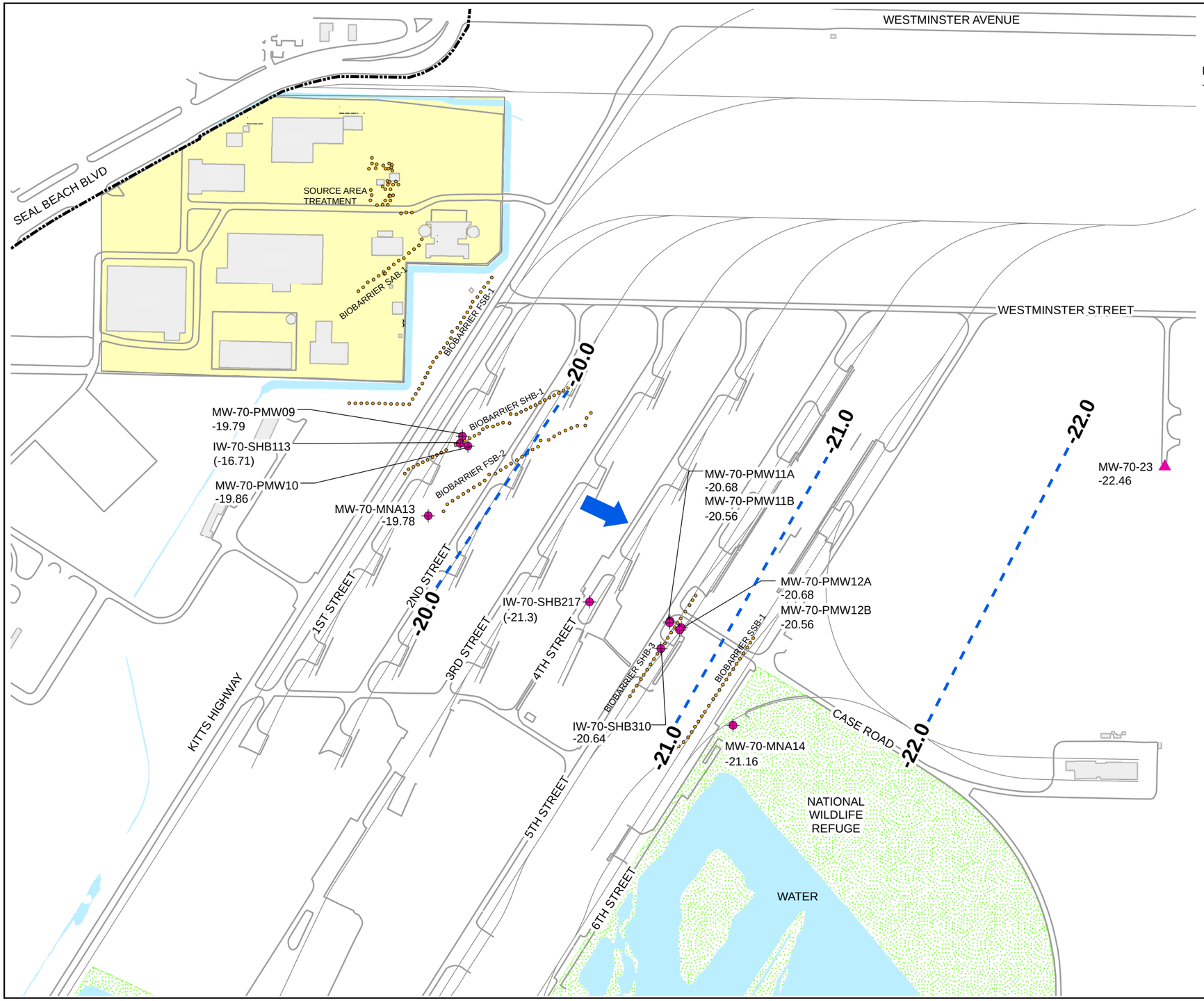
IR Site 70

First Sand Groundwater Elevations

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date:	3/4/2009
File No.	14114fsgw.mdx
Project No.:	4-14114
Rev.	C



LEGEND

- MW-70-MNA14 -21.16 — SHELL HORIZON MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
- MW-70-23 -22.46 — SHELL HORIZON POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- INFERRED DIRECTION OF GROUNDWATER FLOW, LOCAL VARIATIONS DUE TO SEASONAL, TIDAL, AND AGRICULTURAL INFLUENCES
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- APPROXIMATE GROUNDWATER ELEVATION, IN FEET MEAN SEA LEVEL
- BUILDING

NOTES:

( ) - PARENTHESES INDICATE THAT THE GROUNDWATER ELEVATION WAS NOT INCLUDED IN CONTOUR DUE TO SCREEN INTERVAL

WATER LEVELS MEASURED ON AUGUST 18, 2008

HORIZONTAL HYDRAULIC GRADIENT ACROSS THE SITE IS APPROXIMATELY 0.001 FOOT/FOOT

N

0 200 400 800 Feet

Baseline Groundwater Monitoring Report

Figure 6

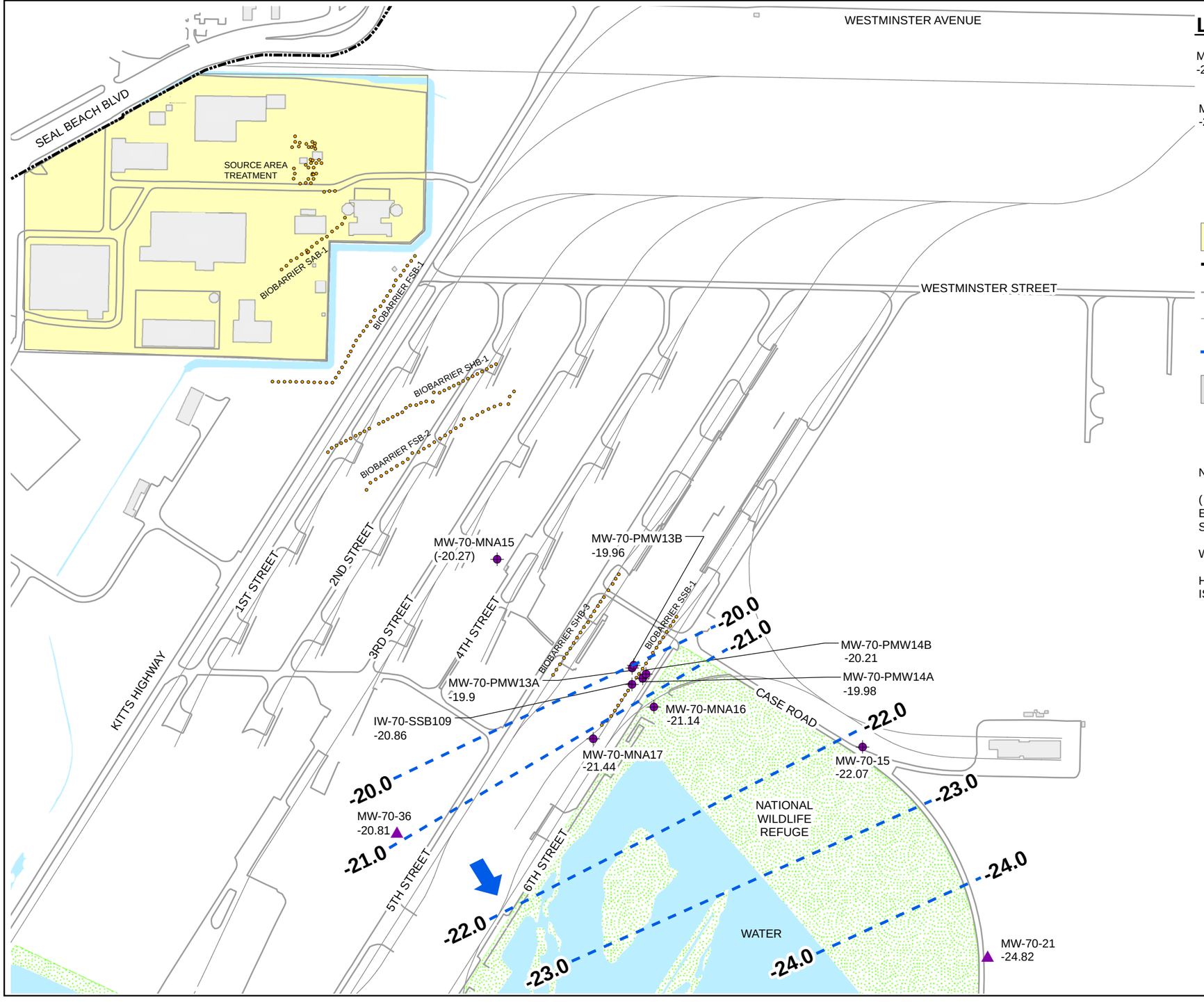
IR Site 70

Shell Horizon Groundwater Elevations

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 3/4/2009
File No. 14114shgw.mdx
Project No.: 4-14114
Rev. D



LEGEND

- MW-70-15 -22.07 — SECOND SAND MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
- MW-70-36 -20.81 — SECOND SAND POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- INFERRED DIRECTION OF GROUNDWATER FLOW, LOCAL VARIATIONS DUE TO SEASONAL, TIDAL, AND AGRICULTURAL INFLUENCES
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- APPROXIMATE GROUNDWATER ELEVATION, IN FEET MEAN SEA LEVEL
- BUILDING

NOTES:

( ) - PARENTHESES INDICATE THAT THE GRONDWATER ELEVATION WAS NOT INCLUDED IN CONTOUR DUE TO SCREEN INTERVAL

WATER LEVELS MEASURED ON AUGUST 18, 2008

HORIZONTAL HYDRAULIC GRADIENT ACROSS THE SITE IS APPROXIMATELY 0.001 FOOT/FOOT

N

0 200 400 800 Feet

Baseline Groundwater Monitoring Report

Figure 7

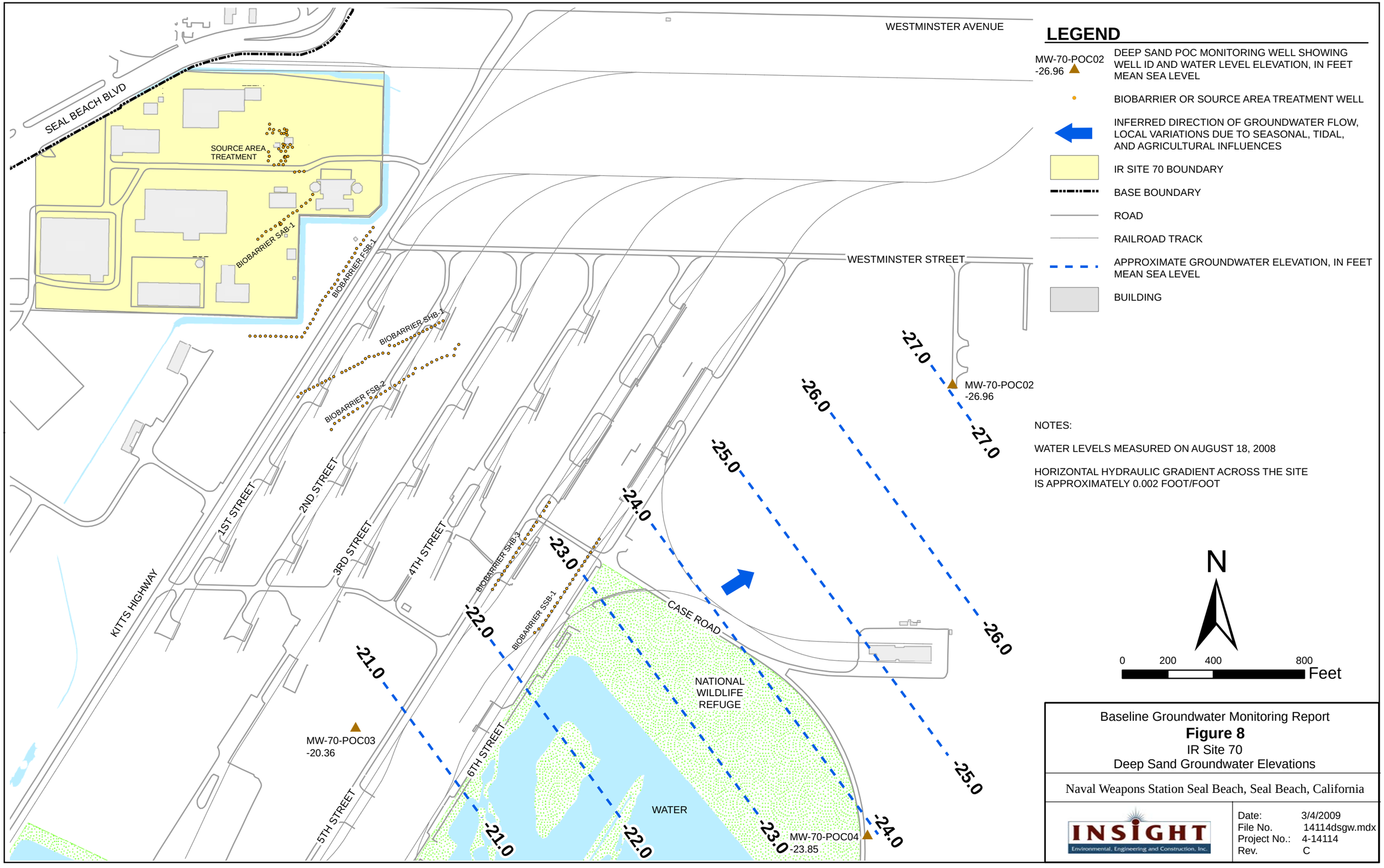
IR Site 70

Second Sand Groundwater Elevations

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date:	3/4/2009
File No.	14114ssgw.mdx
Project No.:	4-14114
Rev.	D



Baseline Groundwater Monitoring Report

Figure 8

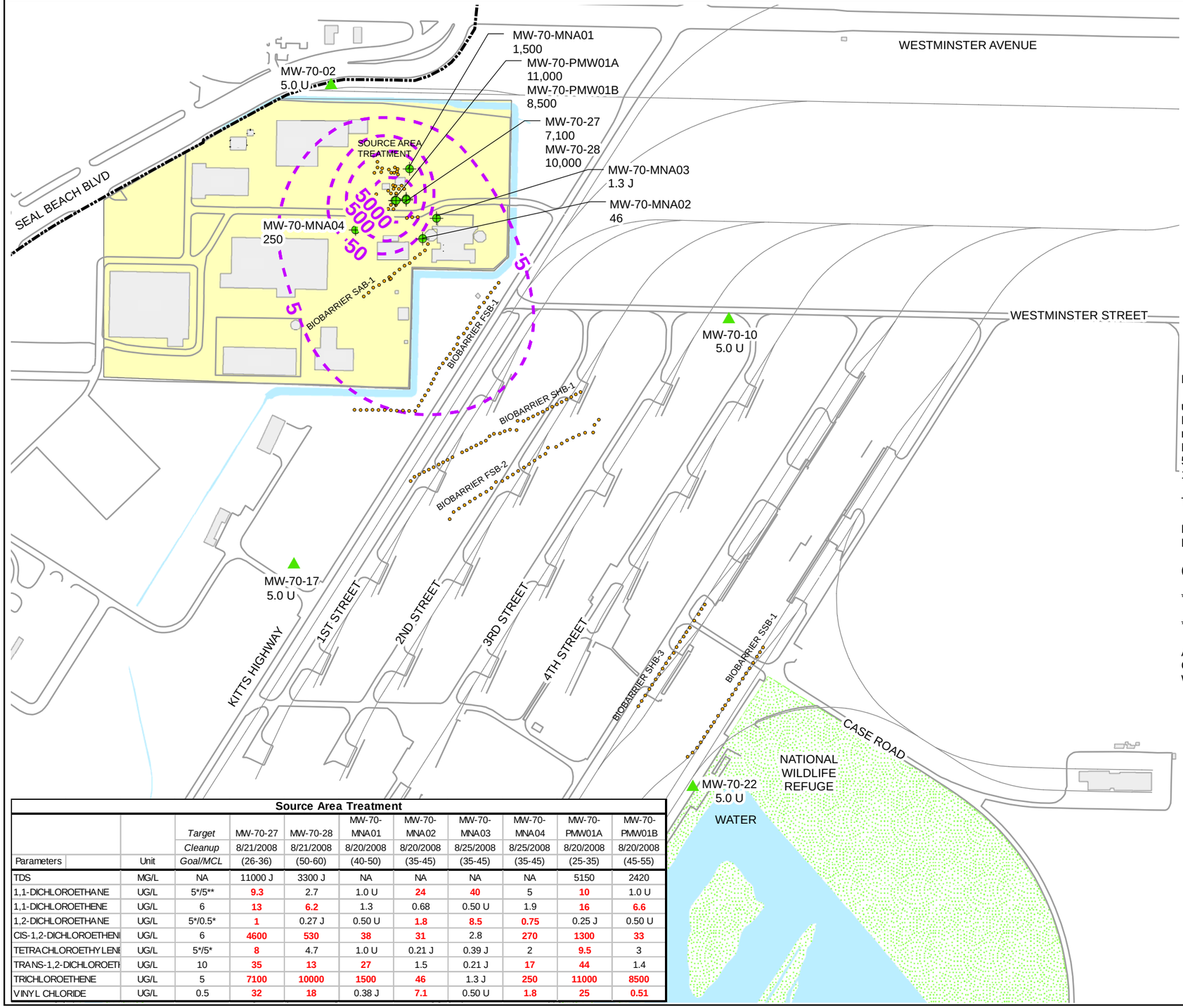
IR Site 70

Deep Sand Groundwater Elevations

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date:	3/4/2009
File No.	14114dsgw.mdx
Project No.:	4-14114
Rev.	C



LEGEND

- MW-70-MNA02 / 46 — UPPER FINES/SOURCE AREA TREATMENT MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L
- MW-70-02 / 5.0 U — UPPER FINES POC MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- BUILDING
- -5- — APPROXIMATE TCE ISOCONCENTRATION CONTOUR (ug/L), DASHED WHERE INFERRED

NOTES:

ug/L - MICROGRAMS PER LITER
MCL - MAXIMUM CONTAMINANT LEVEL
mg/L - MILLIGRAMS PER LITER
NA - NOT ANALYZED
5.0 U - NOT DETECTED LESS THAN REPORTING LIMIT OF 5 ug/L
1.3 J - ESTIMATED VALUE OF 1.3 ug/L

TCE - TRICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

* - U.S. EPA MCL

** - Cal/EPA MCL

ADDITIONAL INTERPRETATION BASED ON BEI (2006) FINAL FIFTH ANNUAL GROUNDWATER MONITORING REPORT, IR SITE 40 AND 70, NAVAL WEAPONS STATION, SEAL BEACH, CA, APRIL

N

0 200 400 800 Feet

Source Area Treatment

		Target	MW-70-27	MW-70-28	MW-70-MNA01	MW-70-MNA02	MW-70-MNA03	MW-70-MNA04	MW-70-PMW01A	MW-70-PMW01B
		Cleanup	8/21/2008	8/21/2008	8/20/2008	8/20/2008	8/25/2008	8/25/2008	8/20/2008	8/20/2008
Parameters	Unit	Goal/MCL	(26-36)	(50-60)	(40-50)	(35-45)	(35-45)	(35-45)	(25-35)	(45-55)
TDS	MG/L	NA	11000 J	3300 J	NA	NA	NA	NA	5150	2420
1,1-DICHLOROETHANE	UG/L	5*/5**	**9.3**	2.7	1.0 U	**24**	**40**	5	**10**	1.0 U
1,1-DICHLOROETHENE	UG/L	6	**13**	**6.2**	1.3	0.68	0.50 U	1.9	**16**	**6.6**
1,2-DICHLOROETHANE	UG/L	5*/0.5*	**1**	0.27 J	0.50 U	**1.8**	**8.5**	**0.75**	0.25 J	0.50 U
CIS-1,2-DICHLOROETHENE	UG/L	6	**4600**	**530**	**38**	**31**	2.8	**270**	**1300**	**33**
TETRACHLOROETHYLENE	UG/L	5*/5*	**8**	4.7	1.0 U	0.21 J	0.39 J	2	**9.5**	3
TRANS-1,2-DICHLOROETH	UG/L	10	**35**	**13**	**27**	1.5	0.21 J	**17**	**44**	1.4
TRICHLOROETHENE	UG/L	5	**7100**	**10000**	**1500**	**46**	1.3 J	**250**	**11000**	**8500**
VINYL CHLORIDE	UG/L	0.5	**32**	**18**	0.38 J	**7.1**	0.50 U	**1.8**	**25**	**0.51**

Baseline Groundwater Monitoring Report

Figure 9

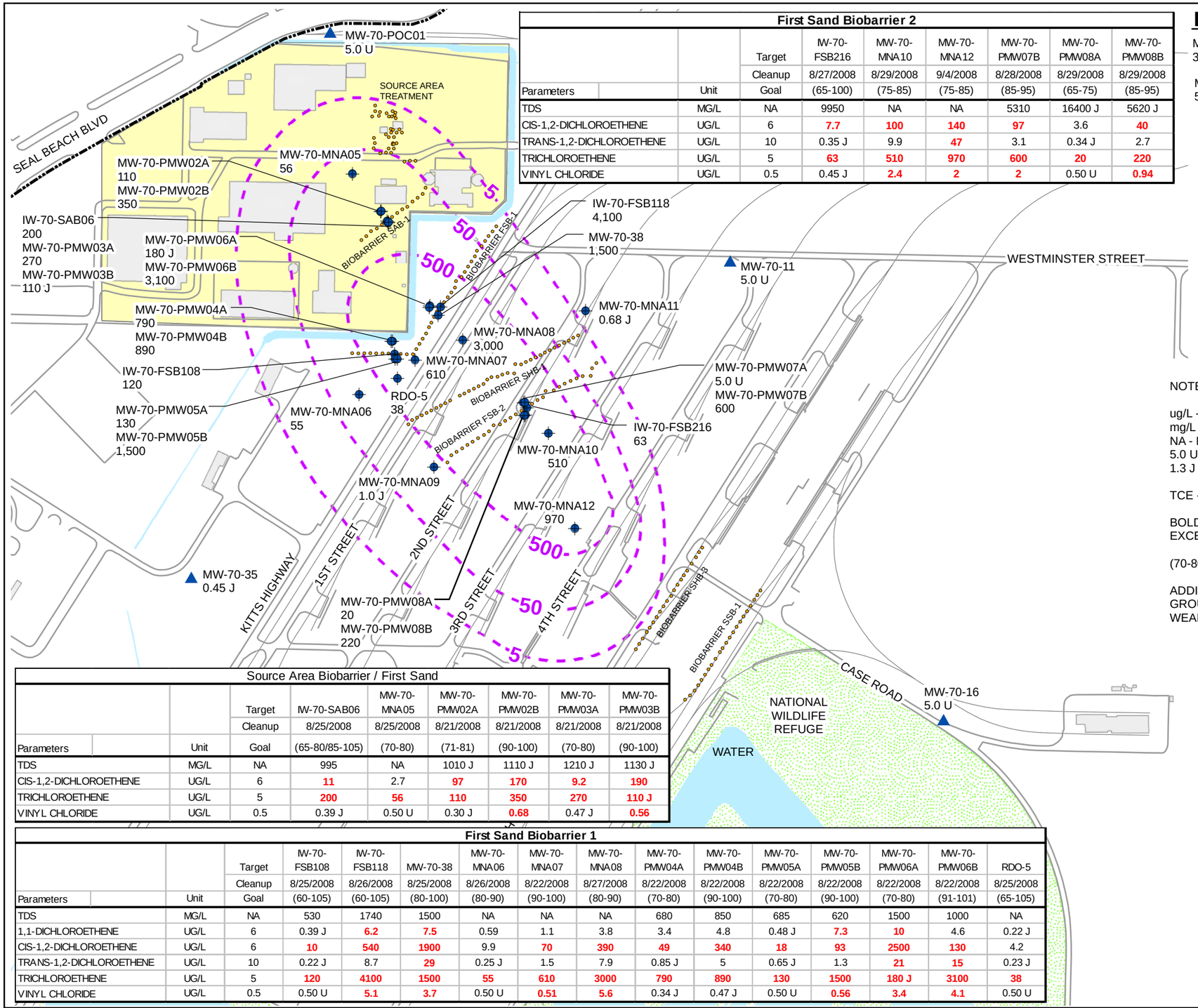
IR Site 70

Upper Fines Groundwater Sampling Results

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 3/4/2009
File No. 14114ufcoc.mdx
Project No.: 4-14114
Rev. C



First Sand Biobarrier 2

Parameters	Unit	Target Cleanup Goal	IW-70-FSB216 8/27/2008	MW-70-MNA10 8/29/2008	MW-70-MNA12 9/4/2008	MW-70-PMW07B 8/28/2008	MW-70-PMW08A 8/29/2008	MW-70-PMW08B 8/29/2008
			(65-100)	(75-85)	(75-85)	(85-95)	(65-75)	(85-95)
TDS	MG/L	NA	9950	NA	NA	5310	16400 J	5620 J
CIS-1,2-DICHLOROETHENE	UG/L	6	**7.7**	**100**	**140**	**97**	3.6	**40**
TRANS-1,2-DICHLOROETHENE	UG/L	10	0.35 J	9.9	**47**	3.1	0.34 J	2.7
TRICHLOROETHENE	UG/L	5	**63**	**510**	**970**	**600**	**20**	**220**
VINYL CHLORIDE	UG/L	0.5	0.45 J	**2.4**	**2**	**2**	0.50 U	**0.94**

Source Area Biobarrier / First Sand

Parameters	Unit	Target Cleanup Goal	IW-70-SAB06 8/25/2008	MW-70-MNA05 8/25/2008	MW-70-PMW02A 8/21/2008	MW-70-PMW02B 8/21/2008	MW-70-PMW03A 8/21/2008	MW-70-PMW03B 8/21/2008
			(65-80/85-105)	(70-80)	(71-81)	(90-100)	(70-80)	(90-100)
TDS	MG/L	NA	995	NA	1010 J	1110 J	1210 J	1130 J
CIS-1,2-DICHLOROETHENE	UG/L	6	**11**	2.7	**97**	**170**	**9.2**	**190**
TRICHLOROETHENE	UG/L	5	**200**	**56**	**110**	**350**	**270**	**110 J**
VINYL CHLORIDE	UG/L	0.5	0.39 J	0.50 U	0.30 J	**0.68**	0.47 J	**0.56**

First Sand Biobarrier 1

Parameters	Unit	Target Cleanup Goal	IW-70-FSB108 8/25/2008	IW-70-FSB118 8/26/2008	MW-70-38 8/25/2008	MW-70-MNA06 8/26/2008	MW-70-MNA07 8/22/2008	MW-70-MNA08 8/27/2008	MW-70-PMW04A 8/22/2008	MW-70-PMW04B 8/22/2008	MW-70-PMW05A 8/22/2008	MW-70-PMW05B 8/22/2008	MW-70-PMW06A 8/22/2008	MW-70-PMW06B 8/22/2008	RDO-5 8/25/2008
			(60-105)	(60-105)	(80-100)	(80-90)	(90-100)	(80-90)	(70-80)	(90-100)	(70-80)	(90-100)	(70-80)	(91-101)	(65-105)
TDS	MG/L	NA	530	1740	1500	NA	NA	NA	680	850	685	620	1500	1000	NA
1,1-DICHLOROETHENE	UG/L	6	0.39 J	**6.2**	**7.5**	0.59	1.1	3.8	3.4	4.8	0.48 J	**7.3**	**10**	4.6	0.22 J
CIS-1,2-DICHLOROETHENE	UG/L	6	**10**	**540**	**1900**	9.9	**70**	**390**	**49**	**340**	**18**	**93**	**2500**	**130**	4.2
TRANS-1,2-DICHLOROETHENE	UG/L	10	0.22 J	8.7	**29**	0.25 J	1.5	7.9	0.85 J	5	0.65 J	1.3	**21**	**15**	0.23 J
TRICHLOROETHENE	UG/L	5	**120**	**4100**	**1500**	**55**	**610**	**3000**	**790**	**890**	**130**	**1500**	**180 J**	**3100**	**38**
VINYL CHLORIDE	UG/L	0.5	0.50 U	**5.1**	**3.7**	0.50 U	**0.51**	**5.6**	0.34 J	0.47 J	0.50 U	**0.56**	**3.4**	**4.1**	0.50 U

LEGEND

- MW-70-MNA08 3,000 — FIRST SAND MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION (ug/L)
- MW-70-11 5.0 U — FIRST SAND POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION (ug/L)
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- BUILDING
- -5- APPROXIMATE TCE ISOCONCENTRATION CONTOUR (ug/L), DASHED WHERE INFERRED

NOTES:

ug/L - MICROGRAMS PER LITER
mg/L - MILLIGRAMS PER LITER
NA - NOT ANALYZED
5.0 U - NOT DETECTED LESS THAN REPORTING LIMIT OF 5 ug/L
1.3 J - ESTIMATED VALUE OF 1.3 ug/L

TCE - TRICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(70-80) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

ADDITIONAL INTERPRETATION BASED ON BEI (2006) FINAL FIFTH ANNUAL GROUNDWATER MONITORING REPORT, IR SITE 40 AND 70, NAVAL WEAPONS STATION, SEAL BEACH, CA, APRIL

N

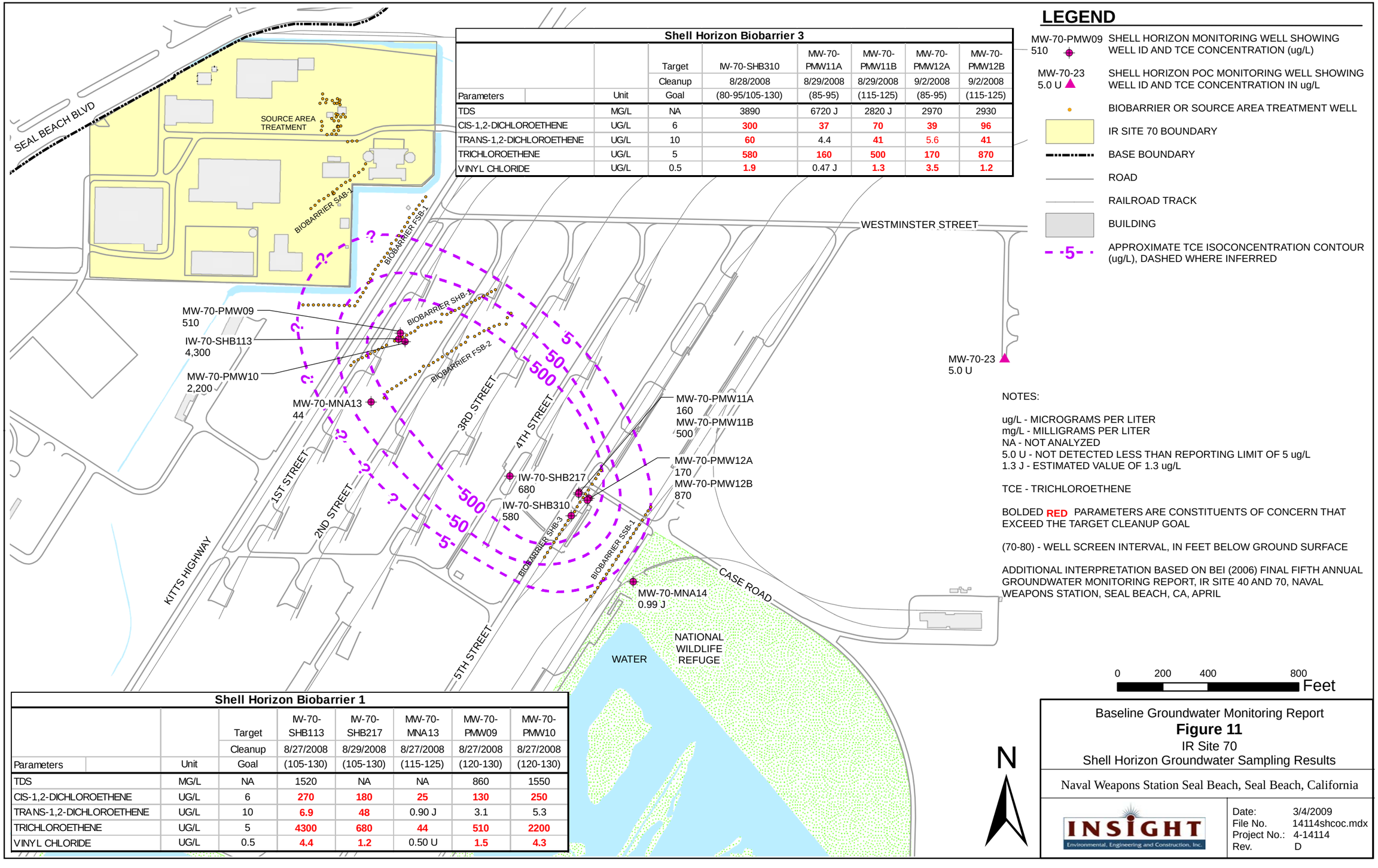
0 200 400 800 Feet

Baseline Groundwater Monitoring Report
Figure 10
IR Site 70
First Sand Groundwater Sampling Results

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 1/17/2009
File No. 14114fscoc.mdx
Project No.: 4-14114
Rev. B



Shell Horizon Biobarrier 3

Parameters	Unit	Target Cleanup Goal	IW-70-SHB310 8/28/2008 (80-95/105-130)	MW-70-PMW11A 8/29/2008 (85-95)	MW-70-PMW11B 8/29/2008 (115-125)	MW-70-PMW12A 9/2/2008 (85-95)	MW-70-PMW12B 9/2/2008 (115-125)
TDS	MG/L	NA	3890	6720 J	2820 J	2970	2930
CIS-1,2-DICHLOROETHENE	UG/L	6	**300**	**37**	**70**	**39**	**96**
TRANS-1,2-DICHLOROETHENE	UG/L	10	**60**	4.4	**41**	5.6	**41**
TRICHLOROETHENE	UG/L	5	**580**	**160**	**500**	**170**	**870**
VINYL CHLORIDE	UG/L	0.5	**1.9**	0.47 J	**1.3**	**3.5**	**1.2**

Shell Horizon Biobarrier 1

Parameters	Unit	Target Cleanup Goal	MW-70-SHB113 8/27/2008 (105-130)	MW-70-SHB217 8/29/2008 (105-130)	MW-70-MNA13 8/27/2008 (115-125)	MW-70-PMW09 8/27/2008 (120-130)	MW-70-PMW10 8/27/2008 (120-130)
TDS	MG/L	NA	1520	NA	NA	860	1550
CIS-1,2-DICHLOROETHENE	UG/L	6	**270**	**180**	**25**	**130**	**250**
TRANS-1,2-DICHLOROETHENE	UG/L	10	**6.9**	**48**	0.90 J	3.1	5.3
TRICHLOROETHENE	UG/L	5	**4300**	**680**	**44**	**510**	**2200**
VINYL CHLORIDE	UG/L	0.5	**4.4**	**1.2**	0.50 U	**1.5**	**4.3**

LEGEND

- MW-70-PMW09 510 — SHELL HORIZON MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION (ug/L)
- MW-70-23 5.0 U — SHELL HORIZON POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- BUILDING
- -5- APPROXIMATE TCE ISOCONCENTRATION CONTOUR (ug/L), DASHED WHERE INFERRED

NOTES:

ug/L - MICROGRAMS PER LITER
mg/L - MILLIGRAMS PER LITER
NA - NOT ANALYZED
5.0 U - NOT DETECTED LESS THAN REPORTING LIMIT OF 5 ug/L
1.3 J - ESTIMATED VALUE OF 1.3 ug/L

TCE - TRICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(70-80) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

ADDITIONAL INTERPRETATION BASED ON BEI (2006) FINAL FIFTH ANNUAL GROUNDWATER MONITORING REPORT, IR SITE 40 AND 70, NAVAL WEAPONS STATION, SEAL BEACH, CA, APRIL

Baseline Groundwater Monitoring Report

Figure 11

IR Site 70

Shell Horizon Groundwater Sampling Results

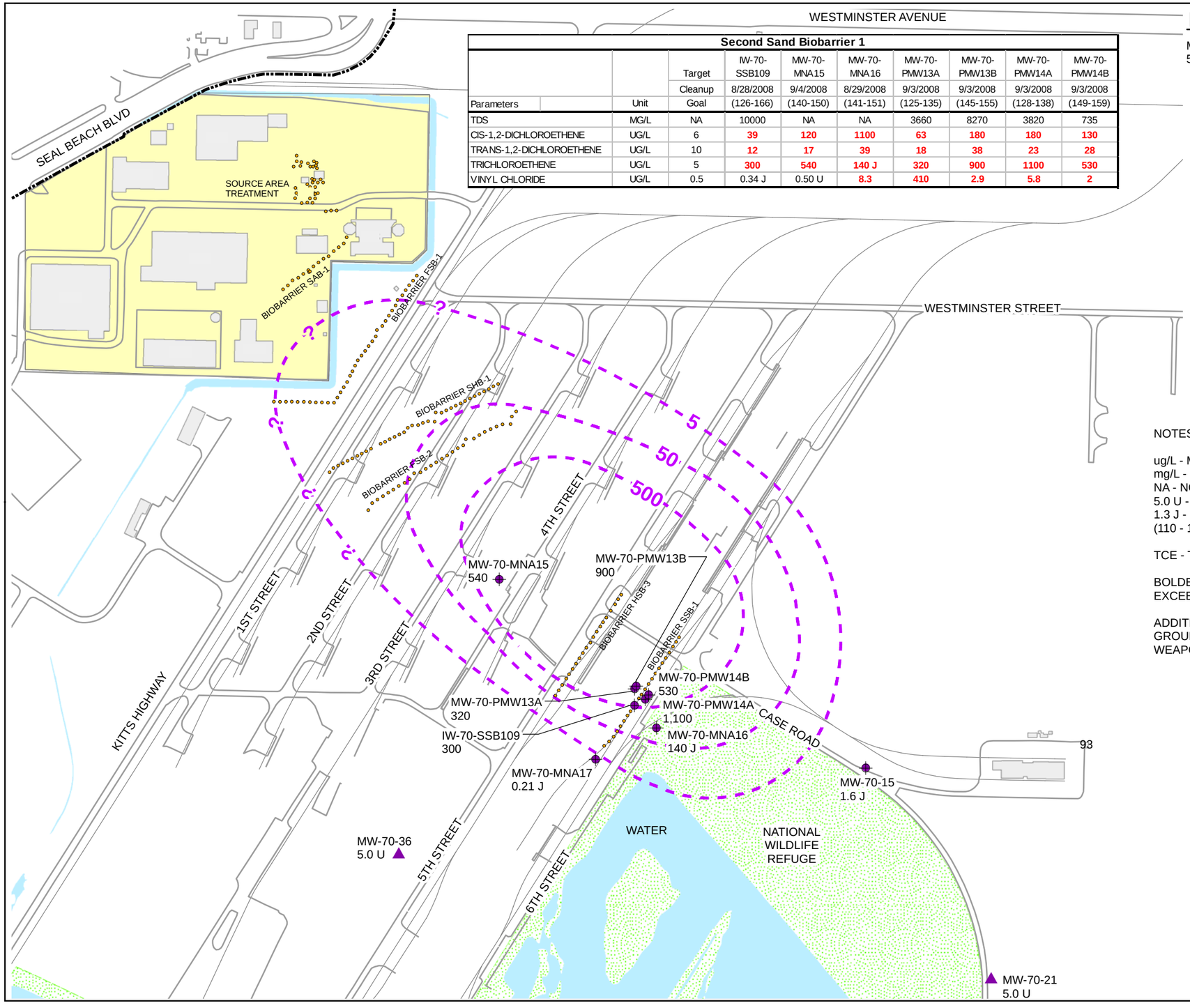
Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT Environmental, Engineering and Construction, Inc.

Date: 3/4/2009
File No. 14114shcoc.mdx
Project No.: 4-14114
Rev. D

Second Sand Biobarrier 1

Parameters	Unit	Target Cleanup Goal	IW-70-SSB109 8/28/2008 (126-166)	MW-70-MNA15 9/4/2008 (140-150)	MW-70-MNA16 8/29/2008 (141-151)	MW-70-PMW13A 9/3/2008 (125-135)	MW-70-PMW13B 9/3/2008 (145-155)	MW-70-PMW14A 9/3/2008 (128-138)	MW-70-PMW14B 9/3/2008 (149-159)
TDS	MG/L	NA	10000	NA	NA	3660	8270	3820	735
CIS-1,2-DICHLOROETHENE	UG/L	6	**39**	**120**	**1100**	**63**	**180**	**180**	**130**
TRANS-1,2-DICHLOROETHENE	UG/L	10	**12**	**17**	**39**	**18**	**38**	**23**	**28**
TRICHLOROETHENE	UG/L	5	**300**	**540**	**140 J**	**320**	**900**	**1100**	**530**
VINYL CHLORIDE	UG/L	0.5	0.34 J	0.50 U	**8.3**	**410**	**2.9**	**5.8**	**2**



LEGEND

- MW-70-MNA15 500 — SECOND SAND MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION (ug/L)
- MW-70-36 5.0 U — SECOND SAND POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION (ug/L)
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- BUILDING
- -5- APPROXIMATE TCE ISOCONCENTRATION CONTOUR (ug/L), DASHED WHERE INFERRED

NOTES:

ug/L - MICROGRAMS PER LITER
mg/L - MILLIGRAMS PER LITER
NA - NOT ANALYZED
5.0 U - NOT DETECTED LESS THAN REPORTING LIMIT OF 5 ug/L
1.3 J - ESTIMATED VALUE OF 1.3 ug/L
(110 - 170) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

TCE - TRICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

ADDITIONAL INTERPRETATION BASED ON BEI (2006) FINAL FIFTH ANNUAL GROUNDWATER MONITORING REPORT, IR SITE 40 AND 70, NAVAL WEAPONS STATION, SEAL BEACH, CA, APRIL

N

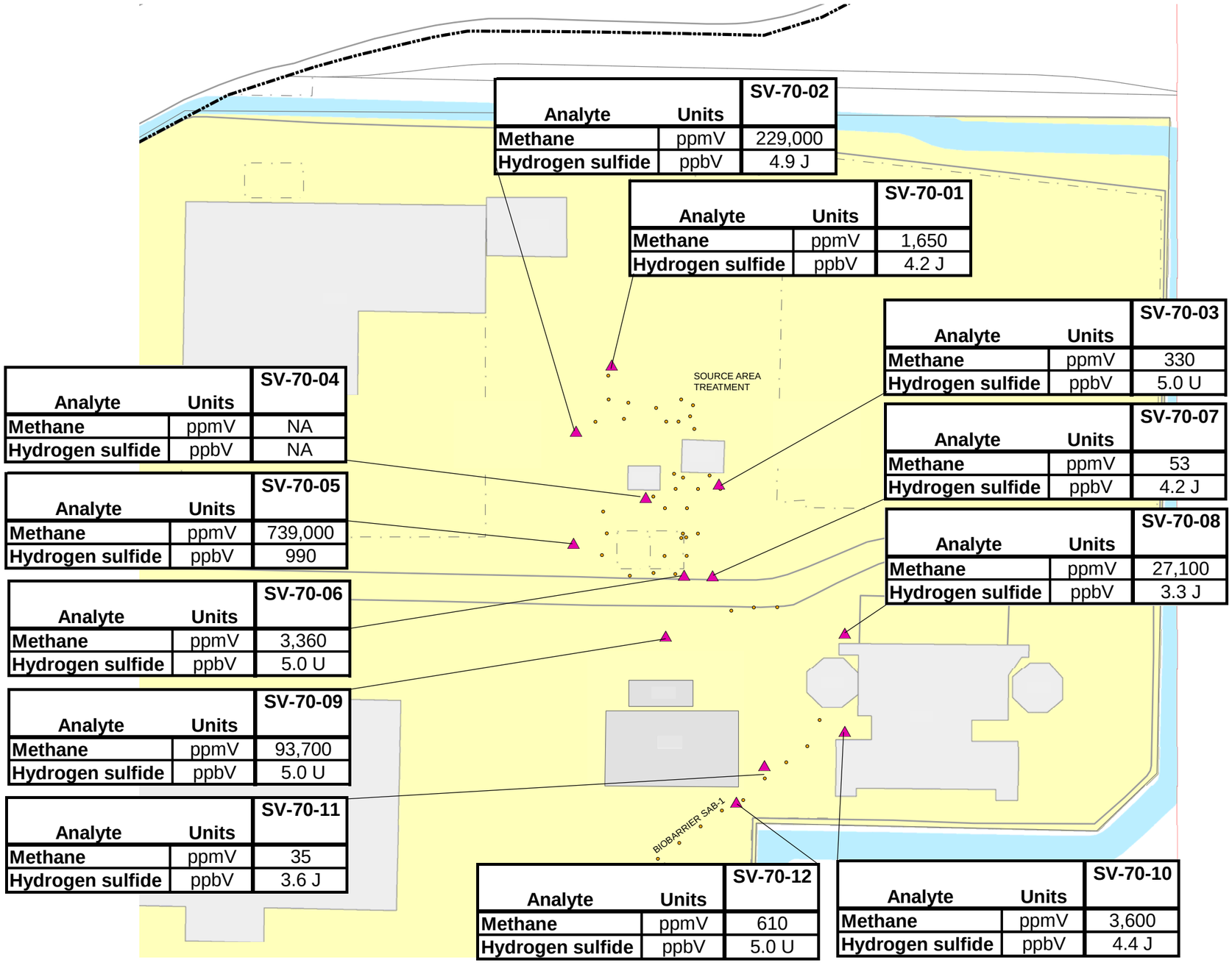
0 200 400 800 Feet

Baseline Groundwater Monitoring Report
Figure 12
IR Site 70
Second Sand Groundwater Sampling Results

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 1/25/2009
File No. 14114sscoc.mdx
Project No.: 4-14114
Rev. C



Analyte	Units	SV-70-02
Methane	ppmV	229,000
Hydrogen sulfide	ppbV	4.9 J

Analyte	Units	SV-70-01
Methane	ppmV	1,650
Hydrogen sulfide	ppbV	4.2 J

Analyte	Units	SV-70-03
Methane	ppmV	330
Hydrogen sulfide	ppbV	5.0 U

Analyte	Units	SV-70-04
Methane	ppmV	NA
Hydrogen sulfide	ppbV	NA

Analyte	Units	SV-70-07
Methane	ppmV	53
Hydrogen sulfide	ppbV	4.2 J

Analyte	Units	SV-70-05
Methane	ppmV	739,000
Hydrogen sulfide	ppbV	990

Analyte	Units	SV-70-08
Methane	ppmV	27,100
Hydrogen sulfide	ppbV	3.3 J

Analyte	Units	SV-70-06
Methane	ppmV	3,360
Hydrogen sulfide	ppbV	5.0 U

Analyte	Units	SV-70-09
Methane	ppmV	93,700
Hydrogen sulfide	ppbV	5.0 U

Analyte	Units	SV-70-11
Methane	ppmV	35
Hydrogen sulfide	ppbV	3.6 J

Analyte	Units	SV-70-12
Methane	ppmV	610
Hydrogen sulfide	ppbV	5.0 U

Analyte	Units	SV-70-10
Methane	ppmV	3,600
Hydrogen sulfide	ppbV	4.4 J

LEGEND

- SOIL VAPOR PROBE LOCATION
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- FENCE
- BUILDING

NOTES:

SOIL VAPOR SAMPLES WERE COLLECTED ON AUGUST 26, 2008

NA - NOT APPLICABLE; SAMPLE WAS NOT COLLECTED DUE TO THE PRESENCE OF WATER IN SAMPLE TUBING

ppmV - PARTS PER MILLION BY VOLUME

ppbV - PARTS PER BILLION BY VOLUME

J - ESTIMATED VALUE

U - NOT DETECTED

N

0 50 100 200 Feet

Baseline Groundwater Monitoring Report

Figure 13

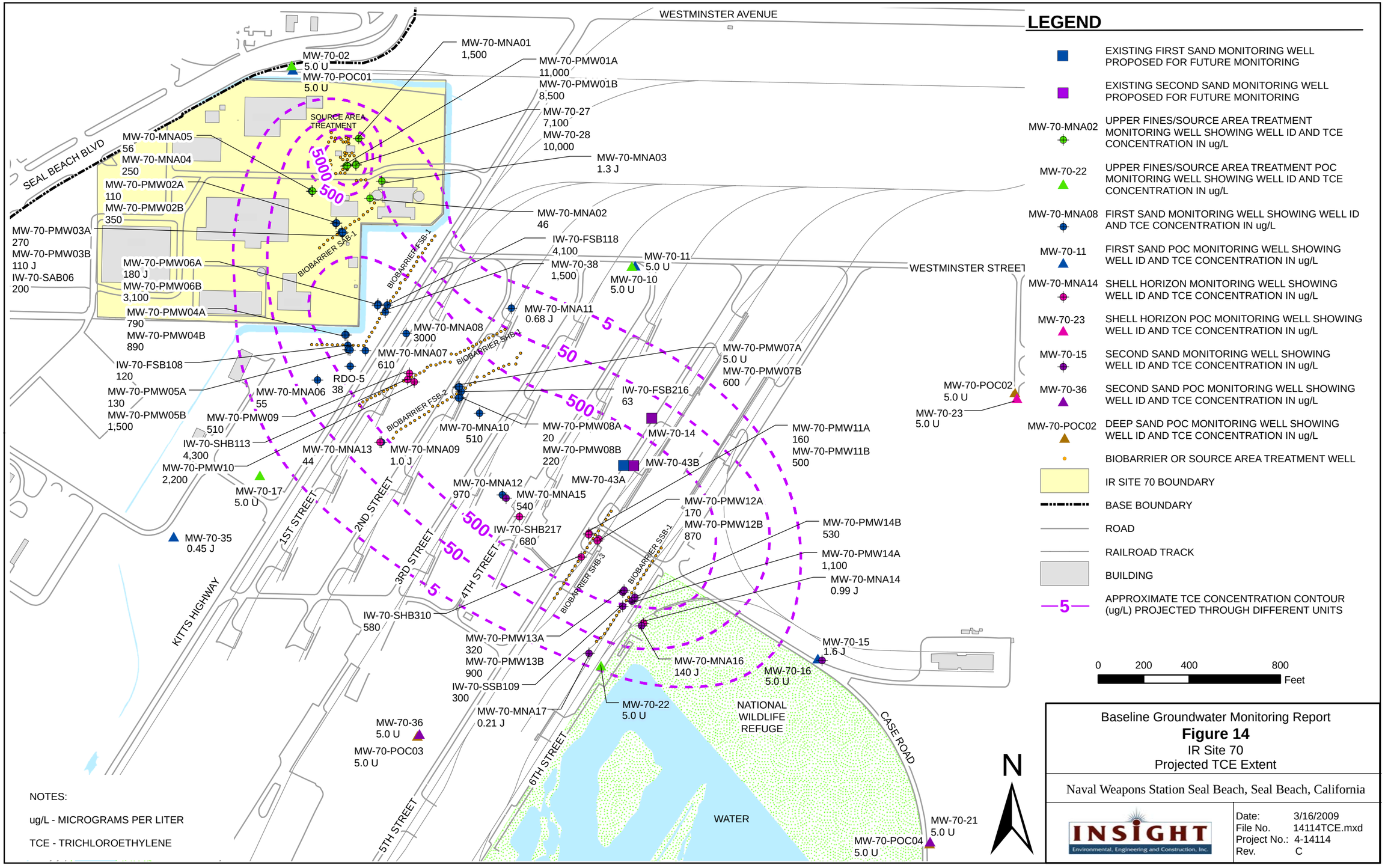
IR Site 70

Soil Vapor Analytical Results

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT Environmental, Engineering and Construction, Inc.

Date: 1/18/2009
File No. 14114svbox.mdx
Project No.: 4-14114
Rev. B



Baseline Groundwater Monitoring Report

Figure 14

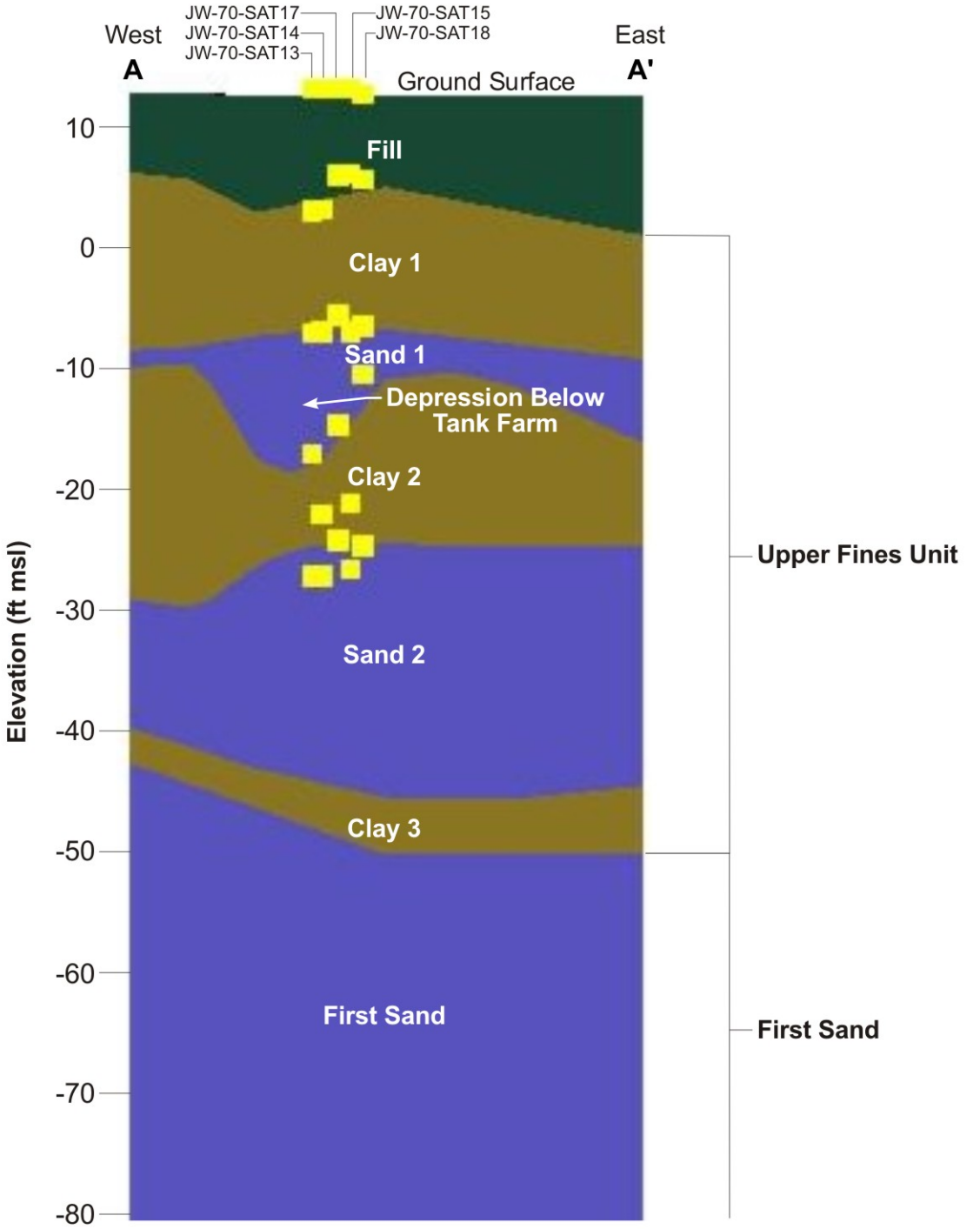
IR Site 70

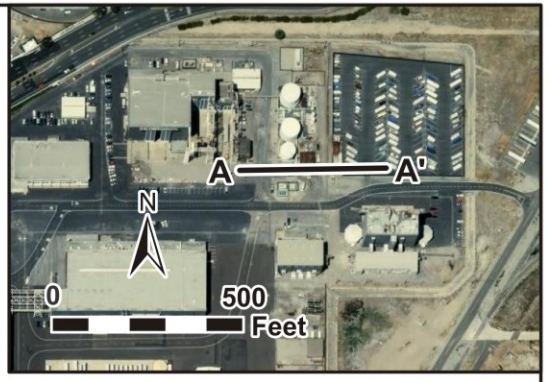
Projected TCE Extent

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date:	3/16/2009
File No.	14114TCE.mxd
Project No.:	4-14114
Rev.	C





LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 100 200 300 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 15

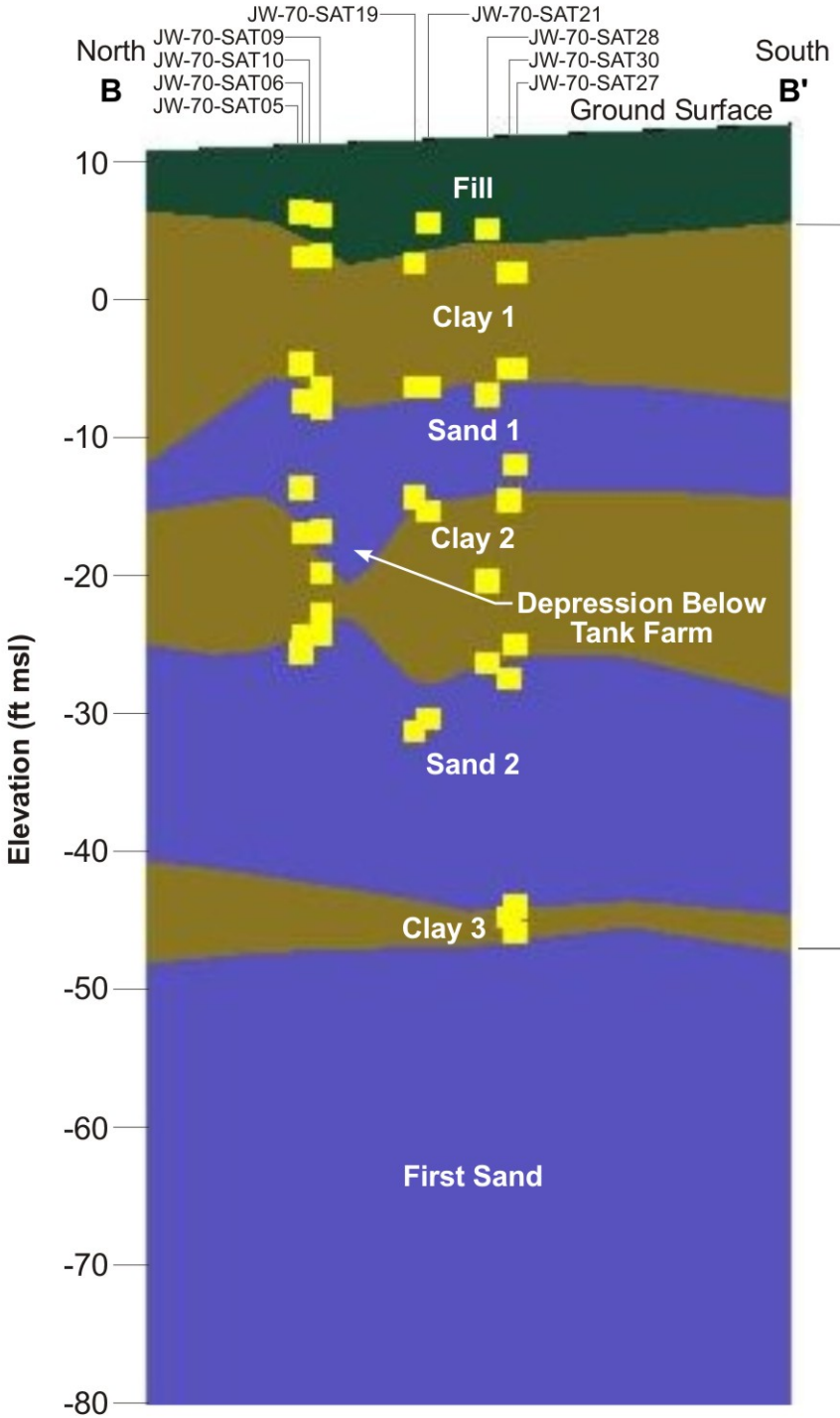
IR Site 70

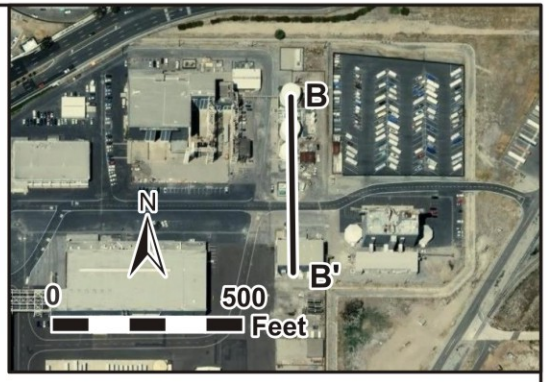
Cross Section A-A'

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/09/2009
File No.: SB03-01_A-A'.CDR
Project No.: G006104-01
Rev. VJS





LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 100 200 300 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 16

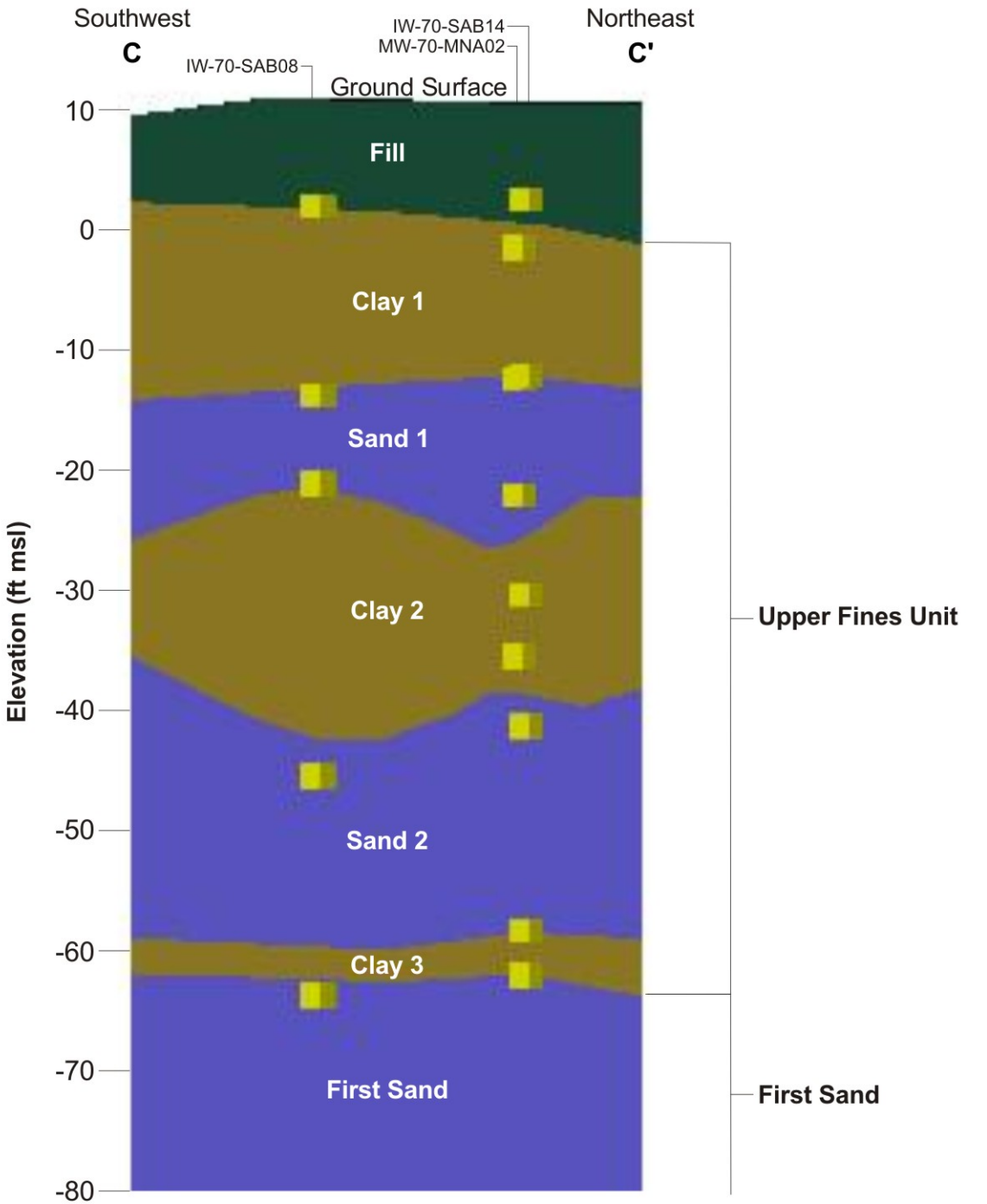
IR Site 70

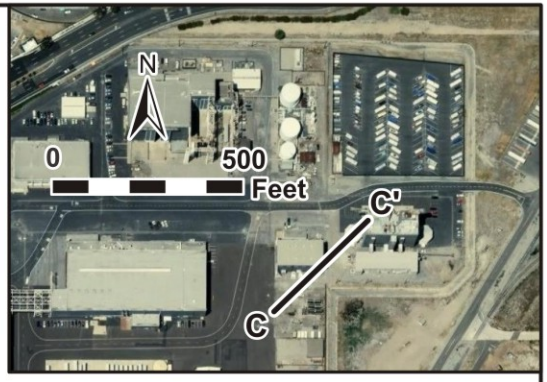
Cross Section B-B'

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/10/2009
File No.: SB03-02_B-B.CDR
Project No.: G006104-01
Rev. VJS





LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 100 200 300 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 17

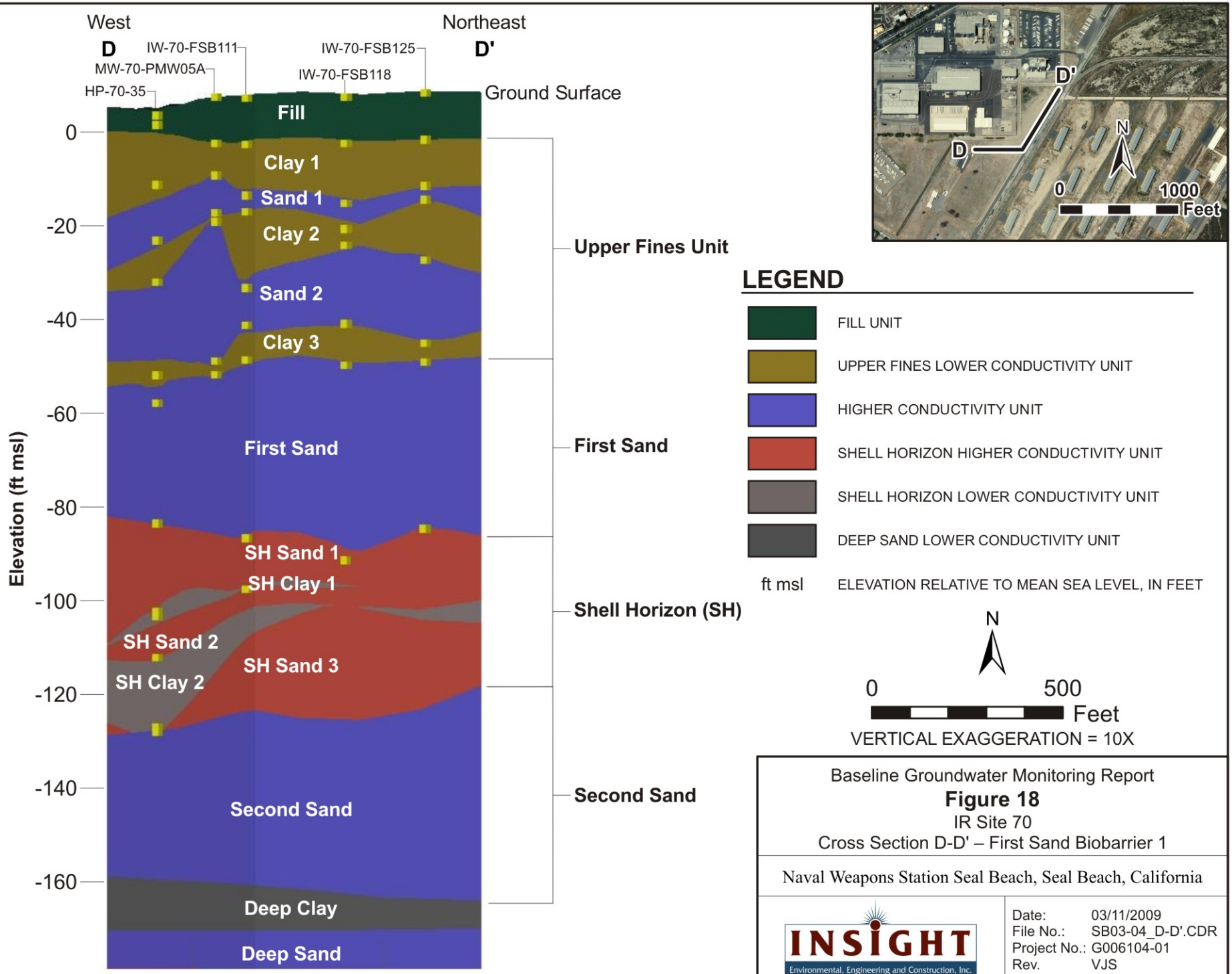
IR Site 70

Cross Section C-C'

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/10/2009
File No.: SB03-03_C-C'.CDR
Project No.: G006104-01
Rev. VJS



Baseline Groundwater Monitoring Report

Figure 18

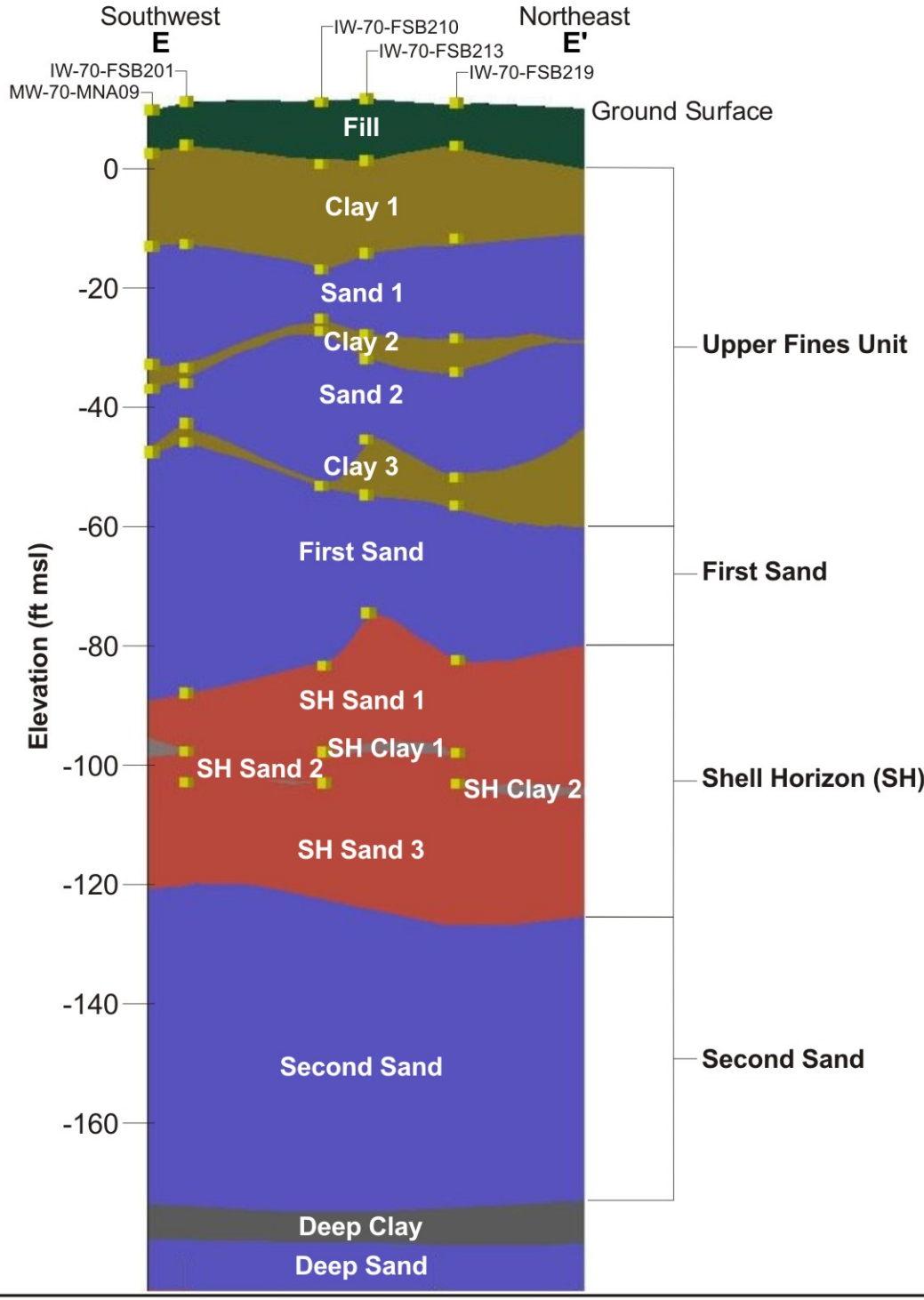
IR Site 70

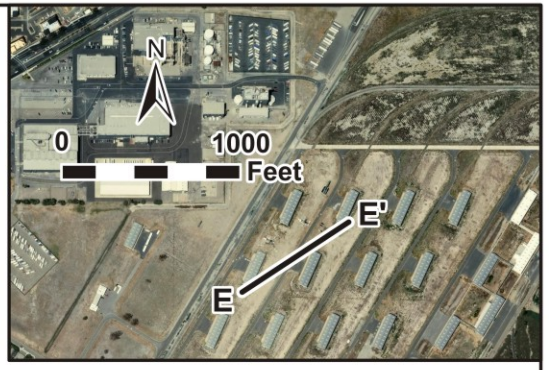
Cross Section D-D' – First Sand Biobarrier 1

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-04_D-D'.CDR
Project No.: G006104-01
Rev. VJS





LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON LOWER CONDUCTIVITY UNIT
- DEEP SAND LOWER CONDUCTIVITY UNIT

ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 500 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 19

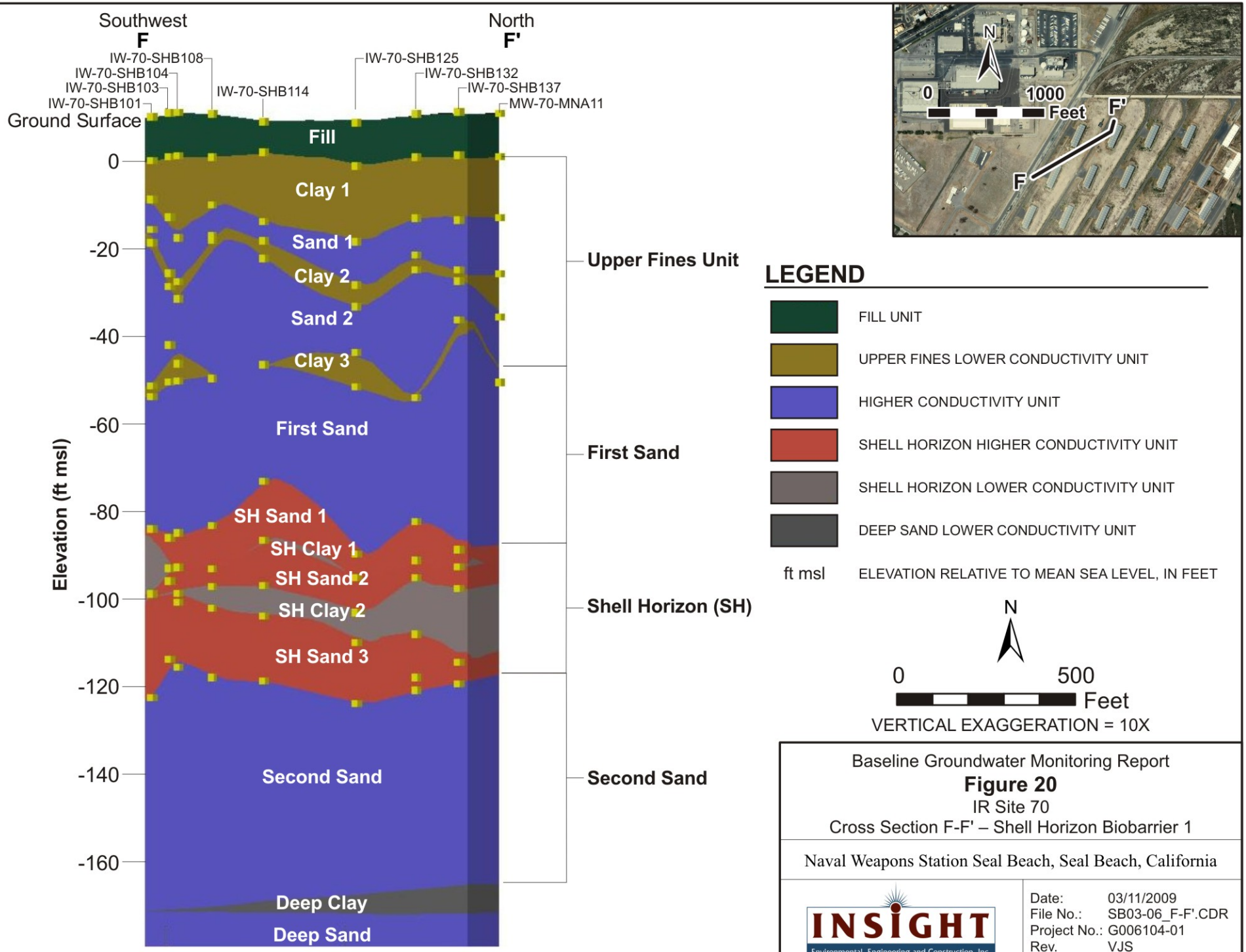
IR Site 70

Cross Section E-E' – First Sand Biobarrier 2

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-05_E-E'.CDR
Project No.: G006104-01
Rev. VJS



Baseline Groundwater Monitoring Report

Figure 20

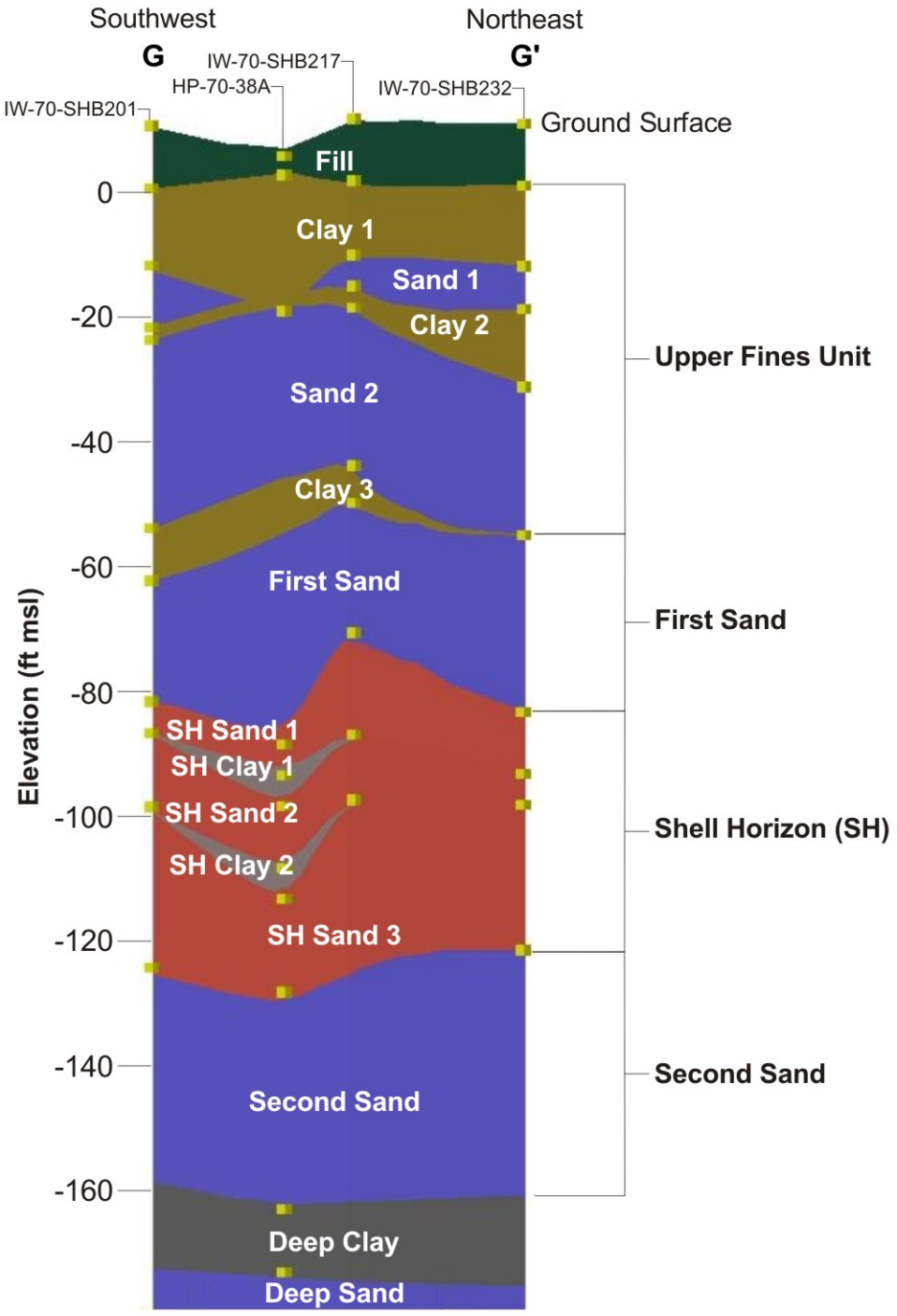
IR Site 70

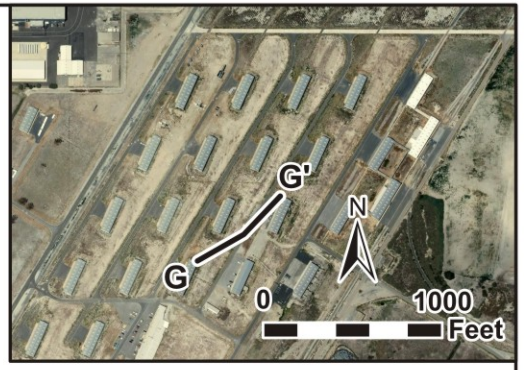
Cross Section F-F' – Shell Horizon Biobarrier 1

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-06_F-F'.CDR
Project No.: G006104-01
Rev. VJS





LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON LOWER CONDUCTIVITY UNIT
- DEEP SAND LOWER CONDUCTIVITY UNIT

ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 500 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 21

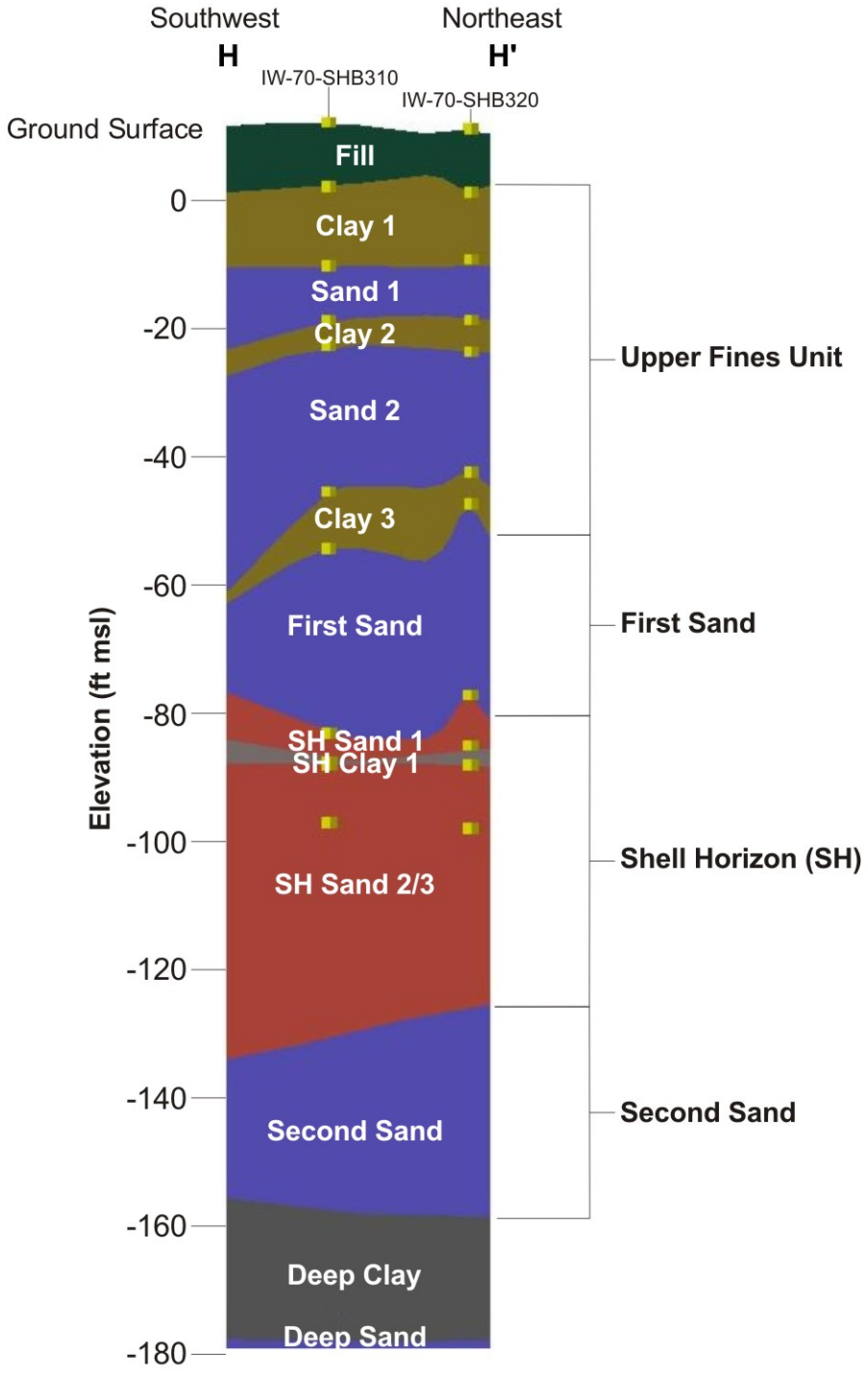
IR Site 70

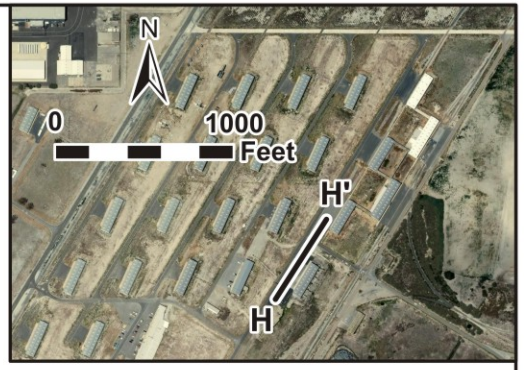
Cross Section G-G' – Shell Horizon Biobarrier 2

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-07_G-G'.CDR
Project No.: G006104-01
Rev. VJS





LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON LOWER CONDUCTIVITY UNIT
- DEEP SAND LOWER CONDUCTIVITY UNIT
- ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 500 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 22

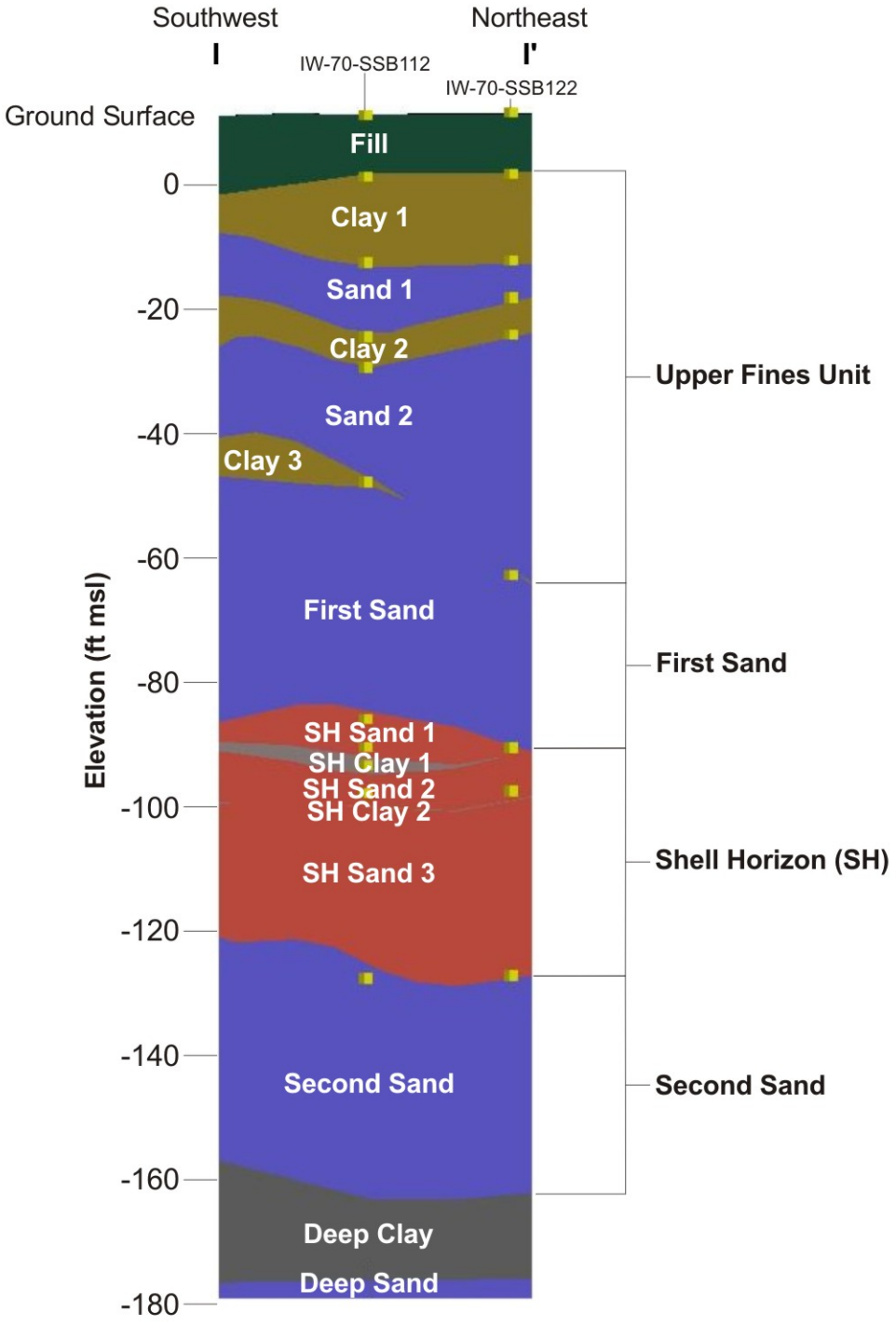
IR Site 70

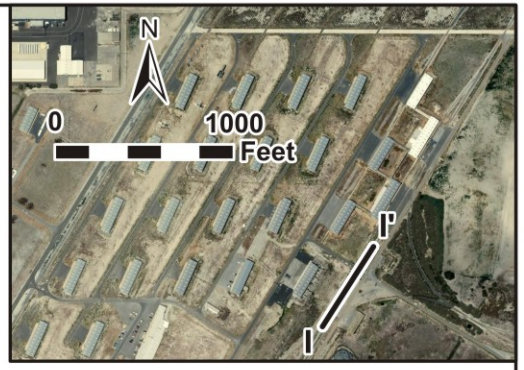
Cross Section H-H' – Shell Horizon Biobarrier 3

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-08_H-H'.CDR
Project No.: G006104-01
Rev. VJS





LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON LOWER CONDUCTIVITY UNIT
- DEEP SAND LOWER CONDUCTIVITY UNIT
- ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 500 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 23

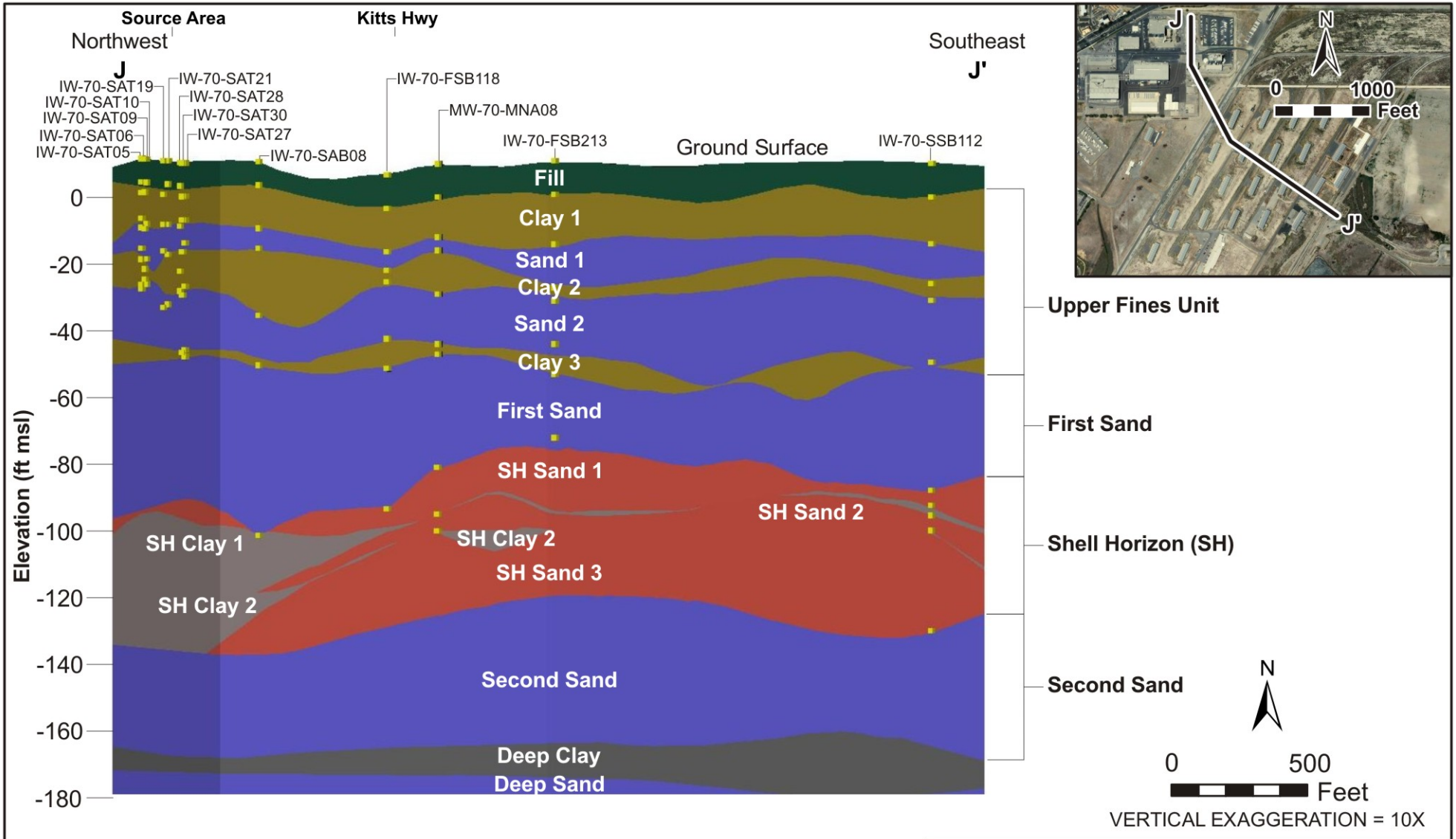
IR Site 70

Cross Section I-I' – Second Sand Biobarrier 1

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-09_I-I'.CDR
Project No.: G006104-01
Rev. VJS



LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON LOWER CONDUCTIVITY UNIT
- DEEP SAND LOWER CONDUCTIVITY UNIT
- ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

Baseline Groundwater Monitoring Report

Figure 24

IR Site 70

Cross Section J-J'

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-10_J-J'.CDR
Project No.: G006104-01
Rev. VJS

LEGEND

	APPROXIMATE 1,000-µG/L TCE PLUME EXTENT (2008)
µg/L	MICROGRAMS PER LITER
TCE	TRICHLOROETHENE

Baseline Groundwater Monitoring Report

Figure 25

IR Site 70

1,000 µg/L TCE Plume Extent at 35' BGS in Source Area (Shallow)

Naval Weapons Station Seal Beach, Seal Beach, California

N

0 250 Feet

VERTICAL EXAGGERATION = 10X

INSIGHT
Environmental, Engineering and Construction, Inc.

Date:	03/25/2009
File No.:	SB03-11_TCE_1000_35FTBGS_BL.CDR
Project No.:	G006104-01
Rev.	VJS

LEGEND

	APPROXIMATE 1,000-µG/L TCE PLUME EXTENT (2008)
µg/L	MICROGRAMS PER LITER
TCE	TRICHLOROETHENE

N

Scale in Feet

0 125 250

Baseline Groundwater Monitoring Report

Figure 26

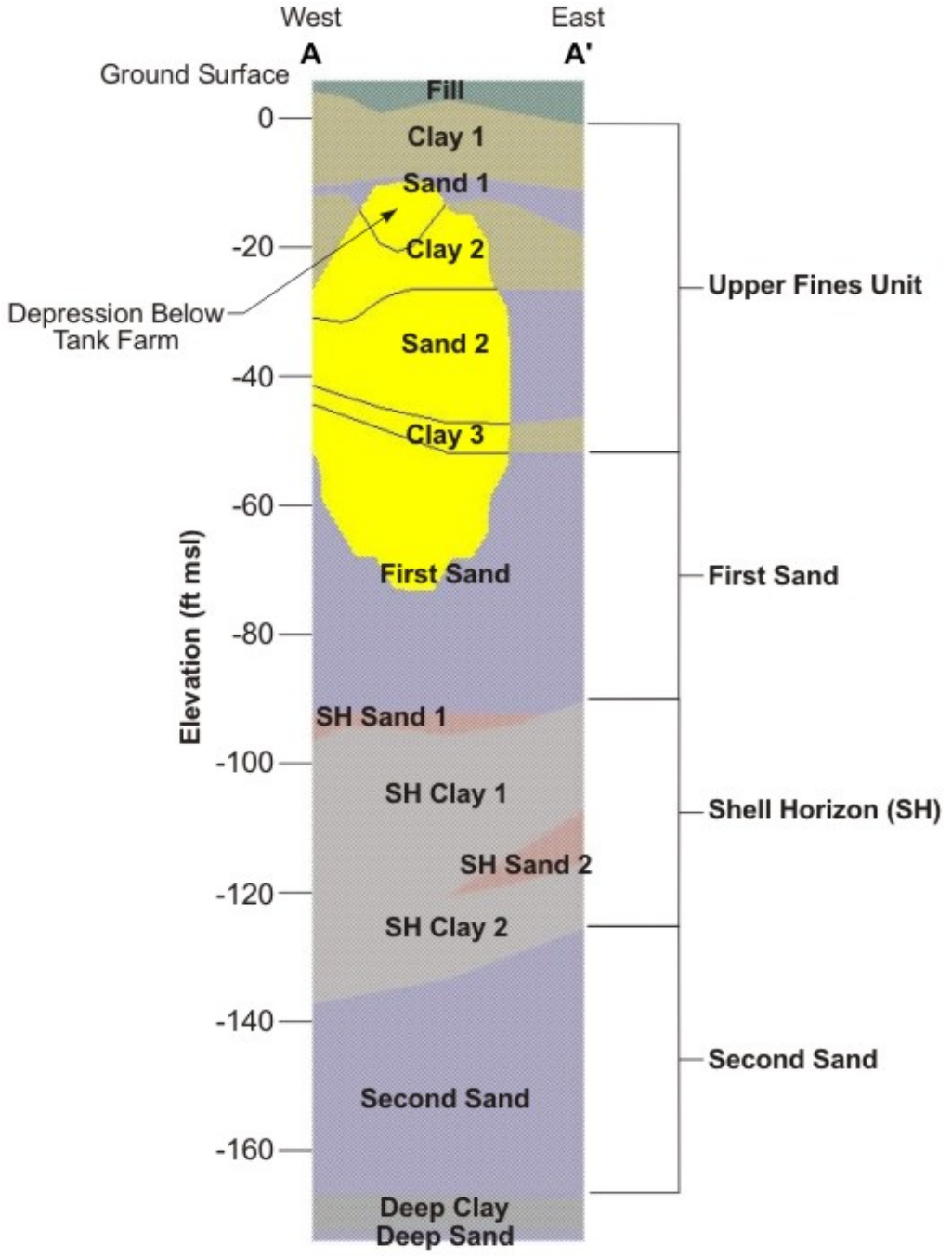
IR Site 70

1,000 µg/L TCE Plume Extent at 50' BGS in Source Area (Shallow)

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/25/2009
File No.: SB03-11_TCE_1000_50FTBGS_BL.CDR
Project No.: G006104-01
Rev. VJS



LEGEND

	250 µg/L TCE PLUME, 2008
µg/L	MICROGRAMS PER LITER
ft msl	ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET
TCE	TRICHLOROETHENE

N

0 500 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 27

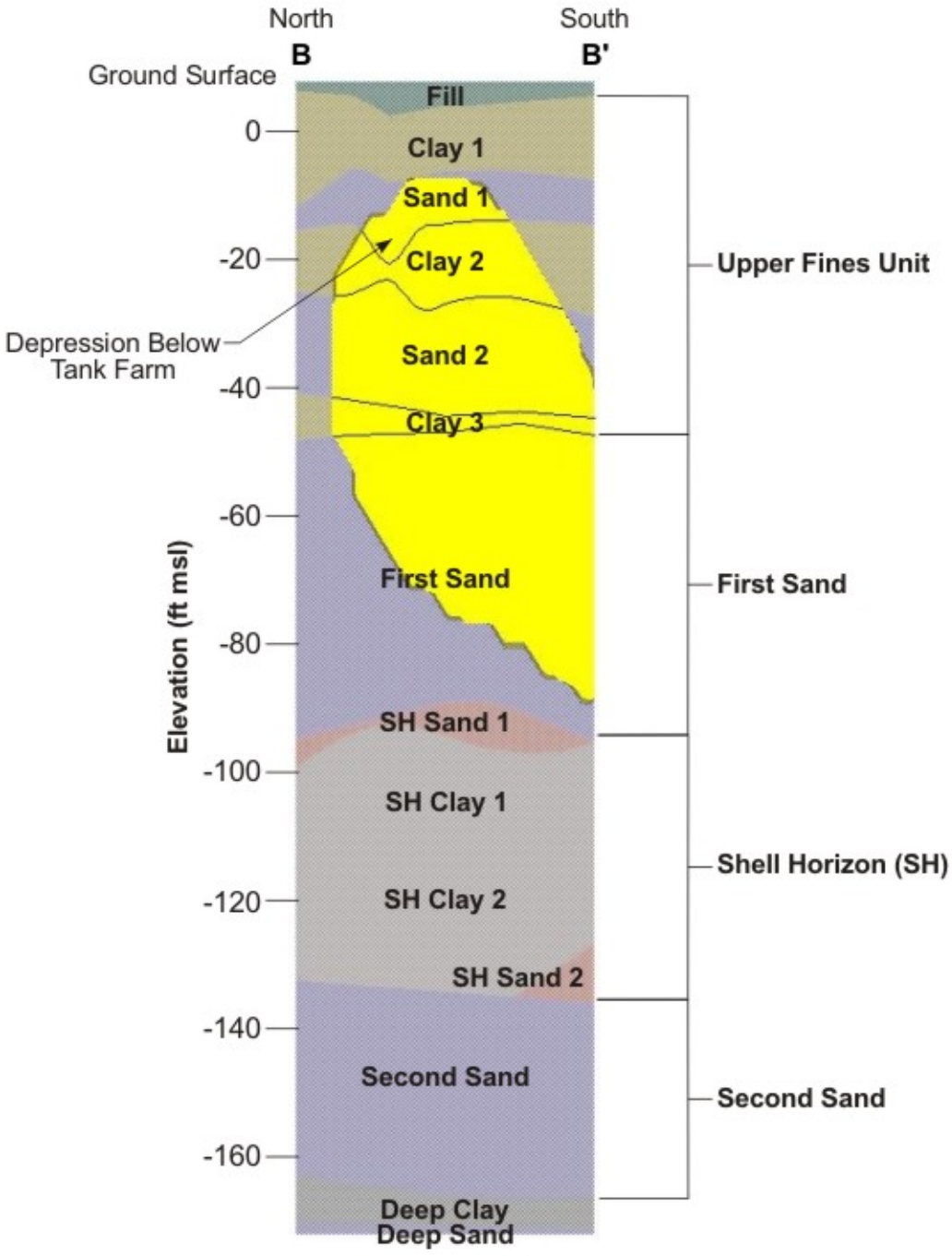
IR Site 70

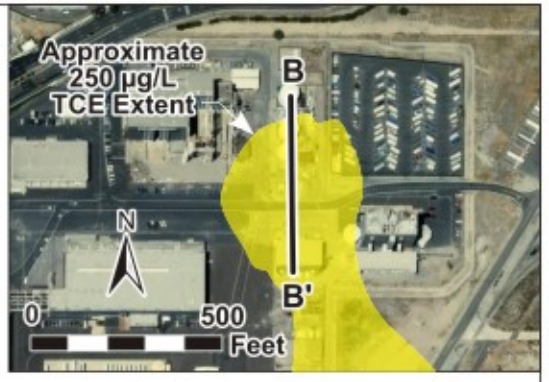
Cross Section A-A' With 250 µg/L TCE Plume

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-12_A-A'_TCE_wMDHPs_BL.CDR
Project No.: G006104-01
Rev. VJS





LEGEND

	250 µg/L TCE PLUME, 2008
µg/L	MICROGRAMS PER LITER
ft msl	ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET
TCE	TRICHLOROETHENE

N

0 500 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 28

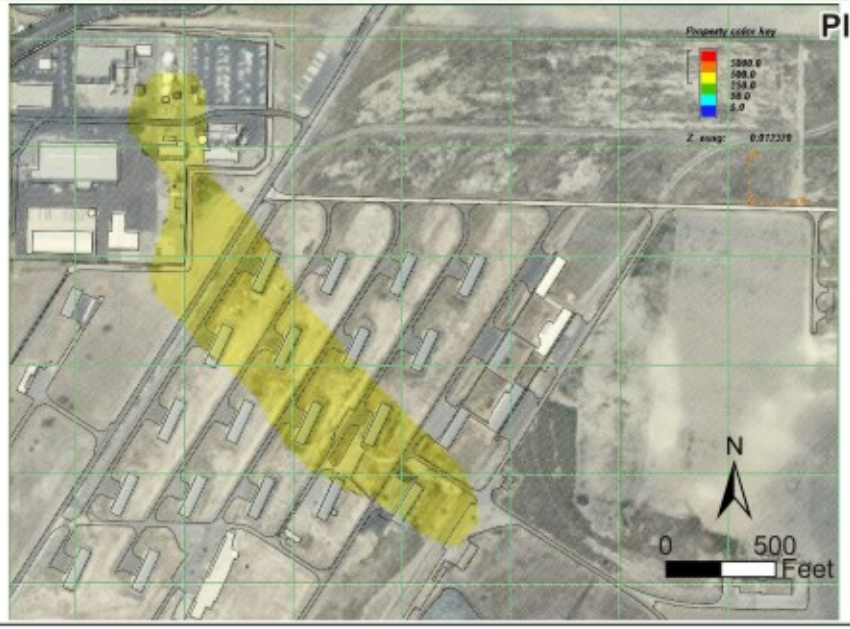
IR Site 70

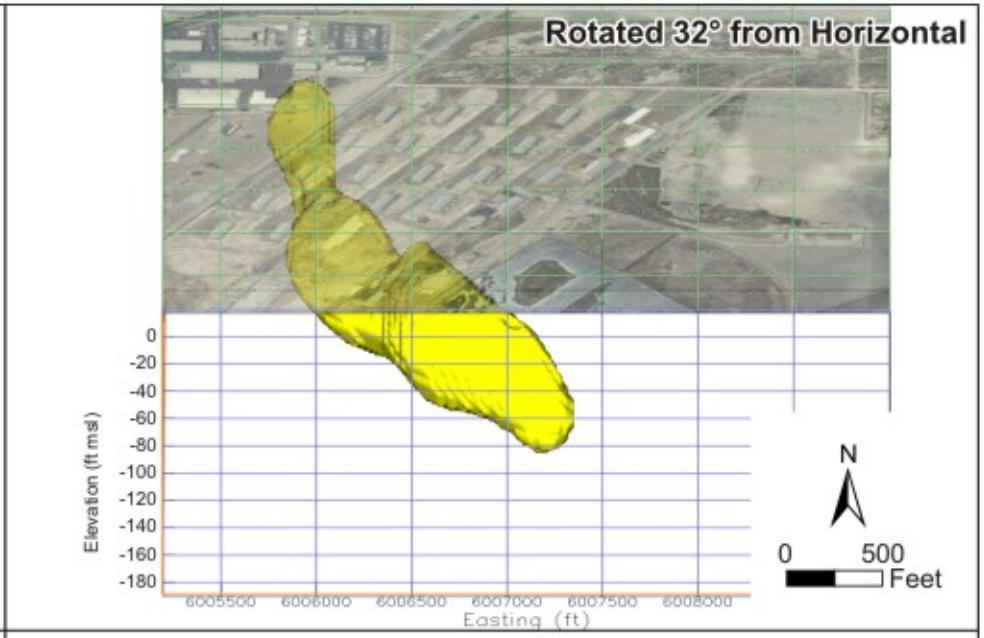
Cross Section B-B' With 250 µg/L TCE Plume

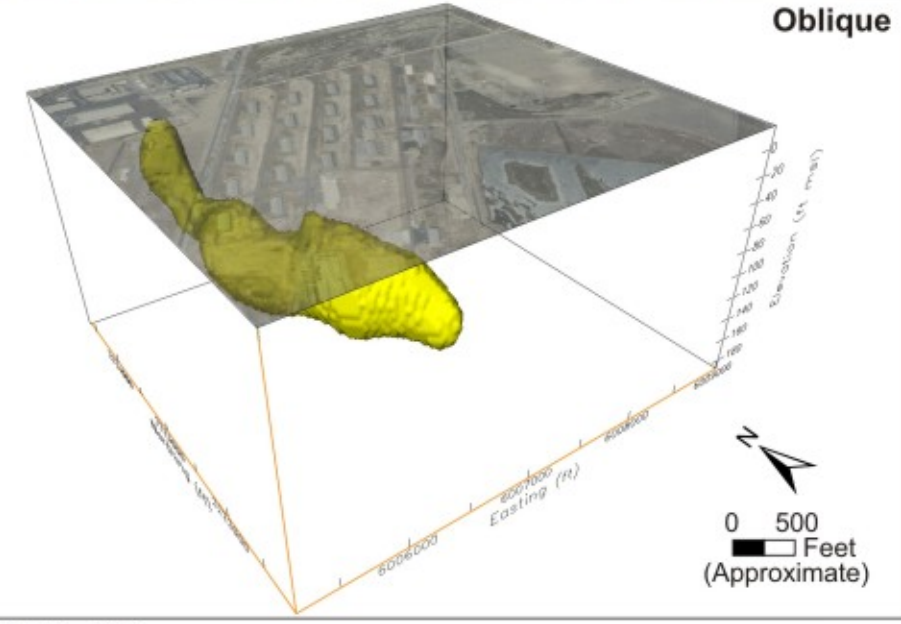
Naval Weapons Station Seal Beach, Seal Beach, California

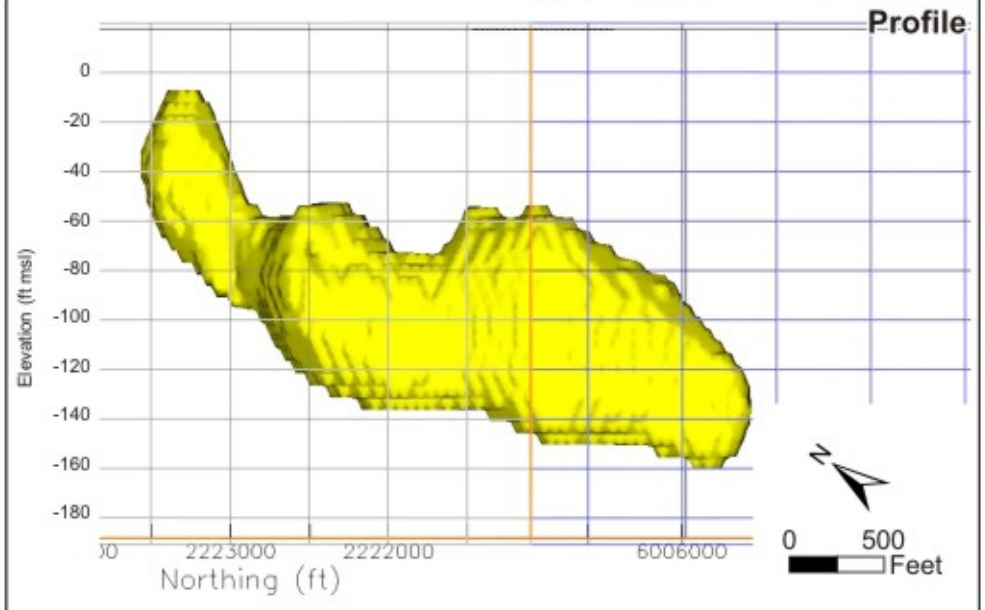
INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-13_B-B'_TCE_wNDHPs_BL.CDR
Project No.: G006104-01
Rev. VJS









LEGEND

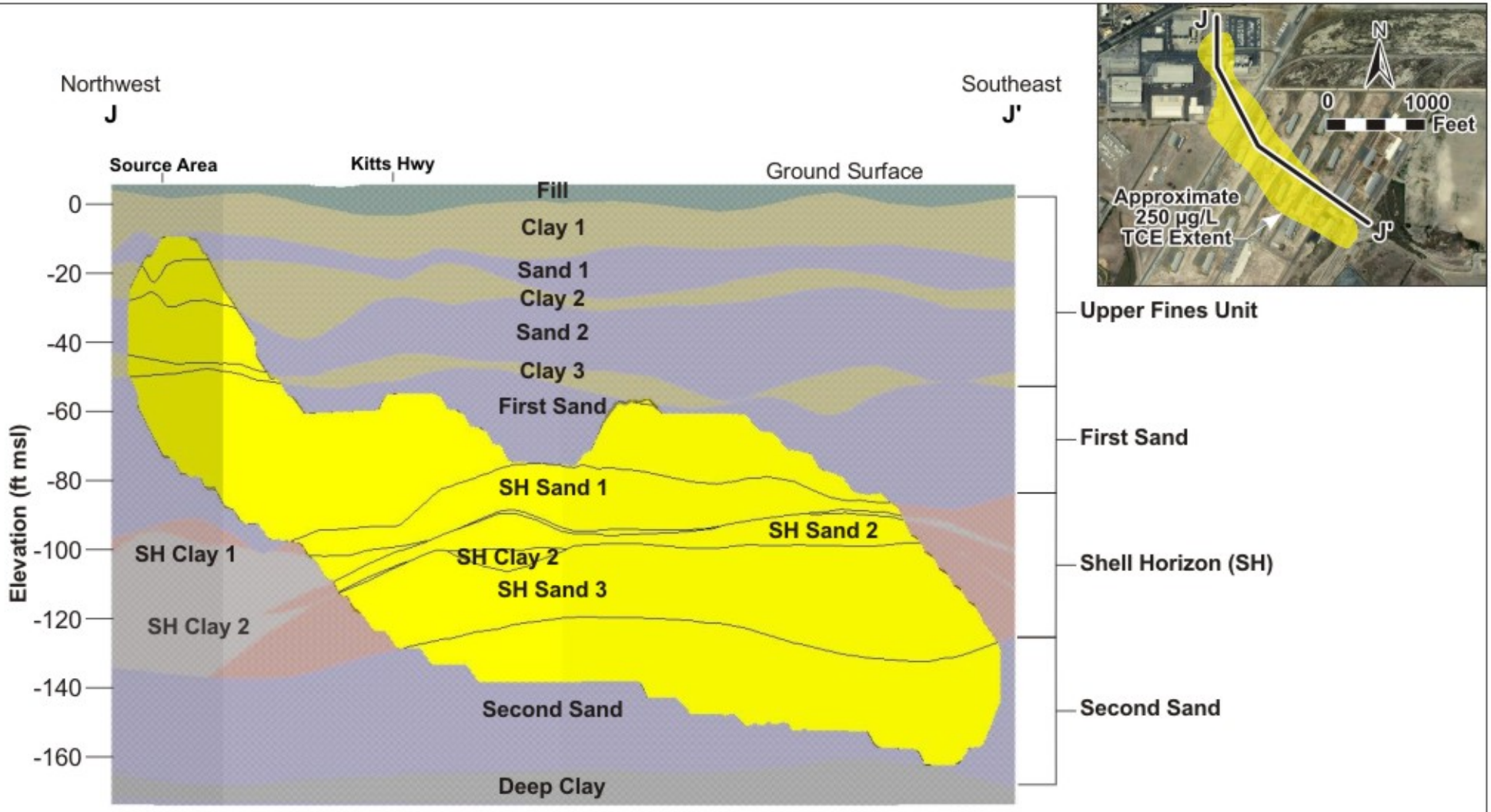
- APPROXIMATE 250 µG/L TCE PLUME, 2008
- µg/L MICROGRAMS PER LITER
- TCE TRICHLOROETHENE

Baseline Groundwater Monitoring Report
Figure 29
IR Site 70
Oblique Views of 250 µg/L TCE Plume

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-14_TCE_250_BL.CDR
Project No.: G006104-01
Rev. VJS



N

0 500 Feet

VERTICAL EXAGGERATION = 10X

LEGEND

	250 µg/L TCE PLUME, 2008
µg/L	MICROGRAMS PER LITER
ft msl	ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET
TCE	TRICHLOROETHENE

Baseline Groundwater Monitoring Report

Figure 30

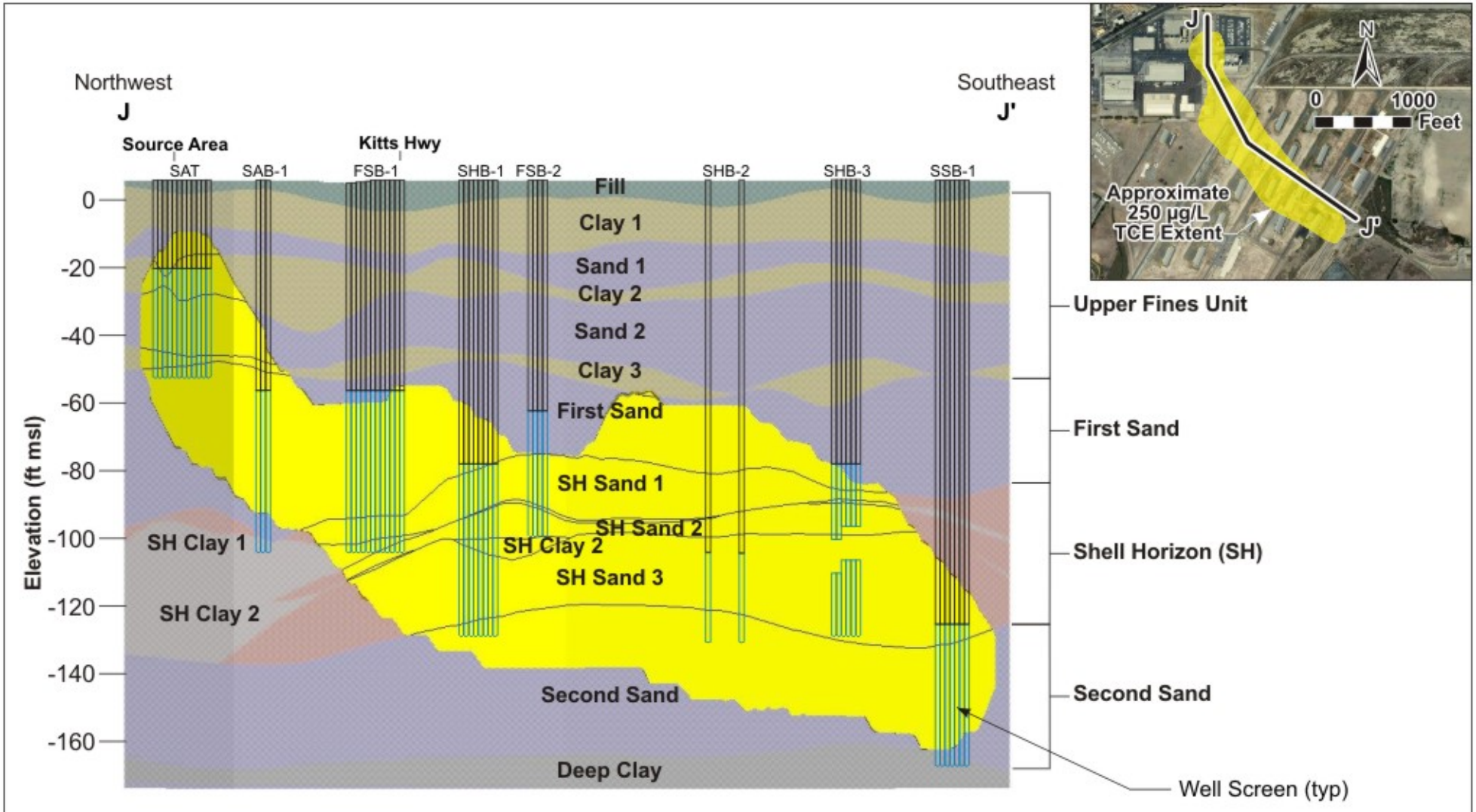
IR Site 70

Cross Section J-J' With 250 µg/L TCE Plume

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-15_J-J'_TCE_wNDHPs_BL.CDR
Project No.: G006104-01
Rev. VJS



N

0 500 Feet

VERTICAL EXAGGERATION = 10X

LEGEND

	250 µg/L TCE PLUME, 2008
µg/L	MICROGRAMS PER LITER
ft msl	ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET
TCE	TRICHLOROETHENE

Baseline Groundwater Monitoring Report

Figure 31

IR Site 70

Complete Injection System Cross Section

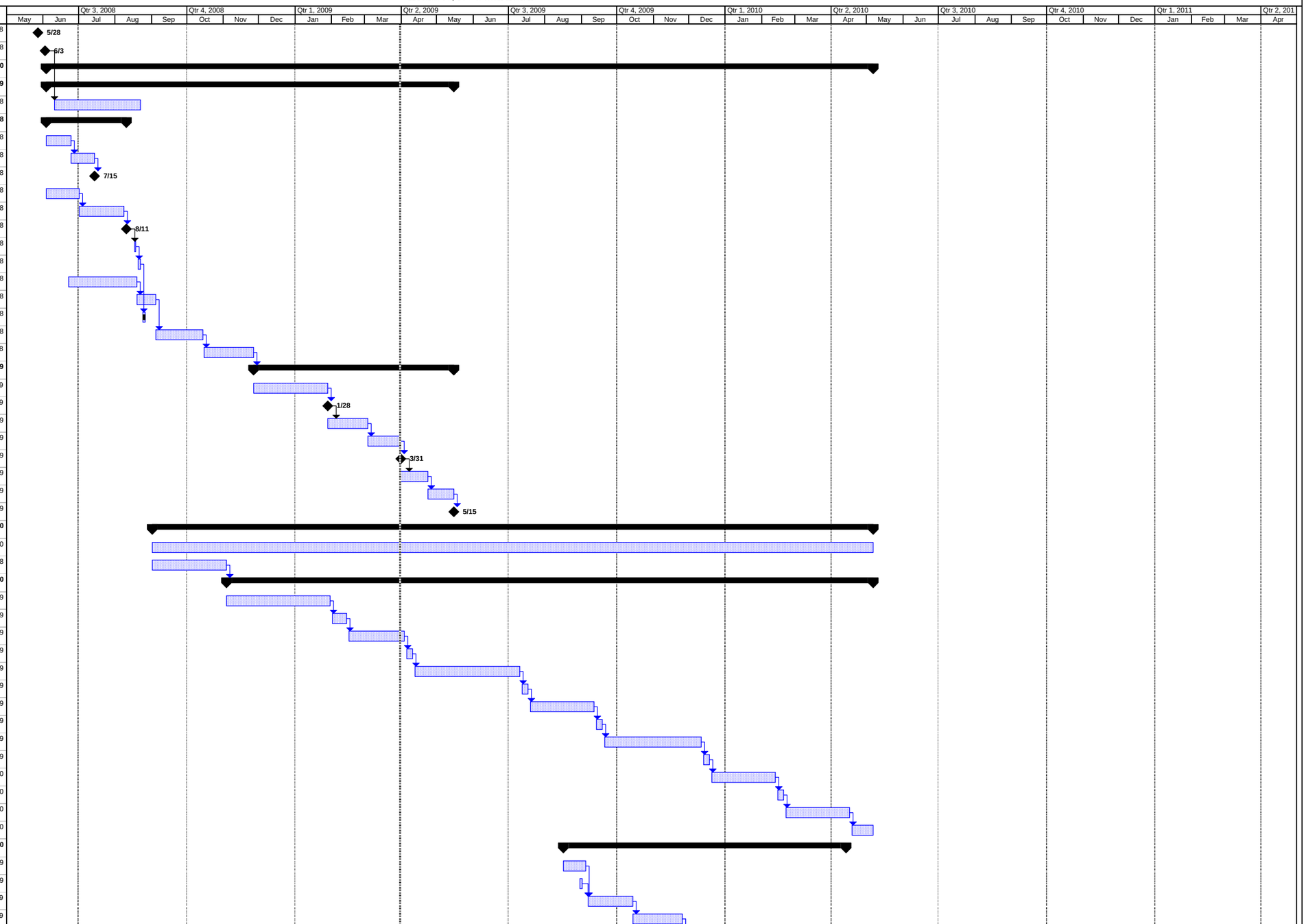
Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-16_J-J'_TCE_INJ_wNDHPs_BL.CDR
Project No.: G006104-01
Rev. VJS

Figure 32
Project Schedule
Bioremediation of DNAPL and Disolved Phase Chlorinated Solvent Plume,
IR Site 70, NWS Seal Beach

ID	Task Name	Duration	Start	Finish
1	**Date of Award**	0 days	Wed 5/28/08	Wed 5/28/08
2	**Kick-off Meeting**	0 days	Tue 6/3/08	Tue 6/3/08
3	**BASE BID**	**502 days**	**Wed 6/4/08**	**Thu 5/6/10**
4	**Task 1- Baseline Groundwater Sampling**	**248 days**	**Wed 6/4/08**	**Fri 5/15/09**
5	Meetings	53 days	Wed 6/11/08	Fri 8/22/08
6	**Pre-Construction Submittals**	**48 days**	**Wed 6/4/08**	**Mon 8/11/08**
7	SAP Addendum Preparation and Submittal	15 days	Wed 6/4/08	Tue 6/24/08
8	Navy Review SAP Addendum	14 days	Wed 6/25/08	Mon 7/14/08
9	Final SAP Addendum	0 days	Tue 7/15/08	Tue 7/15/08
10	APP/HASP Addendum Preparation and Submittal	20 days	Wed 6/4/08	Tue 7/1/08
11	Navy Review APP/HASP Addendum	28 days	Wed 7/2/08	Fri 8/8/08
12	Final APP/HASP Addendum	0 days	Mon 8/11/08	Mon 8/11/08
13	Geophysical Survey	1 day	Mon 8/18/08	Mon 8/18/08
14	Soil Vapor Probe Installation	2 days	Thu 8/21/08	Fri 8/22/08
15	Dedicated Pump Inventory, Procurement, and Installation	42 days	Mon 6/23/08	Tue 8/19/08
16	Baseline Monitoring	12 days	Wed 8/20/08	Thu 9/4/08
17	Soil Vapor Sampling	2 days	Mon 8/25/08	Tue 8/26/08
18	Laboratory Analysis	28 days	Fri 9/5/08	Tue 10/14/08
19	Data Evaluation	30 days	Thu 10/16/08	Wed 11/26/08
20	**Reporting**	**122 days**	**Thu 11/27/08**	**Fri 5/15/09**
21	Preparation of Draft Report	45 days	Thu 11/27/08	Wed 1/28/09
22	Submit Draft report to Navy	0 days	Wed 1/28/09	Wed 1/28/09
23	Draft Report Review by Navy	24 days	Thu 1/29/09	Tue 3/3/09
24	Preparation of Draft-Final Report	20 days	Wed 3/4/09	Tue 3/31/09
25	Submit Draft-Final Report to Navy, RWQCB, and DTSC	0 days	Tue 3/31/09	Tue 3/31/09
26	Draft-Final Report Review by Navy, RWQCB, and DTSC	17 days	Wed 4/1/09	Thu 4/23/09
27	Preparation of Final Report	16 days	Fri 4/24/09	Fri 5/15/09
28	Submit Final Report to Navy, RWQCB, and DTSC	0 days	Fri 5/15/09	Fri 5/15/09
29	**Task 2 - EVO Injection, Source Area & Six Biobarriers**	**438 days**	**Tue 9/2/08**	**Thu 5/6/10**
30	Meetings	438 days	Tue 9/2/08	Thu 5/6/10
31	Pre-Field Activities	45 days	Tue 9/2/08	Mon 11/3/08
32	**EVO/KB-1 Injection**	**393 days**	**Tue 11/4/08**	**Thu 5/6/10**
33	Source Area Biobarrier (SAB)	64 days	Tue 11/4/08	Fri 1/30/09
34	Mobilization and Prep.	10 days	Mon 2/2/09	Fri 2/13/09
35	Second Sand Biobarrier 1 (SSB-1)	35 days	Mon 2/16/09	Fri 4/3/09
36	Mobilization and Prep.	5 days	Mon 4/6/09	Fri 4/10/09
37	Shell Horizon Biobarrier 3 (SHB-3)	65 days	Mon 4/13/09	Fri 7/10/09
38	Mobilization and Prep.	5 days	Mon 7/13/09	Fri 7/17/09
39	First Sand Biobarrier 2 (FSB-2)	40 days	Mon 7/20/09	Fri 9/11/09
40	Mobilization and Prep.	5 days	Mon 9/14/09	Fri 9/18/09
41	First Sand Biobarrier 1 (FSB-1)	60 days	Mon 9/21/09	Fri 12/11/09
42	Mobilization and Prep.	5 days	Mon 12/14/09	Fri 12/18/09
43	Shell Horizon Biobarrier 1 (SHB-1)	40 days	Mon 12/21/09	Fri 2/12/10
44	Mobilization and Prep.	5 days	Mon 2/15/10	Fri 2/19/10
45	Source Area Treatment Grid	40 days	Mon 2/22/10	Fri 4/16/10
46	Demobilization	14 days	Mon 4/19/10	Thu 5/6/10
47	**Task 3 - 2009 Annual Groundwater Performance Monitoring**	**172 days**	**Mon 8/17/09**	**Tue 4/13/10**
48	Performance Monitoring	15 days	Mon 8/17/09	Fri 9/4/09
49	Soil Vapor Sampling	2 days	Mon 8/31/09	Tue 9/1/09
50	Laboratory Analysis	28 days	Mon 9/7/09	Wed 10/14/09
51	Data Evaluation	30 days	Thu 10/15/09	Wed 11/25/09



Project: PTO X182
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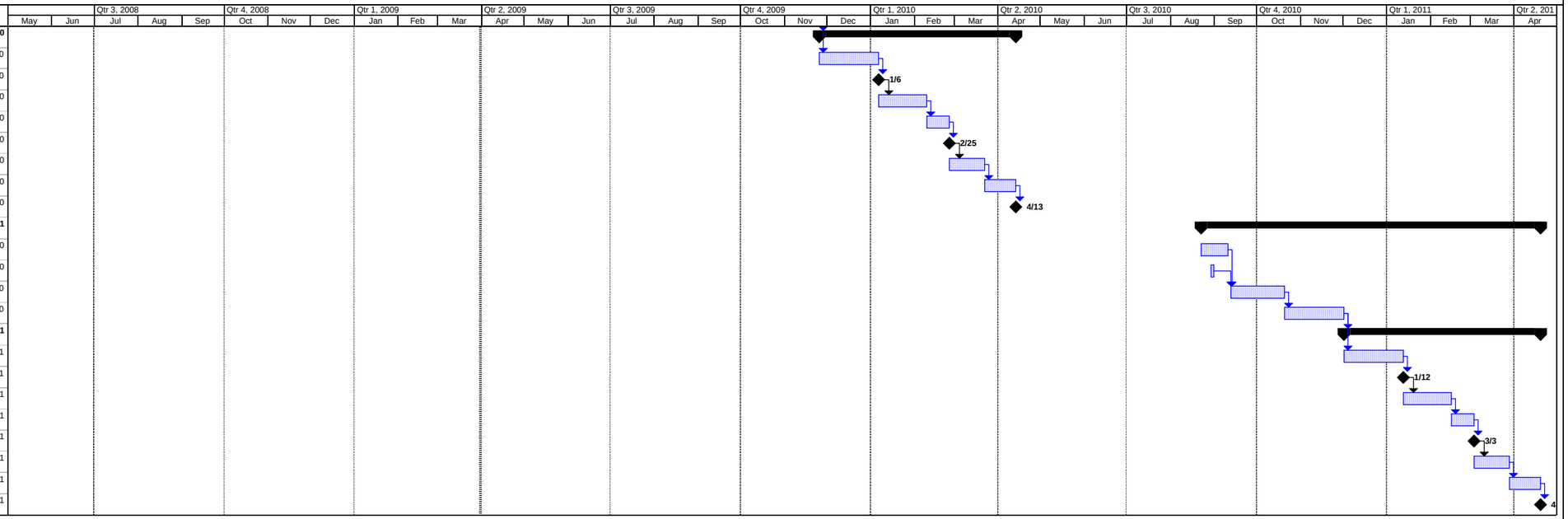
Task | Progress | Summary | Rolled Up Split | Rolled Up Progress | Project Summary
Split | Milestone | Rolled Up Task | Rolled Up Milestone | External Tasks

Figure 32
Project Schedule
Bioremediation of DNAPL and Disolved Phase Chlorinated Solvent Plume,
IR Site 70, NWS Seal Beach

ID	Task Name	Duration	Start	Finish
52	**Reporting**	**99 days**	**Thu 11/26/09**	**Tue 4/13/10**
53	Preparation of Draft Report	30 days	Thu 11/26/09	Wed 1/6/10
54	Submit Draft report to Navy	0 days	Wed 1/6/10	Wed 1/6/10
55	Draft Report Review by Navy	24 days	Thu 1/7/10	Tue 2/9/10
56	Preparation of Draft-Final Report	12 days	Wed 2/10/10	Thu 2/25/10
57	Submit Draft-Final Report to Navy, RWQCB, and DTSC	0 days	Thu 2/25/10	Thu 2/25/10
58	Draft-Final Report Review by Navy, RWQCB, and DTSC	17 days	Fri 2/26/10	Mon 3/22/10
59	Preparation of Final Report	16 days	Tue 3/23/10	Tue 4/13/10
60	Submit Final Report to Navy, RWQCB, and DTSC	0 days	Tue 4/13/10	Tue 4/13/10
61	**Task 3 - 2010 Annual Groundwater Performance Monitoring**	**172 days**	**Mon 8/23/10**	**Tue 4/19/11**
62	Performance Monitoring	15 days	Mon 8/23/10	Fri 9/10/10
63	Soil Vapor Sampling	2 days	Mon 8/30/10	Tue 8/31/10
64	Laboratory Analysis	28 days	Mon 9/13/10	Wed 10/20/10
65	Data Evaluation	30 days	Thu 10/21/10	Wed 12/1/10
66	**Reporting**	**99 days**	**Thu 12/2/10**	**Tue 4/19/11**
67	Preparation of Draft Report	30 days	Thu 12/2/10	Wed 1/12/11
68	Submit Draft report to Navy	0 days	Wed 1/12/11	Wed 1/12/11
69	Draft Report Review by Navy	24 days	Thu 1/13/11	Tue 2/15/11
70	Preparation of Draft-Final Report	12 days	Wed 2/16/11	Thu 3/3/11
71	Submit Draft-Final Report to Navy, RWQCB, and DTSC	0 days	Thu 3/3/11	Thu 3/3/11
72	Draft-Final Report Review by Navy, RWQCB, and DTSC	17 days	Fri 3/4/11	Mon 3/28/11
73	Preparation of Final Report	16 days	Tue 3/29/11	Tue 4/19/11
74	Submit Final Report to Navy, RWQCB, and DTSC	0 days	Tue 4/19/11	Tue 4/19/11



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Task | Progress | Summary | Rolled Up Split | Rolled Up Progress | Project Summary
Split | Milestone | Rolled Up Task | Rolled Up Milestone | External Tasks