8/1/06-00989

Final

Treatability Study Report
Site 13
Naval Amphibious Base Little Creek
Virginia Beach, Virginia

NAVFAC
Naval Facilities Engineering Command
NAVFAC ATLANTIC

Prepared for

Department of the Navy
Naval Facilities Engineering Command Atlantic

Contract No. N62470-03-D-4401
Task Order-0026

AGVIQ
AGVIQ ENVIRONMENTAL SERVICES
CH2M HILL
JOINT VENTURE

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Prepared by:

AGVIQ
AGVIQ ENVIRONMENTAL SERVICES
CH2M HILL
JOINT VENTURE

Virginia Beach, VA

August 31, 2006

Commander
NAVFAC Mid Atlantic
Attention: Mr. Scott Park, P.E.
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Code EV3, Bldg. N-26, Rm. 3208
Norfolk, VA 23511-3095

Subject: Final Site 13 Treatability Study Report
NAB Little Creek, Virginia Beach, Virginia
Contract N62470-03-D-4401
Task Order 026

Dear Mr. Park:

Enclosed is one hard copy of change pages and one CD ROM of the Final Site 13 Treatability Study Report, NAB Little Creek. Hard copy change pages are being distributed to the U.S. Environmental Protection Agency and Virginia Department of Environmental Quality as outlined on the distribution list below

If you have any questions or comments regarding the enclosed document, please feel free to contact me at 757.671.8311 ext 412.

Sincerely,

AGVIQ-CH2M HILL JVI

Paul Landin, P.E.
Project Manager

cc: Mr. Jeff Boylan/USEPA (4 hard copies of change pages)
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Acronyms and Abbreviations

bgs	below ground surface
CCR	Construction Completion Report
CTE	central tendency exposure
DCE	dichloroethene
DO	dissolved oxygen
DPT	direct-push technology
EE/CA	Engineering Evaluation/Cost Analysis
EOS®	Edible Oil Substrate®
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERA	ecological risk assessment
ERD	enhanced reductive dechlorination
FS	Feasibility Study
HHRA	human health risk assessment
HQ	hazard quotient
IAS	Initial Assessment Study
IES	Solutions-Industrial and Environmental Services
IRA	interim removal action
IRI	Interim Remedial Investigation
ISOTEC	In-Situ Oxidative Technologies, Inc.
ISCO	in situ chemical oxidation
kg	kilogram
L	liter
µg	microgram
MCL	maximum contaminant level
mg	milligram
MIP	membrane interface probe
MNA	monitored natural attenuation
MS/MSD	matrix spike/matrix spike duplicate
mV	millivolts
NAB	Naval Amphibious Base
ORC®	Oxygen Release Compound
ORP	oxidation/reduction potential

PCE	tetrachloroethene
PCP	pentachlorophenol
PP	Proposed Plan
PRG	preliminary remediation goals
PVC	polyvinyl chloride
PWC	Public Works Center
QA/QC	quality assurance/quality control
RAO	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
ROI	radius of influence
RVS	Round 1 Verification Step
SRI	Supplemental Remedial Investigation
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Unit
TAL	target analyte list
TCE	trichloroethene
TCL	target compound list
TOC	total organic carbon
VC	vinyl chloride
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound

SECTION 1

Introduction

This report presents the results of a groundwater treatability study conducted at Site 13, Naval Amphibious Base (NAB) Little Creek in Virginia Beach, Virginia. The groundwater treatability study evaluated the potential for treatment of chlorinated volatile organic compounds (VOCs) and one semi-volatile organic compound (SVOC), pentachlorophenol (PCP), in Site 13 groundwater using in situ chemical oxidation (ISCO) in the northern portion of the site, and enhanced reductive dechlorination (ERD) in the southern portion of the site. Three additional monitoring wells were installed to supplement the seven existing treatability study wells, and a complete round of groundwater samples were collected from the monitoring well network to provide baseline groundwater characteristics for post-treatment comparison. Implementation of the treatability study was performed according the *Final Work Plan for Treatability Study at Site 13* (Agviq-CH2M HILL JVI, October 2004).

The objectives of the treatability study were to:

- Implement ISCO in the northern treatment area and ERD in the southern treatment area to reduce concentrations in groundwater; and
- Evaluate the effectiveness and progress of the ISCO and ERD applications.

This treatability study report is divided into five sections. The remainder of Section 1 describes facility and site background. Section 2 presents the treatability study design and field approach. Section 3 presents analytical results. Conclusions and recommendations are provided in Section 4. References are provided in Section 5.

1.1 Facility Background

NAB Little Creek is primarily an industrial facility providing logistic support services for local commands, organizations, home-ported ships, and other units to meet the amphibious warfare training requirements of the Armed Forces of the United States. In addition to industrial land use, NAB Little Creek is also used for recreational, commercial, and residential purposes. The location of NAB Little Creek is shown in Figure 1-1.

The area surrounding the 2,215-acre NAB is low lying and relatively flat with several freshwater lakes—Chubb Lake, Lake Bradford, Little Creek Reservoir/Lake Smith, and Lake Whitehurst—located on, or adjacent to, the base. Little Creek Reservoir/Lake Smith, located south of the base, serves as a secondary drinking-water supply for parts of the city of Norfolk. NAB Little Creek is bordered by three saltwater bodies: Little Creek Cove, Desert Cove, and Little Creek Channel. The channel connects the coves with the Chesapeake Bay, which borders the facility to the north.

NAB Little Creek is located within the Atlantic Coastal Plain Physiographic Province. The uppermost geologic unit at the installation is the Columbia Formation, which is characterized by interbedded clay, sand, gravel, and silt with some shell fragments. These

sediments comprise the water-bearing strata of the shallow water table aquifer (Columbia Aquifer). The water table is at a depth ranging seasonally from 4 to 7 feet below the ground surface (bgs). The bottom of the Columbia Aquifer is approximately 20 to 27 feet bgs, and is underlain by a clay confining unit (Yorktown Confining Unit) that ranges in thickness from 30 to 40 feet. This confining unit separates the Columbia Aquifer from the deeper Yorktown Aquifer. Groundwater flow direction in the Columbia Aquifer at the site is west to southwest. The hydraulic conductivity has been estimated via pumping tests at nearby Site 12 to be 110 feet/day and is likely to be similar at Site 13. The average gradient at Site 13 is 0.002 feet/feet. Using an effective porosity of 0.3 (Wiedemeier et al., 1996), the groundwater flow velocity in the Columbia Aquifer at Site 13 is estimated to be approximately 0.73 feet/day.

1.2 Site 13 Description and History

Site 13 is located near the intersection of 7th and F Streets in the eastern portion of NAB Little Creek (Figure 1-2). The site consisted of a PCP dip tank and wash rack formerly used to treat wood with a mixture of PCP, diesel, and kerosene; an adjacent area that contained drying racks for the PCP-treated wood; an open area formerly used by the public works center (PWC) for storage of supplies and equipment, and a concrete wash rack at the southwestern end of that area (Figure 1-2). This site is also referred to in the Resource Conservation and Recovery Act (RCRA) Facilities Assessment (RFA) as Solid Waste Management Units (SWMUs) 14 (wash rack) and 15 (dip tank).

The PCP dip tank was in operation from the early 1960s until 1974. The tank was constructed of metal, and was 20 feet in length and 5 feet in diameter. The top third of the tank was cut off and replaced with a metal lid. The bottom half of the tank was buried in the ground. A tank of this size and specifications would hold approximately 1,500 gallons.

The contents of the tank were a mixture of one part PCP to ten parts diesel and kerosene. Wood was dipped into the tank and either set on racks for drying or placed directly on trucks for delivery to where it was to be used on base. The drying racks were located immediately east of the dip tank between the tank and Building 3165E. A pump was located at the south end of the tank, outside the fenced compound. This pump was used to mix the contents of the tank and to empty the waste into 55-gallon drums when it became spent. The dip tank was cleaned out approximately every 6 months (RGH, 1984). All remaining PCP solution and associated sludges were removed from the tank in 1975, and the tank itself was dismantled in 1982. The area formerly containing the PCP dip tank and drying racks has since been paved with asphalt and converted to a PWC storage area.

The wash rack and storage area continues to be used by the PWC. The wash rack is a concrete pad with bermed sides and centrally located deck drain (Figure 1-2). The rack was installed in 1945 and is used by the PWC to clean vehicles, equipment, and miscellaneous objects with steam and biodegradable chemical cleaners. Wash water and other runoff from the rack drains through the central deck drain into an oil/water separator located under the paved driveway between the wash rack and Building 3165.

1.3 Previous Investigations

The 1984 Initial Assessment Study (IAS) reported readily observable solvents, paint, fuel, and tar staining the surface in the dip tank, wash rack, and storage area. During the Interim Remedial Investigation (IRI) in 1991, the gravel area was free of surface staining, indicating that although the area continued to be used as a storage yard by Public Works, the occurrence of spillage and other releases has been significantly reduced (Ebasco, 1991).

As part of the Round I Verification Study (RVS), five groundwater monitoring wells were installed and sampled for groundwater quality parameters, and water-level measurements were collected to determine groundwater flow direction. Three surface soil and three subsurface soil samples were collected for analysis to assess the nature and extent of contamination. A second round of groundwater monitoring was conducted during the IRI.

A Remedial Investigation/Feasibility Study (RI/FS) was conducted at Site 13 (FWES, November 1994). Five surface soil, three subsurface soil, and seven groundwater samples were collected and analyzed for VOCs, SVOCs, and total organic carbon (TOC, soil only). The results indicated that VOCs and SVOCs were present in groundwater at concentrations that may pose potential human health risk. Additional soil and groundwater sampling was recommended.

Following the RI/FS, a Supplemental RI (SRI) was completed to further define the nature and extent of contamination. This evaluation included a sewer investigation, an ecological risk assessment (ERA) and a human health risk assessment (HHRA) (CH2M HILL, 2002). The sanitary sewer survey concluded that the discharge rate of groundwater from the aquifer to the sewer line running north to south along F street was approximately 16 gallons per minute. The ERA was completed using data from the 1993 RI, Phase I (1995) SRI, and Phase II (1998) SRI. The results indicated that there were no unacceptable risks to ecological receptors under the current conditions at Site 13 (CH2M HILL, 2001).

Before the HHRA, an Engineering Evaluation/Cost Analysis (EE/CA) was prepared to evaluate remedial alternatives to minimize the continued release of PCP in soil to site groundwater (CH2M HILL, 1999). EPA guidance was used to calculate a leaching-based soil removal action level of 16,000 µg/kg. Subsequent to the EE/CA, an interim removal action (IRA) was conducted to remove 442 tons of PCP-contaminated soil from the area directly below and surrounding the former dip tank (Figure 1-3). Confirmation samples were collected to ensure that soil remaining in place did not exceed 16,000 µg/kg. Following confirmation sampling, the site was backfilled, re-graded, and paved (IT-OHM, 1999). The HHRA included analytical results from the 1993 RI, 1995 Phase I SRI, and 1998 Phase II SRI, and eliminated soil samples collected within the area excavated during the 1999 IRA. The HHRA evaluated potential risks associated with exposure of site soil and groundwater to the current/future industrial worker, future construction worker, and future resident (adult/child). A summary of the cancer risks and noncancer hazards based on reasonable maximum exposure (RME) calculations is provided on Table 1-1. Central tendency exposure (CTE) risks and hazards were calculated for receptors and media that had RME risks or hazards greater than EPA's target levels and are provided on Table 1-2.

There were no unacceptable hazards or risks associated with exposure to Site 13 soil to a construction worker, industrial worker, or future adult resident based on RME calculations.

The RME hazard for exposure to site soil by a future child resident (ingestion) was slightly above EPA's target threshold of 1 (HI=1.1). However, there were no individual target organ effects that contribute to an HI above 1, and the CTE hazard was below EPA's target threshold of 1 (HI=0.40). Therefore, the Navy in partnership with the U.S. Environmental Protection Agency (EPA), and Virginia Department of Environmental Quality (VDEQ) agreed that no further action for soil at Site 13 is warranted.

The results of the HHRA indicated that exposure to site groundwater by a construction worker, industrial worker, and future adult and child resident may pose an unacceptable risk based on dermal contact with PCP by a construction worker or industrial worker, and ingestion and dermal contact of PCP, three VOCs (tetrachloroethene [PCE], trichloroethene [TCE], and vinyl chloride [VC]), and two metals (iron and manganese) by future residents. Iron and manganese are essential human nutrients—their concentrations present in site groundwater are consistent with background, and the CTE calculations are below EPA's target threshold of 1. Therefore, the Navy, in partnership with EPA and VDEQ, agreed that iron and manganese do not pose unacceptable risk. The SRI recommended an FS to evaluate potential remedial alternatives and develop preliminary remediation goals (PRGs) to mitigate potential human health risks due to the presence of PCP, PCE, TCE, and VC in site groundwater.

A pilot study was completed at Site 13 from October 2000 through January 2002 in a 17-foot by 47-foot rectangular area within the vicinity of the soil excavation area (Figure 1-2). While the intent of the soil excavation was to remove leachable concentrations of PCP, the intent of the pilot study was to aerobically biodegrade PCP in the underlying groundwater using Oxygen Release Compound (ORC®). During the pilot study, the maximum PCP concentrations were detected in MW21S and MW26S at concentrations of 450 µg/L and 880 µg/L, respectively. These concentrations decreased by the final round of post-ORC®-treatment sampling to 130 µg/L and 110 µg/L, respectively. With the exception of MW21S and MW26S, PCP concentrations decreased to below 20 µg/L in all monitoring wells sampled during the final round of monitoring.

Additional groundwater investigations were conducted in October 2003 using a membrane interface probe (MIP) to confirm the extent of the groundwater plume. Also, groundwater data were collected from existing monitoring wells in December 2003. The PCP and total chlorinated ethenes groundwater plume are depicted in Figures 1-4 and 1-5, respectively.

The FS evaluated potential alternatives to remediate PCP and chlorinated ethenes in groundwater. The site-specific remedial action objective (RAO) for Site 13 is to prevent exposure to unacceptable risks to potential receptors of groundwater. Two alternatives, enhanced anaerobic bioremediation and enhanced aerobic bioremediation and MNA, were ranked similarly as the most effective alternative. The Navy, EPA, and VDEQ agreed to conduct a treatability study to evaluate the effectiveness of a combined treatment utilizing chemical oxidation in the northern portion of the plume and bioremediation in the southern portion of the plume. Before implementation of the treatability study, a survey was conducted of the sewer line running north–south along F-Street. No leaks were observed at the time of the 2003 survey and it is assumed that the sewer line has been repaired. Currently, the PCP and VOC groundwater plumes appear to be migrating south/southeast toward Gator Boulevard and the PWC Building 3165 (Figure 1-2).

Table 1-1
Summary of RME Cancer Risks and Hazard Indices
Site 13 Treatability Study Report
NAB Little Creek

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Hazard Index	Chemicals with HI>1
Construction Worker	Surface and Subsurface Soil	Ingestion	2.9E-07		0.2	
		Dermal Contact	2.2E-08		0.02	
		Inhalation	NA		NA	
		Total	3.1E-07		0.2	
	Groundwater	Ingestion	NA		NA	
		Dermal Contact	2.8E-04	Pentachlorophenol (2.8E-4)	6.8	Pentachlorophenol (5.4)
		Inhalation	1.5E-08		0.001	
		Total	2.8E-04		6.8	
	All Media	Total	2.8E-04		7.0	
Industrial Worker	Surface Soil	Ingestion	1.0E-06		1.8E-04	
		Dermal Contact	7.8E-07		6.1E-04	
		Inhalation	NA		NA	
		Total	1.8E-06		7.9E-04	
	Surface and Subsurface Soil	Ingestion	3.0E-06		0.08	
		Dermal Contact	1.5E-06		0.06	
		Inhalation	NA		NA	
		Total	4.5E-06		0.14	
	Groundwater	Ingestion	2.9E-04	Pentachlorophenol (1.3E-4)	1.9	All individual constituents <1
		Dermal Contact	NA		NA	
		Inhalation	NA		NA	
		Total	2.9E-04		1.9	
	All Media	Total	2.9E-04		2.0	
Resident Adult	Surface and Subsurface Soil	Ingestion	NA		0.11	
		Dermal Contact	NA		0.07	
		Inhalation	NA		NA	
		Total	NA		0.18	
	Groundwater	Ingestion	NA		5.4	Iron (1.9)
		Dermal Contact	NA		9.9	Pentachlorophenol (9.0)
		Inhalation	NA		0.28	
		Total	NA		16	
	All Media	Total	NA		16	
Resident Child	Surface and Subsurface Soil	Ingestion	NA		1.1	
		Dermal Contact	NA		0.09	
		Inhalation	NA		NA	
		Total	NA		1.1	
	Groundwater	Ingestion	NA		13	Tetrachloroethene (2.2), Trichloroethene (1.6), Iron (4.3), Manganese (2.3)
		Dermal Contact	NA		22	Tetrachloroethene (1.2), Pentachlorophenol (20)
		Inhalation	NA		NA	
		Total	NA		35	
	All Media	Total	NA		36	

Table 1-1
Summary of RME Cancer Risks and Hazard Indices
Site 13 Treatability Study Report
NAB Little Creek

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Hazard Index	Chemicals with HI>1
Resident Child/Adult	Surface and Subsurface Soil	Ingestion	1.3E-05		NA	
		Dermal Contact	2.1E-06		NA	
		Inhalation	NA		NA	
		Total	1.5E-05		NA	
	Groundwater	Ingestion	1.6E-03	Tetrachloroethene (2.7E-4), Vinyl Chloride (6.5E-4), Pentachlorophenol (5.7E-4)	NA	
		Dermal Contact	1.8E-02	Tetrachloroethene (1.5E-4), Pentachlorophenol (1.7E-2)	NA	
		Inhalation	7.6E-05		NA	
		Total	1.9E-02		NA	
	All Media	Total	1.9E-02		NA	

NA - Exposure media/route not analyzed

Table 1-2
Summary of CTE Cancer Risks and Hazard Indices
Site 13
Treatability Study Report
NAB Little Creek

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Hazard Index	Chemicals with HI>1
Construction Worker	Groundwater	Ingestion	NA		NA	
		Dermal Contact	7.5E-05		1.7	Pentachlorophenol (1.4)
		Inhalation	NA		NA	
		Total	7.5E-05		1.7	
	All Media	Total	7.5E-05		1.7	
Industrial Worker	Groundwater	Ingestion	4.2E-05		0.72	
		Dermal Contact	NA		NA	
		Inhalation	NA		NA	
		Total	4.2E-05		0.72	
	All Media	Total	4.2E-05		0.72	
Resident Adult	Groundwater	Ingestion	NA		1.1	All individual constituents <1
		Dermal Contact	NA		5.8	Pentachlorophenol (5.4)
		Inhalation	NA		NA	
		Total	NA		6.9	
	All Media	Total	NA		6.9	
Resident Child	Surface and Subsurface Soil	Ingestion	NA		0.35	
		Dermal Contact	NA		0.05	
		Inhalation	NA		NA	
		Total	NA		0.40	
	Groundwater	Ingestion	NA		3.6	All individual constituents <1
		Dermal Contact	NA		12	Pentachlorophenol (12)
		Inhalation	NA		NA	
		Total	NA		16	
	All Media	Total	NA		16	
Resident Child/Adult	Groundwater	Ingestion	4.4E-04	Vinyl Chloride (1.6E-4), Pentachlorophenol (2.0E-4)	NA	
		Dermal Contact	1.8E-02	Pentachlorophenol (6.1E-3)	NA	
		Inhalation	1.3E-05		NA	
		Total	1.8E-02		NA	
	All Media	Total	1.8E-02		NA	

NA - Exposure media/route not analyzed

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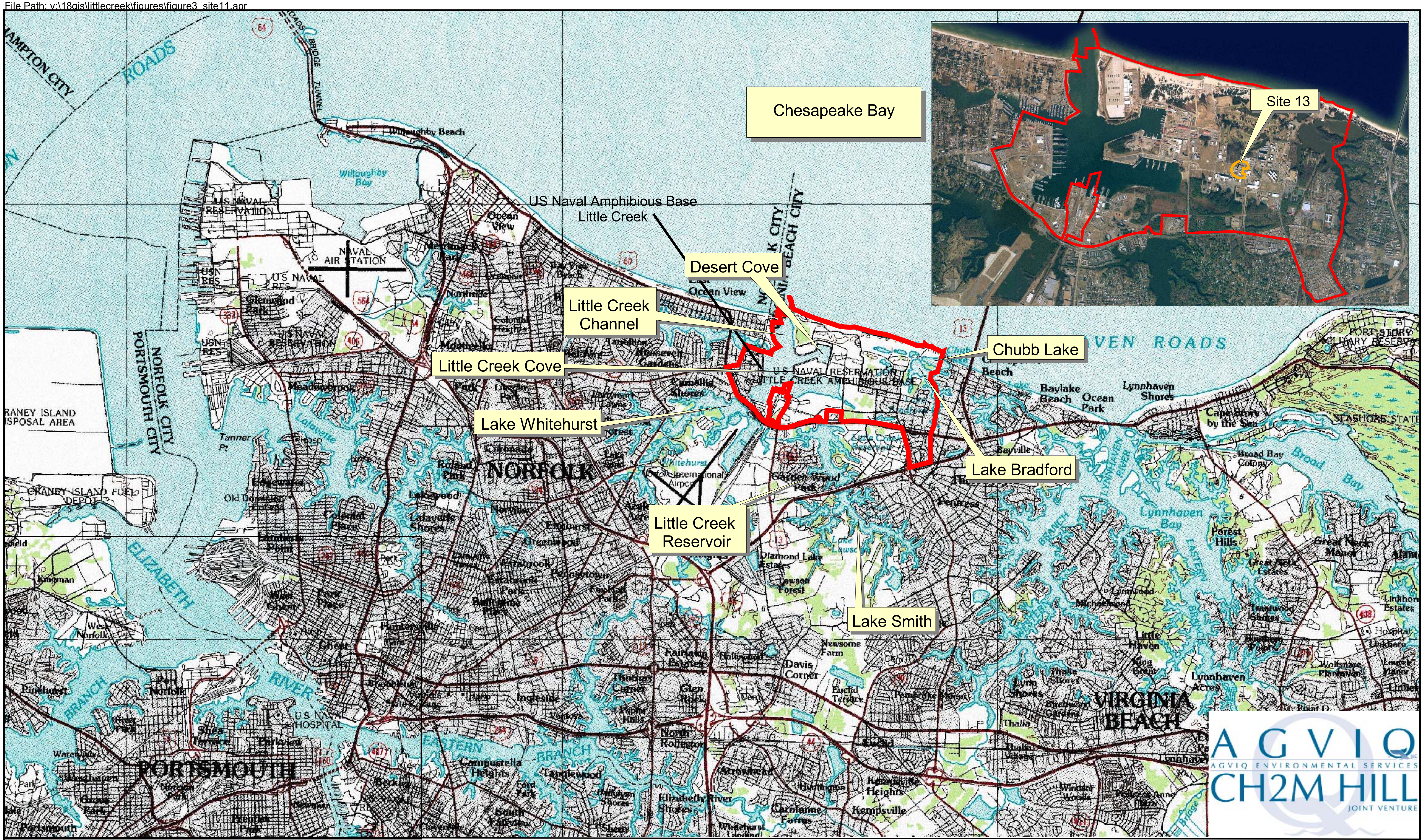

LEGEND

Base Boundary

Site 13 Area of Investigation

N

0 6000 12000 18000 Feet

Figure 1-1
NAB Little Creek & Site 13 Location
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

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LEGEND

- Site 13 Area of Investigation
- Monitoring Well
- Sanitary Sewer Lines
- Fire Hydrant
- Groundwater Contour (ft msl)
- Inferred Groundwater Contour
- Groundwater Flow Direction (April 2006)
- Soil Removal Area (1999)
- ORC Treatment Area (2000-2002)

N

0 150 300 Feet

Figure 1-2
Site 13 Location and Vicinity
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

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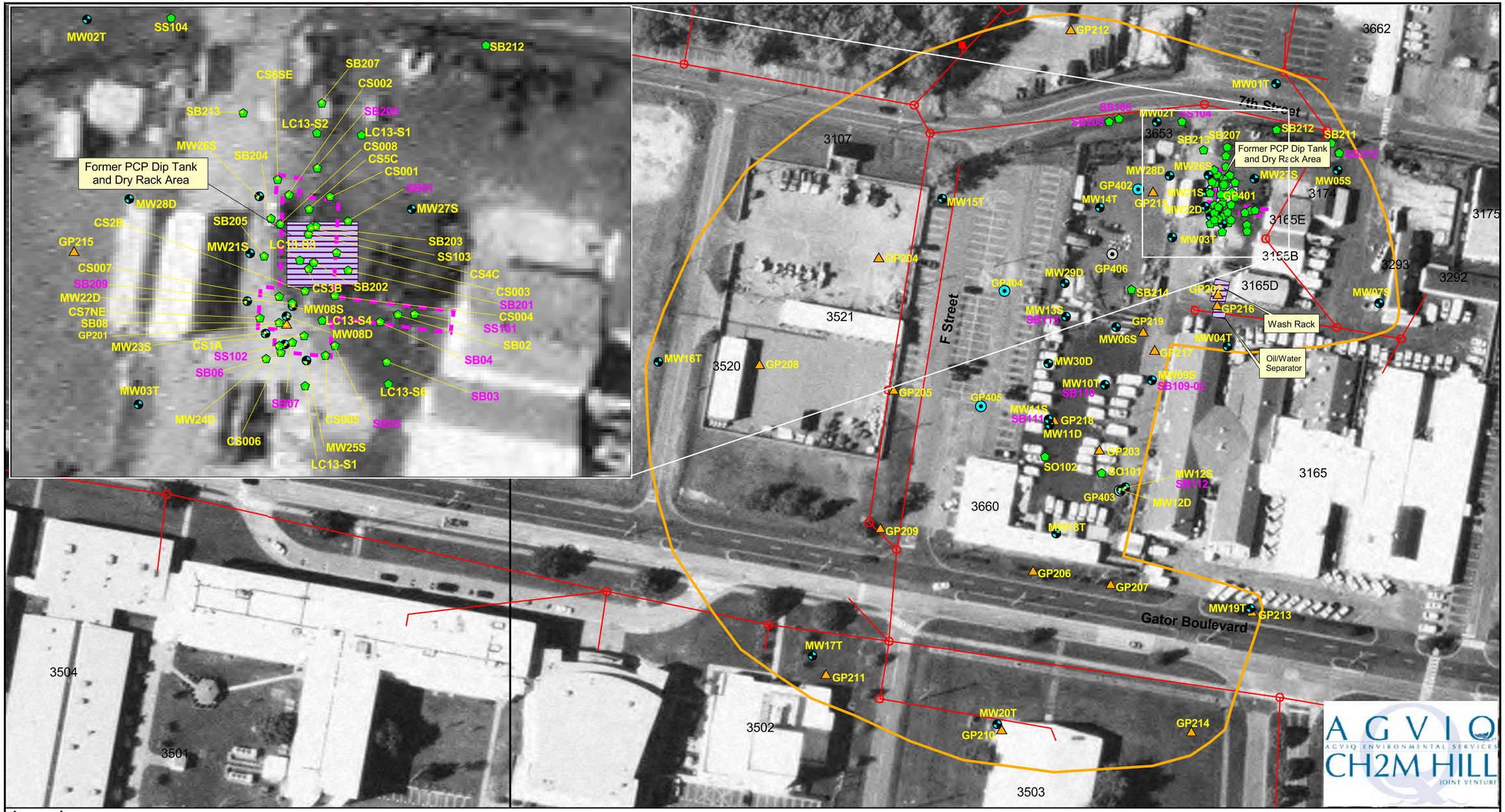

Legend

- Site 13 Area of Investigation
- Soil Removal Area (1999)
- Sanitary Sewer Line
- MIP and Groundwater Sampling Location
- MIP Location
- Monitoring Well Sample Locations
- Soil Geoprobe Sample Locations
- Soil Sample Locations
- SS104 Soil Samples included in HHRA

N

0 100 200 Feet

Figure 1-3
Previous Investigation Sample Locations
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

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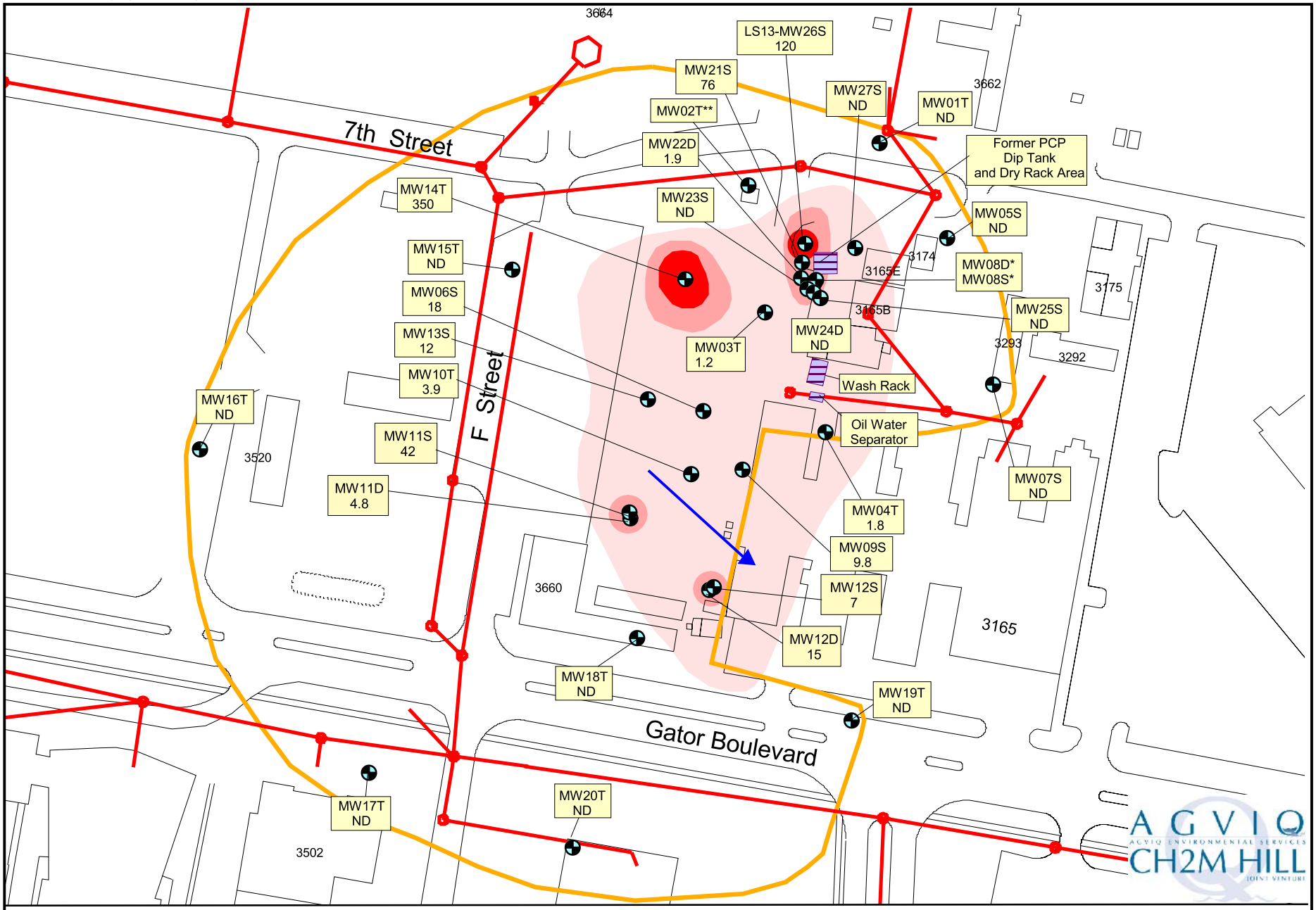

LEGEND

- Site 13 Area of Investigation
- Monitoring Well
- 1-10 ug/L
- 10-100 ug/L
- 100+ ug/L
- Sanitary Sewer Lines
- Groundwater Flow Direction (December 2003)

ND - Not Detected
4.8 PCP Concentration µg/L
* - Wells removed during 1999 removal action
** - Well not found

N

0 125 250 Feet

Figure 1-4
PCP Isoconcentration
Columbia Aquifer, December 2003
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

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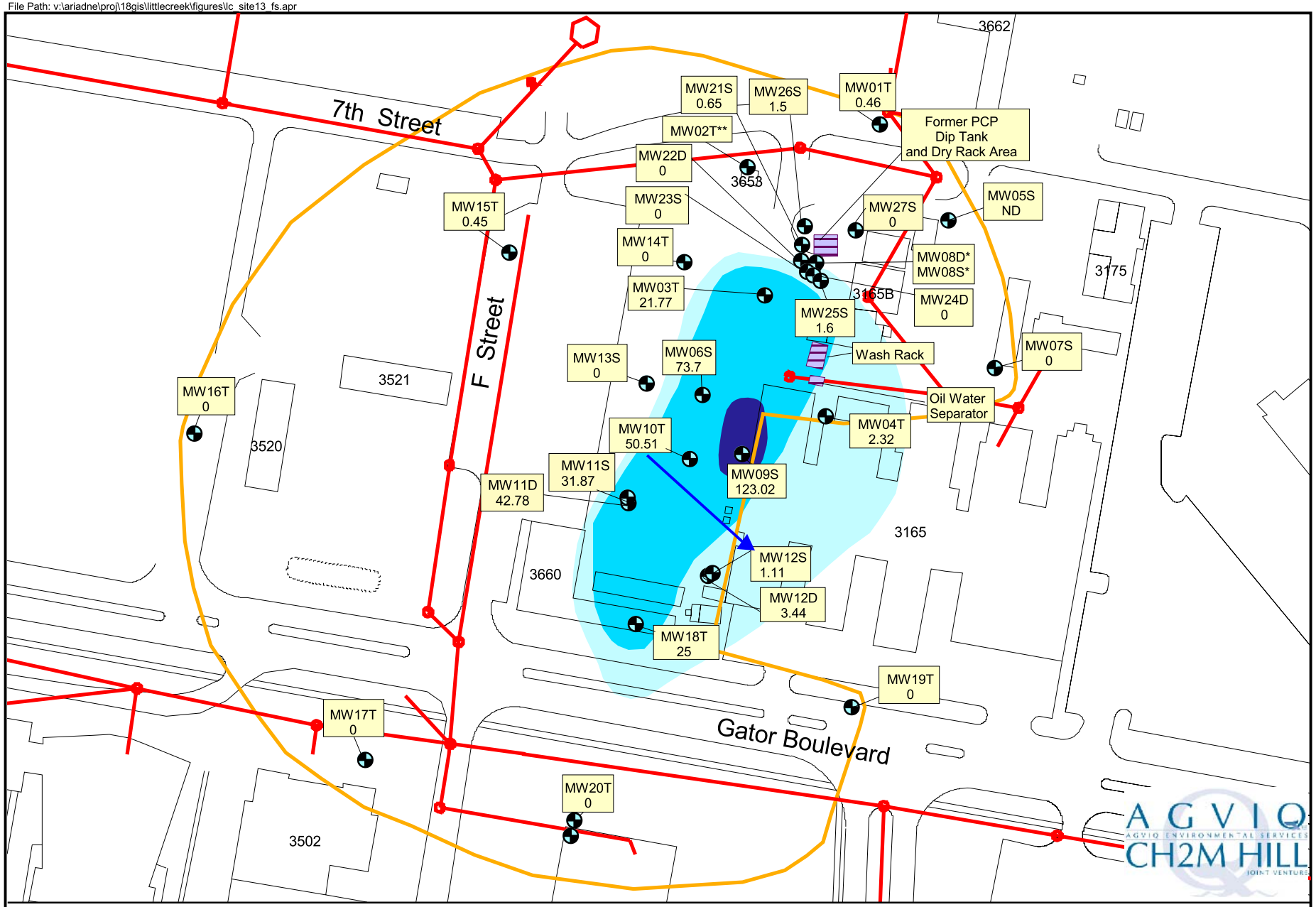

LEGEND

- Site 13 Area of Investigation
- Monitoring Well
- 1-10 ug/L
- 10-100 ug/L
- 100+ ug/L
- Sanitary Sewer Lines
- Groundwater Flow Direction (December 2003)

ND - Not Detected
3.44 Total Chlorinated Ethene Concentration (PCE, TCE, DCE, VC) µg/L
* - Wells removed during 1999 removal action
** - Well not found

N

0 125 250 Feet

Figure 1-5
Total Chlorinated Ethenes Isoconcentration
Columbia Aquifer, December 2003
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

SECTION 2

Treatability Study Design and Field Approach

The treatability study at Site 13 was designed to decrease PCP and VOC concentrations (specifically chlorinated ethenes) in groundwater. Site 13 was partitioned into two treatment areas: the northern area was treated with ISCO, and the southern area was treated with ERD. The treatability study design and implementation approach are summarized below and documented in a Construction Completion Report (CCR) (Appendix A).

2.1 ISCO – Northern Treatment Area

ISCO involves the application of chemical oxidants into the saturated zone to oxidize organic contaminants. Complete mineralization of the PCP and VOCs to carbon dioxide, water, chloride ions, and other innocuous byproducts is the stoichiometric endpoint of the ISCO process. Consequently, no waste streams requiring permitting, treatment, or disposal are produced. ISCO can be accomplished by catalyzing hydrogen peroxide with ferrous iron, which provides a dramatic increase in the oxidative strength of the hydrogen peroxide. The iron/peroxide mixture is known as Fenton's reagent. Classic Fenton's reaction, which uses a low concentration of hydrogen peroxide of approximately 300 milligrams per liter (mg/L, 0.03%), takes place at a pH of 2.5 to 3.5 to maintain iron solubility, thereby increasing its availability for reaction. The patented In-Situ Oxidative Technologies, Inc. (ISOTEC) ISCO process in the northern treatment area is a modified Fenton's reaction that uses 12 percent hydrogen peroxide and a chelated iron catalyst at neutral pH to maintain iron solubility.

Hydrogen peroxide was delivered to the site as a 35 percent bulk solution and was transferred to a 300-gallon polyethylene tank where it was diluted with water to the application concentration of 12 percent. The iron catalyst was shipped to the site in dry form and mixed in 300-gallon polyethylene tanks using on-site water.

The northern portion of the plume was estimated to encompass an area of approximately 100 feet by 200 feet (20,000 square feet) (Figure 2-1). The radius of influence (ROI) was estimated to be 12 feet; therefore, 43 DPT injection locations were spaced in a grid on approximately 24-foot centers. To uniformly distribute the reagents across the target depth of 7 feet bgs to 23 feet bgs, a shallow and a deep 1.5-inch injection point were driven at each of the 43 DPT locations for a total of 86 temporary DPT injection points. The shallow injection point was screened from 8 feet bgs to 13 feet bgs; the deep injection point was screened from 14 feet bgs to 23 feet bgs.

At each injection point, the direct-push injection rod was fitted with a wellhead assembly that included a pressure gauge and a relief valve. Polyvinyl chloride (PVC) flexible tubing was attached from the wellhead assembly to an air-operated diaphragm pump and from the pump to either the hydrogen peroxide, catalyst, or water tanks. The hydrogen peroxide, catalyst, and water were injected through the PVC tubing using the air-operated diaphragm pump.

At each injection location, the shallow and deep injection points were treated simultaneously. Injection volumes, pressures, and rates varied on a point-by-point basis. Approximately 10 to 15 gallons of water were injected before the injection of the hydrogen peroxide, between the injection of the hydrogen peroxide and iron catalyst, and following the injection of the iron catalyst. The majority of the injection points received 100 gallons of 12 percent hydrogen peroxide and 100 gallons of iron catalyst. However, injection volumes in some wells were limited because of surfacing and increased injection pressure. Surfacing was limited to only minimal amounts of liquid forming at the surface. After surfacing occurred, the injection ceased immediately and the liquid was contained using absorbent materials. Injection was also halted when pressures exceeded more than approximately 70 pounds per square inch. Reagents were injected from December 4, 2004, through December 8, 2004. Details of the ISOTEC ISCO injection, including reagent volumes applied per well, are included in the CCR that is provided as Appendix A.

2.2 ERD – Southern Treatment Area

To implement ERD, a suitable substrate (soluble or insoluble) is applied to the subsurface to enhance the reductive dechlorination process. Solutions-Industrial and Environmental Services (Solutions IES) product Edible Oil Substrate® (EOS®) was selected for ERD in the southern treatment area at Site 13. EOS® is comprised of lactate, soybean oil, and nutrients. The lactate provides a readily available carbon source while the soybean oil serves as a slower release carbon source to provide sustained conditions suitable for reductive dechlorination. The nutrients are intended to aid biotic stimulation. To complete anaerobic degradation of PCP, the replacement of a chlorine with a hydrogen molecule results in the production of first tetrachlorophenol, then trichlorophenol, dichlorophenol, and finally chlorophenol before the phenol ring is broken relatively late in the process. The sequential degradation pathway for chlorinate ethenes begins with PCE degrading to TCE, cis-1,2-DCE, VC, and finally to the innocuous end product, ethene. Ethene further degrades to ethane, then methane.

To implement ERD in the southern treatment area at Site 13, 1-inch temporary injection wells were installed using a Geoprobe®. The injection wells were constructed to a depth of approximately 22.5 feet bgs and were screened from 7.5 feet bgs to 22.5 feet bgs. Following installation, each injection well was developed using a combination of surging throughout the well screen and pumping, until the turbidity of the discharge water was substantially reduced. The injection locations are illustrated on Figure 2-1.

Concentrated EOS® was delivered to the site in drums, pumped into a tank and diluted with four parts water obtained from the fire hydrant on F Street (Figure 1-2). An intake hose ran from the tank of the dilute EOS® to a 3 horsepower single-phase electrical centrifugal pump. Manifolds were used to connect the injection hose from the pump to the injection well. The manifold included a valve that could be used to vary the delivery of the substrate, a pressure gage to evaluate injection pressures, a water meter to read injection volumes, and a bleed valve to remove air from the lines. The substrate was injected into the injection wells simultaneously in alternate injection manifolds (i.e., inject one well, skip one well, inject one well, etc.) to reduce the potential for breakthrough.

Approximately 150 gallons of EOS® was injected under low pressure into each of the wells. After the EOS® was injected, a small volume of approximately 285 milliliters of pre-mixed vitamin B12 solution was added to each injection well by pouring it into the top of the manifold. Subsequent to the EOS® and B12 application, approximately 1,100 gallons of chase water was injected into each injection well to move the emulsion away from the injection well and into the formation. Depending on location and injection sequence, between four and eight wells were injected simultaneously during each stage. Water levels were monitored by Solutions IES to evaluate mounding of the water table during the injection phase. Some mounding was observed 10 feet from the injection points with a maximum value of 2 feet above static level. Following the completion of the injection and water-level monitoring, all injection wells were abandoned by filling the well with granular bentonite clay to within 12 inches of the top. The PVC casing was cut below grade and the remaining hole was filled with neat cement grout. The injections were completed from December 6, 2004, through December 15, 2004. Details of the EOS® injection are provided in the CCR (Appendix A).

2.3 Treatability Study Monitoring

To evaluate treatment effectiveness, pre- and post-application groundwater samples were collected during seven sampling events from ten monitoring wells in the Site 13 monitoring well network (Figure 2-1). Pre-application groundwater samples were collected in October 2004 to serve as a baseline. Post-application groundwater sampling was completed in December 2004 (Round 1), February 2005 (Round 2), May 2005 (Round 3), July 2005 (Round 4), September 2005 (Round 5), and January 2006 (Round 6).

Sampling activities were conducted in accordance with Standard Operating Procedures as outlined in the NAB Little Creek Master Project Plan (CH2M HILL, December 2000). The wells were sampled using a peristaltic pump and low-flow sampling method. During purging, water quality parameters including pH, conductivity, turbidity, dissolved oxygen (DO), temperature, oxidation/reduction potential (ORP), and salinity, were monitored using a Horiba U-22 water quality indicator; well purging continued until these parameters stabilized. Following purging, groundwater samples were collected directly from disposable plastic tubing into laboratory-prepared sample bottles and immediately packed on ice for overnight shipment to the laboratory. Samples were submitted for analysis of target compound list (TCL) VOCs (OLM03.2) and target analyte list (TAL) total and dissolved metals (ILM04). Additionally samples in the southern treatment area were analyzed for metabolic acids, ethene, ethane, and methane. Quality assurance/quality control (QA/QC) samples were collected during the baseline and final round of groundwater sampling to support third-party validation. These included one trip blank per VOC analytical method per cooler containing VOCs, one field blank per week, one equipment blank per day, one duplicate sample per ten samples collected, and one matrix spike /matrix spike duplicate (MS/MSD) per 20 samples collected. Limited QA/QC including trip blanks, field blanks, and MS/MSD were collected during the interim monitoring rounds to ensure sample integrity.

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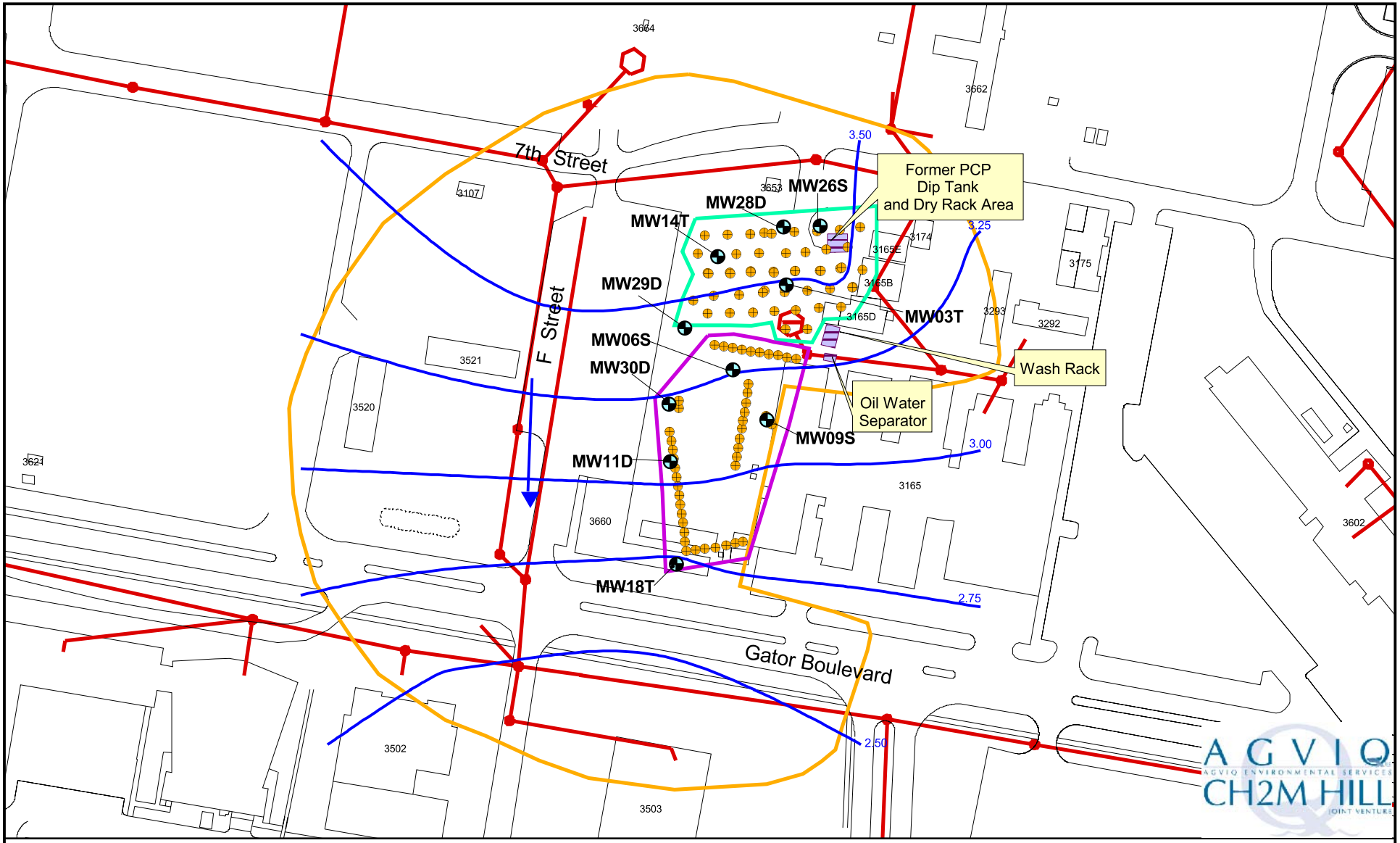

LEGEND

- Site 13 Area of Investigation
- Injection Points
- Treatability Study Monitoring Well Locations
- Groundwater Elevation (ft msl)
- Groundwater Flow Direction (April 2006)
- ISCO Treatment Area
- ERD Treatment Area
- Sanitary Sewer System

N

0 150 300 Feet

Figure 2-1
Injection and Monitoring Well Locations
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

SECTION 3

Analytical Results

This section presents analytical results for the baseline and six post-application rounds of monitoring and evaluates treatability study effectiveness for the northern treatment area and the southern treatment area.

3.1 Northern Treatment Area

Five monitoring wells were sampled in the northern treatment area to evaluate aquifer conditions before and after ISCO application. Monitoring wells MW03T, MW14T, MW26S, and MW28D are within the treatment area, and MW29D is downgradient of the treatment area (Figure 2-1). The monitoring well locations were within the following distances to the nearest injection points:

- MW14T: 3.5 ft
- MW03T: 7.5 ft
- MW26S: 6.5 ft
- MW28D: 13 ft
- MW29D: 30 ft

3.1.1 Field and Geochemical Parameters – Northern Treatment Area

ORP, DO, pH, conductivity, ferrous iron, and TOC were evaluated to monitor the distribution of the oxidant. Field parameter data are provided in Table 3-1. Figures 3-1a through 3-1f illustrate changes in field parameters over time. Because modified Fenton's reactions are typically short lived, any changes in aquifer conditions were expected to occur soon after the ISCO application followed by a return to near baseline conditions by Round 6.

Consistent with the treatment approach, notable increases in ORP were observed in all wells monitored in the northern treatment area (Figure 3-1a). This increase may have been the result of the presence of hydrogen peroxide, oxygen produced from the hydrogen peroxide added, or hydroxyl radicals (Fenton's reagent) formed from the hydrogen peroxide. It is difficult to tell from ORP if hydroxyl radicals were present. ORPs ranged from 52 to 105 mV before treatment and 100 to 318 mV during Round 1. Additionally, during Round 1 sample collection for all monitoring wells, and Round 3 for MW14T, the Horiba registered an error message at a DO concentration of 19.99 mg/L, suggesting DO concentrations were greater than this concentration (Figure 3-1b). After the hydrogen peroxide had been depleted, ORP and DO were expected to decreases to baseline. However, following Round 2, ORP and DO subsequently decreased to less than baseline in select wells. These decreases may have resulted from the desorption of organic material caused by the ISCO application, and subsequent biodegradation of organic material.

Because this reaction was not pH dependent, changes in pH were not expected (Figure 3-1c), and remained fairly constant throughout the treatability monitoring period. Conductivity, ferrous iron, and TOC spiked in MW14T and MW28D between baseline and Round 1

(Figures 3-1d and 3-1f), which suggests the chelating agent was adequately distributed to these wells. Because similar increases were not observed in the remainder of the wells in the northern treatment area, adequate distribution of the chelating agent cannot be verified. Conductivity, ferrous iron, and TOC decreased by Round 2 to near baseline, suggesting the chelating agent and thus ferrous iron was no longer available for reaction. Ferrous iron concentrations began to increase in MW28D in Round 3 and in MW26S in Round 5. Likewise, ORP and DO decreased in these monitoring wells. These data suggest the presence of anaerobic conditions in these wells.

3.1.2 Groundwater Analytical Results – Northern Treatment Area

Groundwater samples were collected before and after the ISCO application to monitor PCP, VOC, and metals concentrations. The analytical results are summarized below.

Metals – Northern Treatment Area

The analytical results for the metals detected during the baseline through Round 6 are provided in Table 3-1. Complete analytical results are provided in Appendix B. During the baseline sampling event, concentrations of metals did not exceed maximum contaminant levels (MCLs). During Rounds 1, 3, and 5, sporadic and slight MCL exceedances of thallium, beryllium, and arsenic were observed; however, these constituents did not exceed their respective MCLs in Round 6 samples. Only total (11.9 µg/L) and dissolved (16.6 µg/L) cadmium exceeded the MCL (5 µg/L) in samples from MW26S during Round 6. The chemical changes in the aquifer associated with the application of an oxidant may have allowed for increased metals mobilization; however, metals concentrations are expected to return to baseline conditions as the aquifer re-equilibrates.

PCP and VOCs – Northern Treatment Area

The treatability study was targeted at reducing PCP and VOC concentrations, specifically PCE, TCE, cis,-1,2-DCE, and VC in groundwater. Figure 3-2 depicts the sample location and corresponding constituent concentration per sampling event. A summary of PCP and VOC MCL exceedances is provided in Table 3-1, and complete PCP and VOC analytical results are provided in Appendix B.

Round 6 PCP and VOC groundwater plumes are illustrated in Figures 3-3 and 3-4, respectively. Figures 3-5a through 3-5e illustrate changes in constituent concentrations over time. PCP was detected in baseline groundwater samples from four monitoring wells (MW03T, MW14T, MW26S, and MW28D) at concentrations ranging from 14 to 630 µg/L, exceeding the MCL (1 µg/L). At MW14T, PCP concentrations decreased from 630 µg/L in Baseline to 64 µg/L in Round 6. PCP was below detection limits in samples collected from MW03T and MW28D. While the PCP concentration in MW26S decreased from 50 µg/L in the baseline sample to 34 µg/L in the Round 3 sample, the PCP concentration increased for the remainder of the sampling events, and by Round 6, the PCP concentration in MW26S had increased to 1,500 µg/L.

Because the 1998 removal action did not result in the complete excavation of saturated soils containing PCP, as evidenced by post-removal confirmation samples at a depth of 8 ft bgs, the increase in PCP at MW26S may be attributed to movement of contaminated groundwater to this well, or desorption of PCP from saturated soil as a result of the

application process. It should be noted that there was historically a significant amount of variation in PCP concentration over time. However, concentration increases of this magnitude had not been observed previously. The PCP groundwater plume, based on data collected during Round 6, is illustrated in Figure 3-3.

Select chlorinated ethenes exceeded MCLs in baseline groundwater samples collected from two monitoring wells. Detected concentrations of PCE (18 µg/L) exceeded the MCL (5 µg/L) in MW28D; TCE and VC were detected above their respective MCLs (5 µg/L and 2 µg/L, respectively) in MW03T and MW28T. VOC concentrations had decreased to below the MCL in MW03T by Round 1. In MW28D, PCE and TCE decreased to below the MCL by Round 1, increased in Round 3 (to 18 µg/L and 15 µg/L, respectively), and decreased to below the MCL in Round 4. VC concentrations appeared to spike in MW28D in Round 3, up to almost 50 µg/L, but then decreased to below the MCL by Round 6 (Figure 3-2). Anaerobic conditions existed in this well, which could explain the presence of VC. Because the baseline concentrations were relatively low, and the groundwater concentrations historically fluctuated, it is difficult to attribute the decrease of the chlorinated ethenes to this treatment. The groundwater plume for total chlorinated ethenes, based on data collected during Round 6, is illustrated in Figure 3-4.

3.2 Southern Treatment Area

Five monitoring wells were sampled in the southern treatment area to evaluate aquifer conditions before and after the EOS® application (Figure 2-1). The monitoring well locations were within the following distances to the nearest injection points:

- MW06S: 23 ft
- MW09S: 4 ft
- MW11D: 5 ft
- MW18T: 18 ft
- MW80D: 4 ft

Samples collected from monitoring wells MW06S, MW09S, MW11D, MW18T, and MW30D were analyzed in the baseline and post-injection rounds for parameters summarized below. Groundwater from MW30D was analyzed for volatile fatty acids, ethene, ethane, and methane in Rounds 5 and 6 only.

3.2.1 Field Parameters – Southern Treatment Area

ORP and DO were monitored to evaluate whether the reducing conditions conducive to reductive dechlorination were achieved following the EOS® application. Field parameter data are provided in Table 3-1. Changes in ORP and DO over time are illustrated on Figures 3-6a and 3-6b. Consistent with the treatment approach, appreciable decreases in ORP were observed in all wells monitored in the southern treatment area (Figure 3-6a). Generally, reductive dechlorination is considered possible at ORP values of -50 millivolts (mV) and even more likely to occur at ORP values of less than -100 mV. Based on the ORP measurements from baseline through Round 6 samples, adequate reducing conditions were achieved. The ORP in MW18T decreased to -69 mV and the ORP in MW06S, MW09S, MW11D, and MW30D decreased to below -100 mV. The DO results are also indicative of

anaerobic conditions as concentrations decreased in all southern plume monitoring wells to 0 mg/L by Round 2 (Figure 3-6b).

While reductive dechlorination has the potential to lower pH in systems without adequate buffering capacity, pH did not decrease following the EOS® application. As illustrated in Figure 3-6c, pH remained within the optimal range for reductive dechlorination (between 5 and 9) throughout the treatability study.

3.2.2 Groundwater Analytical Results –Southern Treatment Area

Groundwater samples were collected before and after the EOS® application to monitor geochemical parameters, volatile fatty acids, ethene, ethane, methane, metals, SVOCs, and VOCs. The analytical results are summarized below.

Attenuation Parameters – Southern Treatment Area

Several attenuation parameters were analyzed to ascertain the effectiveness of the EOS® application (Figures 3-7a through 3-7k). Ferrous iron concentrations greater than 1 mg/L, sulfate concentrations less than 20 mg/L, and methane concentrations greater than 0.5 mg/L are indicative of conditions amenable to reductive dechlorination. With the exception of MW18T, ferrous iron concentrations exceeded 1 mg/L in all wells by Round 2. In MW18T, ferrous iron concentrations exceeded 1 mg/L by Round 5. By Round 2, sulfate concentrations were less than 20 mg/L in all southern treatment area wells and remained at these low concentrations through Round 6. Methane concentrations increased to greater than 0.5 mg/L in three of the monitoring wells in the southern treatment area. Ferrous iron, sulfate, and methane trends over time are illustrated in Figures 3-7a through 3-7c, respectively.

TOC, which can be used as an indicator for the distribution of substrate, increased first in the monitoring wells closest to the injection points (MW30S and MW09S in Round 1). Increases were also observed in MW06S in Round 3 and MW11D in Round 4. Small increases were observed in MW18T, suggesting only minimal distribution of substrate to this monitoring well.

Volatile fatty acids including lactate, pyruvate, acetate, propionate, and butyrate (Figures 3-7e through 3-7i, respectively) were monitored to evaluate substrate distribution and longevity. The greatest concentrations of lactate, acetate, propionate, and butyrate were detected in MW09S during Round 2. Concentrations of lactate and acetate remained elevated in Round 6 samples collected from MW09S. Pyruvate concentrations uniformly increased in all monitoring wells sampled during Round 3 and remained at concentrations of greater than 20 mg/L in all Round 6 groundwater samples. These data indicate organic matter was both distributed throughout the treatment area and remained in the aquifer following the final round of post-injection sampling.

Because ethene and ethane are degradation end products of site VOCs, these gases were monitored to evaluate complete reductive dechlorination. Ethene and ethane were detected in the southern treatment area monitoring wells, suggesting suitable conditions for reductive dechlorination. Concentrations over time are illustrated in Figures 3-7j and 3-7k, respectively. Elevated ethene and ethane concentrations were detected primarily in MW09S

and to a lesser extent in MW06S, and are representative of the observed concentrations of the parent compounds.

Metals – Southern Treatment Area

The analytical results for the metals concentrations detected during the baseline through Round 6 are provided in Table 3-1. Complete analytical results are provided in Appendix B. Metals detected during the baseline sampling event did not exceed MCLs in the southern treatment area monitoring wells. While there were no MCL exceedances of metals in samples collected from MW18T during post-injection sampling, three metals (arsenic, antimony, and thallium) were intermittently detected above the MCL in the remainder of the southern treatment area wells. Minor MCL exceedances of thallium were observed in select wells during Rounds 1, 2, and 3. The greatest concentration was detected in MW30D (13.5 µg/L). Thallium was not detected above the MCL (2 µg/L) in subsequent post-injection sampling in the southern treatment area. A minor antimony MCL (6 µg/L) exceedance was observed in only one monitoring well (MW09S, 6.6 µg/L) during Round 6 post-injection monitoring. With the exception of MW18T, arsenic was fairly consistently detected at concentrations greater than the MCL (10 µg/L) in Rounds 2 through 6. The greatest detected concentration of arsenic was 34.7 µg/L in a Round 6 sample collected from MW09S. Increases metals concentrations during post-injection monitoring are attributed to the mobilization of metals as a result of the reducing conditions in the aquifer. Metals concentrations are expected to return to pre-injection conditions as the aquifer re-equilibrates.

PCP and VOCs – Southern Treatment Area

The treatability study was targeted at reducing PCP and VOC concentrations, specifically PCE, TCE, cis,-1,2-DCE, and VC in groundwater. Figure 3-2 depicts the sample location and corresponding constituent concentration per sampling event. A summary of PCP and VOC MCL exceedances is provided in Table 3-1, and complete PCP and VOC analytical results are provided in Appendix B.

Figures 3-8a through 3-8e illustrate changes in constituent concentrations over time. PCP was detected in baseline groundwater samples from four monitoring wells (MW06S, MW09S, MW11D, and MW30D) at concentrations exceeding the MCL (1 µg/L) and decreased to non-detect levels in all monitoring wells by Round 5. The PCP groundwater plume, based on data collected during Round 6, is illustrated in Figure 3-4.

The groundwater plume for total chlorinated ethenes, based on data collected during Round 6, is illustrated in Figure 3-4. PCE exceeded the MCL in samples collected from four monitoring wells (MW06S, MW09S, MW11D, and MW18T) during baseline sampling. PCE concentrations decreased to below detection limits in MW06S and MW09S, below the MCL (5 µg/L) in MW18T, and slightly above the MCL in MW11D (5.2 µg/L). During Baseline sampling, TCE was detected in concentrations exceeding the MCL (5 µg/L) in three monitoring wells (MW06S, MW09S, MW11D). By Round 6, TCE concentrations decreased to below the MCL in MW06S and MW09S, but slightly exceeded the MCL (8.9 µg/L) in MW11D. Baseline and Round 6 MCL exceedances of cis-1,2-DCE and VC were limited to MW06S and MW09S. In both monitoring wells, concentrations of cis-1,2-DCE and VC increased throughout the post-injection monitoring period to concentrations above MCL (70

µg/L and 2 µg/L, respectively). The maximum concentration of cis-1,2-DCE (1,900 µg/L) and VC (61 µg/L) were detected in MW09S in Round 6.

The observed increase in concentrations of cis-1,2-DCE and VC may be attributed to a number of factors. Similar to the ISCO application, the addition of substrate to the subsurface may have aided in desorption of VOCs throughout the treatment area, thereby increasing the mobility of these constituents. Increases may also be attributed to the degradation process. As discussed in Section 2.2.1, the sequential degradation pathway for chlorinated ethenes begins with PCE degrading to TCE, cis-1,2-DCE, VC, and finally to the innocuous end product, ethene. Because PCE and TCE degrade more rapidly than cis-1,2-DCE and VC under anaerobic conditions, the observed increases in these constituent concentrations may be attributed to the reductive dechlorination process. Nonetheless, the concentration of cis-1,2-DCE in MW09S is greater than anticipated based on the stoichiometric degradation of the observed concentrations of PCE and/or TCE. The largest PCE and TCE concentrations observed during the treatability study were 40 µg/L and 63 µg/L, respectively. Degradation of these concentrations would produce cis-1,2-DCE concentrations of less than 100 µg/L. Because the sequential removal of chlorines increases the mobility of the subsequent daughter product, the substantial increase of cis-1,2-DCE in MW09S may be attributed to larger than anticipated upgradient concentrations of PCE and/or TCE. Nevertheless, while cis-1,2-DCE and VC remain above the MCL in two of the monitoring wells sampled during Round 6, the increase in these constituents and the decrease in PCE and TCE indicate reductive dechlorination of site VOCs is continuing to occur in the southern treatment area.

Table 3-1
Field Parameters and Analytical Exceedances of Screening Criteria
NAB Little Creek
Virginia Beach, Virginia

Station ID	LC-Background UTL-Groundwater	MCL Ground-water	Northern Treatement Area Monitoring Wells																											
			LS13-MW03T							LS13-MW14T							LS13-MW21S			LS13-MW26S				LS13-MW28D						
Sample Date			10/26/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/26/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/28/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/26/04	12/21/04	03/01/05	05/09/05	07/07/05	09/06/05	01/10/06
Sampling Round			Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
Chemical Name																														
Volatile Organic Compounds (UG/L)																														
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.15 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	--	7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.18 J	0.5 U	0.21 J	0.73 J	0.5 U	0.5 U	0.5 UJ
1,2-Dichlorobenzene	--	600	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,3-Dichlorobenzene	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,4-Dichlorobenzene	--	75	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 J	0.49 J	1.1 J	0.51	1.4	2.3
2-Butanone	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	8.6	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1.3 J	20	5 U	21 U	5 U	5 U	5 U
Acetone	--	--	5 U	2.5 B	3.2 B	2.7 B	5 U	5 U	5 U	5 U	220	14 B	3.5 B	7.8	5 U	5 U	3.3 B	8.4 B	4.4 B	4.6 B	7.9	5 U	2.3 B	4.3 B	390	2.3 B	14 B	5 U	2.5 J	5 U
Benzene	--	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.18 J	0.45 J	0.2 J	0.22 J	0.5 U
Bromochloromethane	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Bromodichloromethane	--	80	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.64	0.14 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.36 J	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Bromoform	--	80	0.5 U	0.37 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.23 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.25 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Bromomethane	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.37 J	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Carbon disulfide	--	--	0.39 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.13 J	0.15 J	0.34 J	0.5 U	0.5 U	0.5 U	0.39 J	0.93 J	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Chlorobenzene	--	100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J	0.26 J	0.53	1.5	3.3	2	3.4	7.5
Chloroethane	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Chloroform	--	80	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5	0.47 J	0.18 J	0.5 U	0.5 U	0.12 J	0.5 U	0.62	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.74	1.9	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Chloromethane	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.14 J	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Cumene	--	--	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.11 J	0.5 UJ	0.5 U	0.5 U	0.29 J	0.5 U	0.13 J	0.11 J	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	5.7	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.32 J
Cyclohexane	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (Freon-12)	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	--	700	0.5 U	0.5 U	0.5 U	0.5 U	0.45 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.46 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.25 J	0.5 U	2	0.5 U	0.5 U	0.12 J	2.1 U	0.36 J	0.5 U	0.2 J
Methyl acetate	--	--	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.5	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Methyl-tert-butyl ether (MTBE)	--	--	0.78	1.9 J	0.14 J	0.8	0.94	1.2	0.39 J	3.6	0.5 UJ	1	1.4	0.97	0.57	0.61	0.27 J	0.15 J	0.5 U	0.11 J	0.5 U	0.5 U	0.19 J	0.4 J	0.5 U	0.16 J	2.1 U	0.21 J	0.17 J	0.12 J
Methylene chloride	--	5	0.14 B	0.5 U	0.11 B	2.3	0.48 B	0.5 U	0.5 U	0.13 B	0.15 B	0.1 B	0.22 B	0.54 B	0.5 U	0.5 U	0.27 B	0.5 U	0.11 B	2 B	0.51 B	0.5 U	0.5 U	0.28 B	0.15 B	0.5 U	1.5 B	0.56 B	0.5 U	0.5 U
Tetrachloroethene	--	5	3.2	2.5 J	0.51	0.93	0.72	1.2	0.25 J	0.14 J	0.95 J	0.81	0.11 J	0.5 U	0.5 U	0.16 J	0.5 U	0.56 J	0.66	0.5 U	0.5 U	0.5 U	0.5 U	6.3	1.5	1.9	18	1.1	0.31 J	0.5 U
Toluene	--	1,000	0.11 B	0.5 U	0.24 B	0.19 B	0.14 J	0.5 U	0.5 U	0.5 U	0.17 B	0.1 B	0.5 U	0.11 J	0.5 U	0.5 U	0.13 B	0.5 U	0.18 B	0.21 B	0.12 J	0.5 U	0.12 J	0.14 B	0.12 B	0.19 B	2.1 U	0.16 J	0.5 U	0.5 U
Trichloroethene	--	5	5.1	4.1	0.2 B	1.7	1.1	2.9	0.43 J	0.26 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	8	1.6	2.7	15	1.5	0.49 J	0.34 J
Trichlorofluoromethane(Freon-11)	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Vinyl chloride	--	2	2.2 J	0.28 J	0.5 U	0.66	0.29 J	1.8	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	4.2 J	2.7	17	49	9	5.3	1.3
Xylene, total	--	10,000	0.5 U	0.5 U	0.5 U	0.5 U	1.3	0.5 U	0.5 U	0.11 J	0.5 U	0.5 U	0.5 U	1.6	0.5 U	0.23 J	0.14 J	0.5 U	0.5 U	0.5 U	0.76	0.5 U	27	0.5 U	0.5 U	0.5 U	2.1 U	1	0.5 U	0.5 U
cis-1,2-Dichloroethene	--	70	8.6	9	0.1 J	4.5	2.4	11	0.92 J	0.72	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U	0.81 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	9.8	3.2	5.3	18	4.2	1.3	0.77 J
cis-1,3-Dichloropropene	--	--	0.5 U	0.15 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 B	0.5 U	0.44 J	0.5 U	0.5 U	0.5 U
trans-1,2-Dichloroethene	--	100	0.13 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.14 J	0.5 U	0.1 J	2.1 U	0.13 J	0.5 U	0.5 UJ
Semi-volatile Organic Compounds (UG/L)																														
1,1-Biphenyl	--	--	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1.4 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,6-Dinitrotoluene	--	--	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Methylnaphthalene	--	--	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	10	5 U	5 U	14 U	3.7 J	5 U	1.7 J	5 U	5 U	5 U	5 U	5 U	5 U	35	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Methylphenol	--	--	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methylphenol	--	--	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetophenone	--	--	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Caprolactam	--	--	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	19	13	2.7 J	5 U	5 U	5 U	5 U
Naphthalene	--	--	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	13	5 U	5 U	14 U	3.4 J	5 U	1.7 J	5 U	5 U	5 U	5 U	5 U	5 U	68	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Pentachlorophenol	--	1	77 J	4.4 J	5 U	5.6 U	5 U	5 U	5.6 U	630 J	5.1	210	99	210 J	160	64	50 J	48	34	60	57 J	110	1,500	14 J	5 U	5 U	2.7 J	10 J	7.1	5 U
Phenol	--	--	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
bis(2-Ethylhexyl)phthalate	5	6	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	14 U	5 U	4.8 J	5 U	5 U	5 U	5 U	4 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

Notes:

U- Analyte not detected

J- Reported value is estimated

B- Possible blank contamination

UJ- Analyte not detected. Quantitation limit is imprecise

UL- Analyte not detected. Quantitation limit is higher

R- Unreliable result

NA- Not analyzed

ND- Compound not detected during background investigation

Shading exceeds MCL Groundwater Standards

Exceeds Background UTL for Groundwater

Table 3-1
Field Parameters and Analytical Exceedances of Screening Criteria
NAB Little Creek
Virginia Beach, Virginia

			Northern Treatment Area Monitoring Wells							Southern Treatment Area MonitoringWells																			
Station ID	LC-Background UTL-Groundwater	MCL Ground-water	LS13-MW29D							LS13-MW06S							LS13-MW09S							LS13-MW11D						
Sample Date			10/27/04	12/21/04	03/01/05	05/09/05	07/07/05	09/07/05	01/10/06	10/27/04	01/05/05	02/28/05	05/10/05	07/07/05	09/07/05	01/11/06	10/28/04	01/05/05	02/28/05	05/10/05	07/07/05	09/07/05	01/11/06	10/27/04	01/05/05	03/01/05	05/10/05	07/07/05	09/07/05	01/11/06
Sampling Round			Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
Chemical Name																														
Volatile Organic Compounds (UG/L)																														
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	--	--	0.26 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.18 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	--	--	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	--	7	0.5 U	0.5 U	0.2 J	0.5 U	0.5 U	0.5 U	0.5 UJ	0.24 J	0.5 U	0.2 J	0.25 J	0.5 U	0.5 U	0.34 J	0.44 J	0.5 U	0.51 J	0.88	25 U	5	84 U	0.23 J	0.5 U	0.15 J	0.13 J	0.11 J	0.5 U	0.5 U
1,2-Dichlorobenzene	--	600	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,3-Dichlorobenzene	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,4-Dichlorobenzene	--	75	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.14 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	--	--	5 U	5 U	9.4	5 U	5 U	5 U	5 U	5 U	5 U	16	5 U	5 U	5 U	13 U	5 U	4.2 J	21 U	2.4 J	250 U	5 U	240 J	5 U	2.4 J	5 U	5 U	5 U	5 U	5 U
Acetone	--	--	7.3 B	2.2 B	9 B	3.7 B	5 U	3.2 J	5 U	5 U	5 U	12 B	7.3 B	4.6 J	2.4 J	13 B	5 U	19 B	21 U	11 B	250 U	9.3	1,200 B	2.4 B	5 U	3.6 B	4.8 B	4.7 J	5 U	5 U
Benzene	--	5	0.5 U	0.5 U	0.15 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.14 J	0.13 J	0.13 J	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.16 J	25 U	0.36 J	84 U	0.5 U	0.5 U	0.15 J	0.11 J	0.13 J	0.5 U	0.5 U
Bromochloromethane	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.52	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromodichloromethane	--	80	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	--	80	0.5 U	0.31 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	38 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromomethane	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon disulfide	--	--	0.5 U	0.5 U	0.26 J	0.5 U	0.5 U	0.5 U	0.5 U	0.21 J	0.5 U	0.75	0.36 J	0.5 U	0.5 U	1.3 U	0.5 U	1.6 J	2 J	0.26 J	25 U	0.17 J	84 U	0.81	0.15 J	0.29 J	0.22 J	0.5 U	0.5 U	0.5 U
Chlorobenzene	--	100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.39 J	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	--	--	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.81	25 U	0.5 U	84 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	--	80	5.3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.69	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	6.5	2.6	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	--	--	0.5 U	0.5 U	0.18 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cumene	--	--	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane	--	--	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.11 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (Freon-12)	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.36 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	--	700	0.5 U	0.5 U	0.5 U	0.5 U	0.25 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.4 J	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.19 J	0.5 U	0.5 U
Methyl acetate	--	--	0.5 U	0.5 UJ	3.4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	1.1	3.9	0.5 U	1.6	1.3 U	0.5 U	7.4 J	5	0.5 U	25 U	1.2	84 U	0.5 U	0.5 UJ	1.2	0.5 U	4.6	0.5 U	0.5 U
Methyl-tert-butyl ether (MTBE)	--	--	1	1.4 J	2.4	1.3	1.6	0.81	0.99	2.3	6.8 J	2.6	1.3	3.3	1.5	0.63 J	1.9	0.29 J	0.88 J	7.5	25 U	1.9	84 U	0.49 J	1.5 J	9	5.3	8.5	5	8.8
Methylene chloride	--	5	0.47 B	0.5 U	0.22 B	2.1 B	0.29 B	0.5 U	0.5 U	0.13 B	0.5 U	2.9	0.17 B	0.54 B	0.5 U	1.3 U	0.29 B	7.4 J	1.1 B	0.1 B	25 U	0.26 J	84 U	0.2 B	0.5 U	0.5 U	0.19 B	0.6 B	0.5 U	0.5 U
Tetrachloroethene	--	5	3.7	3.6 J	1.2	3.3	2.4	1.8	3	6.5	12	4.1	0.96	0.55	0.33 J	1.3 U	40	9.5	2 J	0.37 J	6.3 J	0.15 J	84 U	18	4.2	1.6	0.5 U	0.34 J	0.61	5.2
Toluene	--	1,000	0.14 B	0.5 U	0.16 B	0.21 B	0.11 J	0.5 U	0.5 U	0.5 U	0.11 B	0.29 B	0.11 J	0.13 J	0.5 U	0.31 J	0.14 B	0.25 B	0.67 B	0.16 J	25 U	0.15 J	84 U	0.16 B	0.16 B	0.33 B	0.11 J	0.19 J	0.5 U	0.5 U
Trichloroethene	--	5	0.59	0.51	0.22 B	0.52	0.4 J	0.28 J	0.41 J	12	24	8.6	15	0.95	1.3	1.3 U	63	9	2.4	10	38	3.1	84 U	10	2.4	0.76	0.17 J	0.24 J	0.25 J	8.9
Trichlorofluoromethane(Freon-11)	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.11 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl chloride	--	2	0.5 UJ	0.5 U	0.18 J	0.5 U	0.5 U	0.5 U	0.5 U	0.99 J	1.8	1.2	2.5	1.1	5.8	10	12 J	2.4 J	15	25 R	65	160	61 J	1.3 J	0.21 J	0.61	0.5 U	0.5 U	0.47 J	0.69
Xylene, total	--	10,000	0.5 U	0.5 U	0.5 U	0.5 U	0.71	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.1	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.55	0.5 U	0.5 U
cis-1,2-Dichloroethene	--	70	0.28 J	0.31 J	11	0.24 J	0.29 J	0.28 J	0.23 J	8.9	24	11	13	18	31	110	93	6.3	58	150	470	1,300	1,900	4.3	1.3	22	18	10	7.2	10
cis-1,3-Dichloropropene	--	--	0.5 U	0.14 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.11 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,2-Dichloroethene	--	100	0.5 U	0.5 U	0.11 J	0.5 U	0.5 U	0.5 U	0.5 UJ	0.36 J	2.5	0.76	0.99	0.52	1.2	0.66 J	2.1	0.26 J	0.62 J	1.6	25 U	11	84 U	0.16 J	0.5 U	0.12 J	0.11 J	0.5 U	0.5 U	0.16 J
Semi-volatile Organic Compounds (UG/L)																														
1,1-Biphenyl	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
2,6-Dinitrotoluene	--	--	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	3.6 J	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
2-Methylnaphthalene	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
2-Methylphenol	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6.1	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
4-Methylphenol	--	--	5 U	5 U	5 U	5 U	5 U	38	5 U	5 U	5 U	420	120 J	57	4.1 J	5 U	5 U	470	290	46 J	58	88	21	5.3 U	5 U	76	110	120	3.8 J	5.4 U
Acetophenone	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Caprolactam	--	--	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Naphthalene	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Pentachlorophenol	--	1	5 U	5 U	5 U	5 U	5 U	5 U	5 U	200 J	51 J	20	5 U	11 J	5 U	5 U	53 J	5.4 J	5 U	5 U	5 U	5 U	5 U	5.4 J	5 U	5 U	5 U	20 U	5 U	5.4 U
Phenol	--	--	5 U	5 U	5 U	5 U	5 U	2.3 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2.4 J	10	4.6 J	5 U	5.3 U	5 U	5 U	5 U	8.5 J	2.1 J	5.4 U
bis(2-Ethylhexyl)phthalate	5	6	5 U	5 U	5 U	4.4 J	5 U	5 U	5 U	5 U	6.7	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	32	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U

Notes:

U- Analyte not detected

J- Reported value is estimated

B- Possible blank contamination

UJ- Analyte not detected. Quantitation limit is imprecise

UL- Analyte not detected. Quantitation limit is higher

R- Unreliable result

NA- Not analyzed

NU- Compound not detected during background investigation

Shading exceeds MCL Groundwater Standards

Exceeds Background UTL for Groundwater

Table 3-1
Field Parameters and Analytical Exceedances of Screening Criteria
NAB Little Creek
Virginia Beach, Virginia

			Southern Treatment Area Monitoring Wells														
Station ID	**LC-Background UTL-Groundwater**	**MCL Ground-water**	LS13-MW18T							LS13-MW30D							
Sample Date			10/27/04	01/05/05	03/01/05	05/10/05	07/07/05	09/07/05	01/11/06	10/27/04	01/05/05	03/01/05	05/09/05	07/07/05	09/07/05	01/10/06	01/10/06
Sampling Round			Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 6 Duplicate
Chemical Name																	
Volatile Organic Compounds (UG/L)																	
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.11 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	--	7	0.24 J	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ
1,2-Dichlorobenzene	--	600	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.16 J	0.13 J
1,3-Dichlorobenzene	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,4-Dichlorobenzene	--	75	0.5 U	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	51	1.1 J	5 U	5 U	5 U	5 U	5 U
Acetone	--	--	5 U	5 U	3 B	2.6 B	5 U	3.2 J	5 U	4.3 B	13 B	5 U	3.2 B	5 U	3.4 J	2.2 B	2.2 B
Benzene	--	5	0.12 J	0.5 U	0.13 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromochloromethane	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromodichloromethane	--	80	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	--	80	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromomethane	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon disulfide	--	--	0.76	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.27 J	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene	--	100	0.72	0.64	0.89	0.53	0.61	0.57	0.31 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	--	80	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	9.1	2.4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cumene	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane	--	--	1.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (Freon-12)	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	--	700	0.5 U	0.5 U	0.5 U	0.5 U	0.13 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methyl acetate	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.27 J	0.5 U	0.5 U	3.2	1.8	0.5 U	0.5 U
Methyl-tert-butyl ether (MTBE)	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.21 J	0.31 J	0.5 U	2.1	1.3	1.1	1.6	0.98	0.7	0.65	0.64
Methylene chloride	--	5	0.21 B	0.5 U	0.27 B	0.22 B	0.49 B	0.5 U	0.5 U	0.3 B	0.24 B	0.15 B	0.28 B	0.5 U	0.5 U	0.5 U	0.5 U
Tetrachloroethene	--	5	9.8	8.7	7.9	4.5	4.5	4.5	4.2	4.3	6.7	5	0.5 U	0.25 J	0.39 J	0.25 J	0.61
Toluene	--	1,000	0.11 B	0.2 B	0.25 B	0.5 U	0.13 J	0.5 U	0.5 U	0.13 B	0.21 B	0.11 B	0.5 U	0.19 J	0.12 J	0.11 J	0.12 J
Trichloroethene	--	5	2.4	2.1	1.7	1.2	1.2	1.1	1.1	1.4	1.5	0.64 B	0.5 U	0.1 J	0.13 J	0.45 J	0.66
Trichlorofluoromethane(Freon-11)	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl chloride	--	2	0.47 J	0.5 U	0.22 J	0.5 U	0.24 J	0.5 U	0.5 U	0.23 J	0.5 U	0.5 U	0.15 J	0.11 J	0.5 U	0.5 U	0.5 U
Xylene, total	--	10,000	0.5 U	0.5 U	0.5 U	0.5 U	0.27 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	--	70	2.4	1.7	1.5	1.2	1.3	1.2	0.96	1.6	1.9	0.36 J	6.8	3.3	3.2	4 J	5.2 J
cis-1,3-Dichloropropene	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.11 B	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,2-Dichloroethene	--	100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ
Semi-volatile Organic Compounds (UG/L)																	
1,1-Biphenyl	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,6-Dinitrotoluene	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Methylnaphthalene	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Methylphenol	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	7.1	5 U	5 U	5 U	5 U	5 U	5 U
4-Methylphenol	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	470	300	5 U	22	5 U	6.3	4.4 J
Acetophenone	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	3.6 J	5 U	5 U	5 U	5 U	5 U	5 U
Caprolactam	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	18	22
Naphthalene	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Pentachlorophenol	--	1	5 U	5 U	5 U	5 U	5 U	5 U	5 U	21 J	49 J	5 U	5 U	5 U	5 U	5 U	5 U
Phenol	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1.7 J	5 U	5 U	5 U
bis(2-Ethylhexyl)phthalate	5	6	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4.4 J	5 U	5 U

Notes:

U- Analyte not detected

J- Reported value is estimated

B- Possible blank contamination

UJ- Analyte not detected. Quantitation limit is imprecise

UL- Analyte not detected. Quantitation limit is higher

R- Unreliable result

NA- Not analyzed

ND- Compound not detected during background investigation

Shading exceeds MCL Groundwater Standards

Exceeds Background UTL for Groundwater

Table 3-1
Field Parameters and Analytical Exceedances of Screening Criteria
NAB Little Creek
Virginia Beach, Virginia

Northern Treatement Area Monitoring Wells

Station ID	LC-Background UTL-Groundwater	MCL Ground-water	LS13-MW03T							LS13-MW14T							LS13-MW21S			LS13-MW26S				LS13-MW28D						
Sample Date			10/26/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/26/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/28/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/26/04	12/21/04	03/01/05	05/09/05	07/07/05	09/06/05	01/10/06
Sampling Round			Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
Chemical Name																														
Total Metals (UG/L)																														
Aluminum	713	--	824	495	762	35 B	32.9 B	45 B	55.7 B	145 J	9,980	216	30.2 B	18.3 B	75.1 B	60.6 B	733.0	2,200	1,540	110 B	41.5 B	86 B	101 B	1,720	6,890	289	32.8 B	57 B	79.1 B	142 B
Antimony	ND	6	2 U	2 U	3.5 B	1.3 U	3.7 U	1.7 U	2.5 U	2 U	2 U	2.1 U	1.3 U	3.7 U	1.7 U	2.5 U	2 U	2 U	2.1 U	1.3 U	3.7 U	1.7 U	2.5 U	2.7 B	2 U	3.2 B	1.3 U	3.7 U	1.7 U	2.5 U
Arsenic	4	10	1.8 U	1.8 U	2.1 U	1.6 U	3.7 U	1.9 U	3.6 U	1.8 U	2.1 B	2.1 U	1.6 U	3.7 U	1.9 U	3.6 U	1.8 U	5.6 B	2.1 U	1.6 U	3.7 U	1.9 U	3.6 U	1.8 U	1.8 U	2.1 U	1.6 U	3.7 U	1.9 U	3.6 U
Barium	55,000	2,000	33.5 J	46.7 B	3.1 B	49.7 J	40.5 J	55.2 J	27 J	25.1 J	33.8 B	21 B	29.5 J	30.2 J	30.3 J	29 J	12.4 J	21.1 B	9.2 B	13.1 J	12.4 J	14.7 J	11.7 J	18.8 J	57.3 B	5 B	11.4 J	13.2 J	14.2 J	13.7 J
Beryllium	0.5	4	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.59 J	0.55 B	0.1 U	4.4 B	0.1 U	0.1 U	0.1 U	0.69 B	0.56 B	0.1 U	0.1 U	0.11 B	0.1 U	0.1 U	0.73 B	0.67 B	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.67 B	0.66 B
Cadmium	2.1	5	1.3 J	3 B	2.3 B	1.3 J	1 J	2.2 J	0.73 B	0.2 U	3.9 B	0.3 U	0.2 U	0.5 U	0.22 B	0.3 U	0.2 U	0.26 B	0.67 B	0.2 U	0.5 U	0.2 U	11.9	0.2 U	3.1 B	0.42 B	0.2 U	0.5 U	0.2 U	0.3 U
Calcium	129,000	--	21,400	24,800	9,870	25,600	23,200	21,400	13,800	19,600	30,800	12,400	15,300	17,000	17,500	14,700	10,000	3,400 B	3,390 B	3,750 J	3,910 J	4,710 J	7,630	9,590	23,700	4,790 B	8,160	7,500	8,510	11,500
Chromium	4.1	100	1.7 J	1.4 B	3.5 B	0.84 J	1.1 U	0.62 J	0.9 U	0.5 U	30.2	0.75 B	0.8 U	1.1 U	0.6 U	0.9 U	1.4 J	3 B	1.7 B	1.8 J	1.1 U	0.6 U	0.9 U	2 J	33.8	0.6 U	0.8 U	1.1 U	0.6 U	0.9 U
Cobalt	2.6	--	2.1 J	7.5 B	1.1 B	1.1 J	1.1 U	4.7 J	5.5 J	3.4 J	158	44.4 B	21.6 J	18.6 J	20.4 J	25.1 J	1.7 J	2 B	2.2 B	2.8 J	2.4 J	3.4 J	3.9 B	3.3 J	51.2	8 B	7.3 J	9.4 J	11.3 J	5.9 J
Copper	ND	1,300	12.8 J	48.2	21.6 B	4.2 J	8.1 J	18 J	8.2 J	0.5 U	98.1	12.9 B	7.2 J	6.8 J	4.7 J	5.7 J	0.6 B	1 B	1.3 B	2 J	1.1 J	0.5 U	0.5 U	0.71 B	134	10.9 B	3.9 J	3.9 J	0.5 U	0.5 U
Cyanide	ND	200	1.6 U	1.6 U	0.8 U	0.8 U	0.8 U	2.8 U	0.7 U	1.6 U	6.1 B	0.8 U	0.8 U	2.6 J	2.8 U	0.7 U	1.6 U	1.6 U	0.8 U	0.8 U	0.8 U	2.8 U	0.7 U	1.6 U	6.8 B	0.8 U	0.8 U	0.8 U	2.8 U	0.7 U
Iron	17,100	--	4,870	3,890	3,860	154 B	256	1,450	992	1,270	69,000	2,380	1,380	978	1,530	1,050	11,800	7,810	4,190	2,000	2,300	4,460	14,400	6,350	71,100	5,300	10,400	12,400	15,700	18,500
Lead	2.4	15	12.5	9.2	13.3	1.2 U	1.6 U	2.1 J	1.7 U	0.9 U	1.4 B	1.3 U	1.2 U	1.6 U	1.4 U	1.7 U	0.9 U	1.4 B	1.3 U	1.2 U	1.6 U	1.4 U	1.7 U	1.2 J	1.8 B	1.3 U	1.3 J	2.6 J	1.5 J	1.7 J
Magnesium	45,600	--	4,050 J	3,330 B	516 B	3,210 J	3,460 J	2,850 J	2,080 J	7,550	18,200	5,680	6,340	6,710	7,030	6,700	3,350 J	1,540 B	1,920 B	2,150 J	2,360 J	2,830 J	4,460 J	3,920 J	10,900	2,210 B	3,210 J	2,860 J	3,350 J	4,100 J
Manganese	1,500	--	283	203	55.5	89.6	93.6	138	59.9	231	3,140	780	593	568	493	415	460	247	256	287	315	362	772	571	2,740	578	968	909	932	1,170
Mercury	0.3	2	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1.1	0.1 U	0.12 J	0.1 U	0.1 U	0.1 U	0.1 U	0.15 B	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	14	--	6.5 J	9.4 B	4.7 B	2.7 J	1.7 J	4.8 J	3.8 J	1.4 J	85.3	25.6 B	8.5 J	9.6 J	11.5 J	5.7 J	0.5 U	2.7 B	2.8 B	4.1 J	1.5 J	2.1 J	1.6 J	1.7 J	67.2	4.2 B	2 J	2.9 J	3.2 J	1.2 J
Potassium	16,600	--	1,060 J	1,230 B	332 B	1,340 J	1,500 J	1,190 J	924 J	1,520 J	4,840 B	1,280 B	1,430 J	1,640 J	1,720 J	1,480 J	1,340 J	1,800 B	953 B	908 J	902 J	1,150 J	903 J	1,100 J	4,010 B	665 B	882 J	979 J	1,090 J	944 J
Selenium	8	50	2.6 U	2.6 U	2.7 U	2.2 U	4.5 U	3 U	3.9 U	2.6 U	9.5	2.7 U	2.2 U	4.5 U	3 U	3.9 U	2.6 U	2.6 U	2.7 U	2.2 U	4.5 U	3 U	3.9 U	2.6 U	21	2.7 U	2.2 U	4.5 U	3 U	3.9 U
Silver	2	--	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U
Sodium	65,000	--	19,200	20,900	4,020 B	19,500	24,200	18,200	18,900	35,000	286,000	42,300	34,900	35,700	33,600	36,700	9,250	10,800	11,400	10,400	12,100	13,100	11,000	19,300	277,000	15,600	13,400	18,600	17,800	13,400
Thallium	2.5	2	1.9 U	1.9 U	3 U	2.8 U	4 U	2.8 U	6.2 U	1.9 U	10.8	3 U	2.8 U	4 U	3 B	6.2 U	1.9 U	1.9 U	3 U	2.8 U	4 U	3.2 B	6.2 U	1.9 U	11.5	3 U	2.8 U	4 U	2.8 U	6.2 U
Vanadium	5	--	2.2 J	1.6 B	2.6 B	0.3 U	0.8 U	0.56 J	0.4 U	0.52 J	4.6 B	1.1 B	0.91 J	0.8 U	0.82 J	0.4 U	1.3 J	3.9 B	2.5 B	0.48 J	0.8 U	0.5 U	0.4 U	2.9 J	10.4 B	8.4 B	6.4 J	8.6 J	9.8 J	4.5 J
Zinc	59	--	4,180	4,220	2,180	2,080	1,190	2,800	1,470	6.5 B	926	62.9	34.2	44.3	57.2	16.6 J	6.4 B	16.8 B	21.5	23.3	16.9 J	19.8 J	26.6	7.7 J	484	45.2	47.1	48	50.1	18.9 J
Dissolved Metals (UG/L)																														
Aluminum	58	--	4.4 U	132 U	51 B	11.4 U	13 U	50.5 B	37.7 B	4.4 U	10,700	66.1 B	11.4 U	13 U	70.7 B	44.4 B	4 U	132 U	24.6 B	20.2 J	17.7 B	86.3 B	42.8 B	432	8,920	14.8 B	11.4 U	28.8 B	73.4 B	47.6 B
Antimony	49	6	2 U	2.8 U	2.1 B	1.4 J	3.7 U	1.7 U	1.2 U	2 U	2.8 U	3.5 B	1.3 U	3.7 U	1.7 U	1.2 U	2 U	2.8 U	2.5 B	1.3 U	3.7 U	1.7 U	1.2 U	2.5 B	2.8 U	2.1 U	1.3 U	3.7 U	1.7 U	1.2 U
Arsenic	4	10	1.8 U	2.9 U	2.1 U	1.6 U	3.7 U	1.9 U	1.4 U	1.8 U	3.7 B	2.1 U	1.6 U	3.7 U	1.9 U	2.2 B	1.8 U	2.9 U	2.1 U	1.6 U	3.7 U	1.9 U	1.5 B	1.8 U	3.4 B	2.1 U	1.6 U	3.7 U	1.9 U	2.7 B
Barium	28,000	2,000	28.6 J	43 B	0.1 U	53.2 J	39.1 J	56.4 J	32.9 J	17.4 J	33.5 B	18.2 B	27.8 J	28.5 J	29 J	28.2 J	10.6 J	11.8 B	3.6 B	12.1 J	11.3 J	14.5 J	12 J	15.1 J	61 B	4.6 B	11.3 J	17.4 J	15 J	13 J
Beryllium	ND	4	0.1 U	0.3 U	0.1 U	0.1 U	0.1 U	0.82 B	0.36 B	0.1 U	5.2	0.1 U	0.1 U	0.1 U	0.98 B	0.5 B	0.1 U	0.3 U	0.1 U	0.1 U	0.1 U	0.96 B	0.44 B	0.1 U	0.86 B	0.1 U	0.1 U	0.1 U	0.9 B	0.54 B
Cadmium	ND	5	0.43 J	2.1 B	0.47 B	1.3 J	0.77 J	2.2 J	1 B	0.2 U	1.9 B	0.3 U	0.2 U	0.5 U	0.2 U	0.2 B	0.2 U	0.3 U	0.54 B	0.2 U	0.5 U	0.2 U	16.6	0.2 U	0.7 B	0.3 U	0.2 U	0.5 U	0.2 U	0.2 U
Calcium	136,000	--	19,000	24,200	10,100	26,300	22,000	20,000	15,100	13,200	34,800	11,300	14,900	15,900	16,300	14,900	9,130	2,730 B	3,230 B	3,750 J	3,670 J	4,650 J	7,950	9,420	25,200	4,780 B	7,940	7,560	8,820	11,600
Chromium	2.1	100	0.5 U	0.7 U	0.6 U	0.8 U	1.1 U	1.2 B	0.4 U	0.5 U	31.2	0.6 U	0.8 U	1.1 U	0.6 U	0.4 U	0.5 U	0.7 U	0.6 U	0.8 U	1.1 U	0.6 U	0.4 U	0.59 B	38.3	0.6 U	0.8 U	2.9 J	0.6 U	0.4 U
Cobalt	1.9	--	2 J	7 B	0.6 U	0.53 J	1.1 U	4.5 J	2.7 B	3 J	186	41.3 B	21.1 J	18.2 J	19.4 J	24.2 J	1.6 J	1.8 B	1.9 B	2.8 J	1.9 J	3.5 J	3.9 B	3.5 J	59.2	8.1 B	7.4 J	9 J	11.7 J	5.7 J
Copper	ND	1,300	0.5 U	42.3	3 B	2.9 J	6.2 J	14.7 J	3.3 J	0.5 U	114	12.5 B	6.7 J	6.8 J	5.4 J	5.5 J	0.5 U	0.4 U	0.59 B	1.4 J	0.8 U	0.5 U	0.3 U	0.5 U	146	10.4 B	3 J	4.4 J	0.5 U	0.3 U
Iron	11,200	--	771	295	39.1 B	10 U	116	1,230	279	863	70,100	1,410	941	856	1,200	1,020	2,990	55 B	465	1,140	2,020	4,120	13,800	4,700	66,800	2,480	9,520	11,500	16,900	16,800
Lead	ND	15	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	2.6 J	1 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U	0.9 U	1.7 U	1.3 U	1.2 U	3.2	1.4 U	1 U
Magnesium	49,000	--	3,930 J	3,530 B	485 B	3,260 J	3,080 J	2,700 J	1,590 J	5,380	21,600	5,230	6,220	6,240	6,650	6,630	3,180 J	1,270 B	1,760 B	2,200 J	2,280 J	2,930 J	4,510 J	3,780 J	13,000	2,210 B	3,110 J	2,860 J	3,520 J	4,090 J
Manganese	1,510	--	246	171	7.8 B	90.7	86.3	138	73.5	205	3,430	715	581	534	464	403	394	187	242	293	301	369	747	552	2,690	576	923	922	1,000	1,130
Mercury	ND	2	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.78	0.1 U	0.11 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	6	--	2.1 B	6.5 B	0.8 B	1.6 J	1.4 J	4.7 J	2.9 J	0.92 B	101	22.7 B	8.1 J	9.4 J	11.5 J	6.2 J	0.5 U	0.98 B	1.2 B	1.9 J	1.4 J	2.2 J	1.3 J	1.3 B	76.1	3.8 B	2.4 J	4.3 J	3.5 J	0.9 U
Potassium	35,500	--	982 J	1,240 B	317 B	1,390 J	1,440 J	1,190 J	683 J	1,150 J	5,260	1,210 B	1,420 J	1,570 J	1,690 J	1,440 J	1,190 J	1,330 B	793 B	886 J	850 J	1,130 J	994 J	988 J	4,300 B	654 B	908 J	1,040 J	1,140 J	914 J
Selenium	9	50	2.6 U	3.5 U	2.7 U	2.2 U	4.5 U	3 U	3.3 U	2.6 U	15.1	2.7 U	2.2 U	4.5 U	3 U	3.3 U	2.6 U	3.5 U	2.7 U	2.2 U	4.5 U	3 U	3.3 B	2.6 U	28.5	2.7 U	2.2 U	4.5 U	3 U	3.3 U
Sodium	360,000	--	18,600	20,500	5,400	19,900	22,100	17,500	9,870	25,500	289,000	39,900	34,700	34,000	31,800	35,300	9,170	9,610	11,000	10,300	9,760	13,100	11,200	19,300	297,000	16,100	14,300	18,400	17,700	13,200
Thallium	4	2	1.9 U	4.9 U	3 U	2.8 U	4 U	2.8 U	3.9 U	1.9 U	5.7 B	3 U	2.8 U	4 U	4 J	3.9 U	1.9 U	4.9 U	3 U	2.8 U	4 U	2.8 U	3.9 U	1.9 U	4.9 U	3 U	4.6 J	4 U	2.8 U	4.3 B
Vanadium	2	--	0.4 U	0.5 U	0.5 U	0.3 U	0.8 U	0.5 U	0.3 U	0.4 U	3.4 B	0.5 U	0.3 U	0.8 U	0.5 U	0.3 U	0.4 U	0.5 U	0.5 U	0.34 J	0.8 U	0.5 U	0.3 U	0.99 J	4.8 B	1.7 B	5.6 J	6.9 J	11 J	3.9 J
Zinc	42	--	1,710	3,070	76.7	2,260	1,030	2,920	2,640	3.9 B	1,060	57.4	32.4 B	41.6	62.5	15.8 B	4.6 B	13.2 B	18.1 B	24.7 B	17.5 J	18.9 J	27.4	6.7 B	542	43.6	47.4 B	48	50.8	17 B

Notes:
U- Analyte not detected
J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is imprecise
UL- Analyte not detected. Quantitation limit is higher
R- Unreliable result
NA- Not analyzed
investigation
Shading exceeds MCL Groundwater Standards
Exceeds Background UTL for Groundwater

Table 3-1
Field Parameters and Analytical Exceedances of Screening Criteria
NAB Little Creek
Virginia Beach, Virginia

Station ID	LC-Background UTL-Groundwater	MCL Ground-water	Northern Treatment Area Monitoring Wells							Southern Treatment Area MonitoringWells																					
			LS13-MW29D							LS13-MW06S							LS13-MW09S							LS13-MW11D						
Sample Date			10/27/04	12/21/04	03/01/05	05/09/05	07/07/05	09/07/05	01/10/06	10/27/04	01/05/05	02/28/05	05/10/05	07/07/05	09/07/05	01/11/06	10/28/04	01/05/05	02/28/05	05/10/05	07/07/05	09/07/05	01/11/06	10/27/04	01/05/05	03/01/05	05/10/05	07/07/05	09/07/05	01/11/06
Sampling Round			Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
Chemical Name																															
Total Metals (UG/L)																															
Aluminum	713	--	439	199 B	407	259	51.3 B	84.3 B	161 B	217	376	157 B	19.1 B	39.3 B	10,300	43.3 B	613	204	225	85.7 B	102 J	199 J	142 B	131 J	169 B	162 B	26.1 B	101 J	127 B	35.1 B
Antimony	ND	6	2 U	2 U	3.3 B	1.3 U	3.7 U	1.7 U	2.5 U	2 U	2.8 U	4.6 B	3.3 J	3.7 U	1.7 U	4 J	2 U	2.8 U	5.1 B	2.9 J	4.3 B	1.7 U	6.8 J	2 U	2.8 U	3.6 B	1.3 U	3.7 U	1.7 U	2.5 U
Arsenic	4	10	2 J	3 B	3.1 B	1.6 U	3.7 U	23.4	3.6 U	1.8 U	2.9 U	4.9 B	6.3 J	9.8 J	14.6	13.8	1.8 U	3.7 B	20.3	23.6	26.7	34.4	33.1	1.8 U	2.9 U	14.3	13.9	22.3	6.9 J	9.9 J
Barium	55,000	2,000	20.6 J	20.6 B	13.8 B	22.6 J	21.7 J	27.9 J	21.2 J	11.9 J	13.1 B	10.3 B	22.8 J	13.1 J	81.7 J	18.1 J	10.7 J	33.1 B	29.1 B	13.5 J	14 J	17.7 J	16.9 J	21.7 J	25 B	36 B	40.3	75.9 J	52.4 J	36.4 J
Beryllium	0.5	4	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.97 B	0.55 B	0.1 U	0.3 U	0.1 U	0.1 U	0.1 U	1.2 J	0.49 B	0.1 U	0.38 B	0.1 U	0.1 U	0.1 U	0.79 B	0.71 B	0.1 U	0.3 U	0.1 U	0.1 U	0.1 U	0.81 B	0.48 B
Cadmium	2.1	5	0.2 U	0.26 B	0.31 B	0.2 U	0.5 U	0.2 U	0.76 B	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	0.2 U	0.3 U	0.2 J	0.46 B	1.2 B	0.2 U	0.5 U	0.2 U	0.3 U	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	2.6 J	0.3 U
Calcium	129,000	--	16,000	15,300	16,000	17,000	16,200	21,200	14,600	9,520	10,600	34,600	44,300	24,300	27,300	39,100	7,360	13,900	22,300	18,000	16,300	15,400	12,700	15,700	23,600	33,500	46,200	76,100	36,300	30,000
Chromium	4.1	100	0.89 J	0.52 B	0.6 U	1.3 J	1.1 U	0.6 U	0.9 U	0.5 U	0.91 B	0.6 U	0.8 U	1.1 U	10.5	0.9 U	0.97 J	1.2 B	0.6 U	0.8 U	1.1 U	0.6 U	0.9 U	0.54 J	0.7 U	0.6 U	0.8 U	1.1 U	0.6 U	0.9 U
Cobalt	2.6	--	2.9 J	3.6 B	2.5 B	2.3 J	2.2 J	7.1 J	1.9 B	7.3 J	8.8 B	15.5 B	18 J	8.1 J	21.7 J	22.9 J	3.1 J	18.8 B	16.9 B	7.9 J	8.2 J	11.2 J	22 J	2.8 J	0.85 B	12.6 B	14.9 J	23 J	9.6 J	6.7 J
Copper	ND	1,300	0.5 U	0.5 U	0.73 B	0.85 J	0.8 U	0.5 U	0.5 U	1.7 B	1.1 B	3.4 B	3.1 J	1.7 J	21.3 J	0.81 J	0.5 U	2 B	2.8 B	4.1 J	1.7 J	1.6 J	2 J	0.5 U	3.5 B	4.4 B	3.9 J	1.4 J	0.5 U	0.5 U
Cyanide	ND	200	1.6 U	1.6 U	0.8 U	0.8 U	0.8 U	2.8 U	0.7 U	1.6 U	1.6 U	0.8 U	0.8 U	0.8 U	2.8 U	0.7 U	1.6 U	1.6 U	0.8 U	0.8 U	0.8 U	2.8 U	2.4 B	1.6 U	1.7 B	0.8 U	0.8 U	1.8 J	2.8 U	0.7 U
Iron	17,100	--	1,720	2,820	2,060	1,070	1,620	67,300	1,500	20,500	8,320	89,600	130,000	58,300	146,000	123,000	4,070	19,900	150,000	114,000	128,000	140,000	201,000	1,010	226	16,300	32,200	58,800	809	12,600
Lead	2.4	15	0.9 U	0.9 U	1.3 U	1.2 U	1.6 U	1.4 U	1.7 U	1.9 J	1.7 U	1.8 B	1.2 U	2.3 J	12.7	1.7 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1.7 J	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1.7 J
Magnesium	45,600	--	4,170 J	3,860 B	4,300 B	4,630 J	4,310 J	9,250	4,260 J	4,030 J	4,590 B	20,000	18,500	11,800	12,600	16,600	5,380	10,800	17,700	14,900	12,000	10,200	10,900	4,140 J	2,830 B	11,000	19,200	35,100	4,710 J	12,400
Manganese	1,500	--	138	188	113	114	112	3,480	110	546	583	2,650	3,750	3,890	3,420	3,040	1,000	2,440	2,090	1,050	1,100	1,560	1,760	506	134	2,780	5,610	8,660	355	2,540
Mercury	0.3	2	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	14	--	3.1 J	2.5 B	2.5 B	3.4 J	2 J	0.9 U	1.8 J	0.54 J	0.7 U	0.8 U	0.8 U	1.3 U	4.9 J	1 U	0.64 J	3 B	0.8 U	1.4 J	1.3 U	4.3 J	1.3 J	3 J	2.7 B	3.9 B	2.1 J	4.8 J	8.5 J	3.2 J
Potassium	16,600	--	1,500 J	1,610 B	1,390 B	1,710 J	1,690 J	1,240 J	1,400 J	1,120 J	1,130 B	996 B	1,640 J	1,020 J	1,820 J	999 J	736 J	7,600	3,510 B	1,890 J	1,740 J	1,890 J	963 J	1,750 J	1,940 B	1,800 B	2,130 J	2,800 J	2,050 J	1,790 J
Selenium	8	50	2.6 U	2.6 U	2.7 U	2.2 U	4.5 U	3 U	3.9 U	2.6 U	3.5 U	7.9	2.2 U	4.5 U	4.1 J	3.9 U	2.6 U	3.5 U	7.7	2.2 U	4.5 U	3 U	3.9 U	2.6 U	3.5 U	2.7 U	2.2 U	4.5 U	3 U	3.9 U
Silver	2	--	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U	0.7 U	0.7 U	0.8 U	0.75 J	1.3 U	0.7 U	0.7 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U
Sodium	65,000	--	32,300	29,200	31,000	33,300	34,400	18,600	25,100	20,200	20,500	25,700	19,100	22,200	19,200	13,400	20,900	23,300	18,800	19,700	22,000	20,200	22,600	26,700	19,900	30,500	34,500	30,800	9,860	22,700
Thallium	2.5	2	1.9 U	1.9 U	3 U	2.8 U	4 U	2.8 U	6.2 U	1.9 U	4.9 U	3 U	6.8 J	4 U	2.8 U	6.2 U	1.9 U	4.9 U	6.9 B	2.8 J	4 U	2.8 U	6.2 U	1.9 U	4.9 U	3 U	5.2 J	4 U	2.8 U	6.2 U
Vanadium	5	--	1.5 J	0.85 B	1.2 B	0.66 J	0.8 U	1.1 J	1.4 J	0.4 U	0.57 B	0.5 U	1.2 J	1.5 J	22.2 J	1.1 J	1.4 J	0.97 B	0.62 B	1.1 J	3.5 J	2.2 J	2.3 J	0.68 J	3.5 B	0.83 B	0.55 J	1.5 J	1.8 J	0.4 U
Zinc	59	--	7.9 J	7.8 B	6.4 B	7.7 B	4.9 J	0.5 U	6 J	8.2 J	6.5 B	5 B	1.2 B	2.4 J	37.9	3.6 U	5.2 B	10.9 B	14.3 B	5.8 B	1.3 U	8.8 J	3.6 U	14.6 J	37.2	37.2	32.3	1.3 U	148	15.8 J
Dissolved Metals (UG/L)																															
Aluminum	58	--	4.4 U	132 U	13.5 U	11.4 U	13 U	52.8 B	39.1 B	4.4 U	824	13.5 U	11.4 U	13 U	58.1 B	56.5 B	4.4 U	154 B	13.5 U	11.4 U	13 U	59.9 B	25.2 B	4.4 U	132 U	13.5 U	11.4	13 U	67.2 B	40.4 B
Antimony	49	6	2 U	2.8 U	2.1 U	1.5 J	3.7 U	1.7 U	1.2 U	2 U	2.8 U	4.2 B	2.7 B	3.7 U	1.7 U	3.5 B	2 U	2.8 U	5 B	2.2 J	3.7 U	1.7 U	5.8 B	2 U	2.9 B	4.2 B	1.5 J	3.7 U	1.7 U	1.2 U
Arsenic	4	10	1.8 U	3.2 B	2.1 U	1.6 U	3.7 U	1.9 U	1.4 U	1.8 U	2.9 U	4.6 B	6.7 B	10.6	9.2 J	16.4	1.8 U	2.9 U	16.7	21.2	25.6	33.8	34.7	1.8 U	2.9 U	18.1	18.5	3.7 U	7.7 J	15.4
Barium	28,000	2,000	18.8 J	20.2 B	12.4 B	19.9 J	20.6 J	17 J	20 J	11.5 J	14.1 B	9.6 B	22.1 J	13.3 J	19 J	17.7 J	9.4 J	33.8 B	29.1 B	13.5 J	12.8 J	18.4 J	16.2 J	16.4 J	33 B	46.7 B	43.8	21.1 J	55.9 J	33.1 J
Beryllium	ND	4	0.1 U	0.3 U	0.1 U	0.1 U	0.1 U	0.73 B	0.48 B	0.1 U	0.3 U	0.1 U	0.1 U	0.1 U	0.82 B	0.54 B	0.1 U	0.43 B	0.1 U	0.1 U	0.1 U	0.81 B	0.28 B	0.1 U	0.33 B	0.1 U	0.1 U	0.1 U	0.91 B	0.52 B
Cadmium	ND	5	0.2 U	0.3 U	0.3 U	0.25 J	0.5 U	0.2 U	0.73 B	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	2.7 J	0.2 U
Calcium	136,000	--	15,500	15,800	16,200	15,700	15,700	13,000	14,800	9,760	10,700	34,200	43,200	25,900	25,100	40,800	7,000	13,700	23,100	17,900	14,900	15,000	12,900	12,300	30,500	47,700	55,600	16,000	41,900	29,500
Chromium	2.1	100	0.5 U	0.7 U	0.6 U	0.8 U	1.1 U	0.6 U	0.4 U	0.5 U	0.99 B	0.6 U	0.8 U	1.1 U	0.6 U	0.4 U	0.5 U	1.4 B	0.6 U	0.8 U	1.1 U	0.6 U	0.4 U	0.5 U	0.7 U	0.6 U	0.84 J	1.1 U	0.6 U	0.4 U
Cobalt	1.9	--	2.8 J	3.5 B	2.2 B	2.4 J	2.1 J	2.6 J	2.3 B	7.7 J	7.8 B	15.6 B	17.8 J	8 J	9.2 J	20.4 J	2.8 J	18.1 B	18.7 B	8 J	8.9 J	11 J	22.6 J	2 J	0.87 B	33.8 B	21.9 J	2 J	9.4 J	6.1 J
Copper	ND	1,300	0.5 U	0.4 B	0.4 U	1 J	0.86 J	0.5 U	0.3 U	0.5 U	2.4 B	0.4 U	1.5 J	0.8 U	0.5 U	0.3 U	0.6 B	1.6 B	0.4 U	2.2 J	0.8 U	0.5 U	0.54 J	0.5 U	0.52 B	0.4 U	1.2 J	0.8 U	0.5 U	0.3 U
Iron	11,200	--	747	1,020	391	264	1,110	1,060	92.1 J	5,610	16,800	84,100	127,000	59,100	67,000	123,000	110	19,200	154,000	115,000	115,000	143,000	201,000	789	13.6 U	25,200	41,600	1,130	832	11,900
Lead	ND	15	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U
Magnesium	49,000	--	4,000 J	4,260 B	4,330 B	4,270 J	4,150 J	3,620 J	4,210 J	4,140 J	4,460 B	19,600	18,500	12,900	11,500	16,900	5,140	10,500	18,500	14,800	10,800	10,400	10,900	3,560 J	5,560	20,200	25,500	4,220 J	7,210	12,600
Manganese	1,510	--	132	191	119	112	112	121	123	532	537	2,600	3,940	4,300	2,550	2,880	956	2,350	2,490	1,130	1,310	1,510	1,780	253	141	5,840	7,870	116	620	2,480
Mercury	ND	2	0.1 U	0.1 U	0.1 U	0.12 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.12 B	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	6	--	1.9 B	2.1 B	1.9 B	2.1 J	2 J	2.3 J	1.5 J	0.5 U	0.89 B	0.8 U	0.8 U	1.3 U	0.9 U	0.9 U	0.5 U	2.2 B	0.8 U	0.8 U	1.3 U	2.1 J	0.9 U	1.2 B	2 B	4.8 B	1.7 J	1.9 J	8.6 J	2.9 J
Potassium	35,500	--	1,420 J	1,680 B	1,430 B	1,570 J	1,600 J	1,480 J	1,340 J	1,150 J	1,200 B	954 B	1,550 J	1,020 J	1,180 J	978 J	711 J	7,800	3,750 B	1,840 J	1,620 J	1,900 J	925 J	1,520 J	2,060 B	1,920 B	2,040 J	1,650 J	2,120 J	1,590 J
Selenium	9	50	2.6 U	3.5 U	2.7 U	2.2 U	4.5 U	3 U	3.3 U	2.6 U	3.5 U	5.9	2.2 U	4.5 U	4 J	6.2 B	2.6 U	3.5 U	8.2	2.2 U	4.5 U	5.7	7.7 B	2.6 U	3.5 U	4 B	2.2 J	4.5 U	3 U	3.3 U
Sodium	360,000	--	31,100	28,600	31,200	27,700	32,500	19,700	23,200	20,700	20,000	25,900	18,600	23,600	18,900	13,200	20,800	23,300	19,700	18,900	20,300	21,000	21,700	25,700	25,600	38,800	36,400	33,300	12,300	22,300
Thallium	4	2	1.9 U	4.9 U	3 U	2.8 U	4 U	2.8 U	3.9 U	1.9 U	4.9 U	3.5 B	5.5 J	4 U	2.8 U	3.9 U	1.9 U	6.2 B	5.9 B	2.8 U	4 U	2.8 U	6.4 B	1.9 U	5.3 B	3 U	6 J	4 U	2.8 U	5.3 B
Vanadium	2	--	0.4 U	0.54 B	0.5 U	0.3 U	0.8 U	0.5 U	0.3 U	0.4 U	1.6 B	0.5 U	0.85 J	1.1 J	0.69 B	0.77 B	0.4 U	1.1 B	0.5 U	1.4 J	3.2 J	2.1 B	1.9 B	0.47 J	3 B	0.5 U	0.3 U	0.8 U	0.72 B	0.3 U
Zinc	42	--	7.8 B	8.1 B	5.4 B	11 B	6.5 B	6.7 B	6.3 B	3.8 B	11.5 B	3 B	2.4 B	1.3 U	0.5 U	0.3 U	3.3 B	7.9 B	4.4 B	2.4 B	1.3 U	5.3 B	0.38 B	2.9 B	29.7	1.2 U	3.5 B	4.1 B	140	10.8 B

Notes:
U- Analyte not detected
J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is imprecise
UL- Analyte not detected. Quantitation limit is higher
R- Unreliable result
NA- Not analyzed
investigation
Shading exceeds MCL Groundwater Standards
Exceeds Background UTL for Groundwater

Table 3-1
Field Parameters and Analytical Exceedances of Screening Criteria
NAB Little Creek
Virginia Beach, Virginia

			Southern Treatment Area Monitoring Wells														
Station ID	**LC-Background UTL-Groundwater**	**MCL Ground-water**	LS13-MW18T							LS13-MW30D							
Sample Date			10/27/04	01/05/05	03/01/05	05/10/05	07/07/05	09/07/05	01/11/06	10/27/04	01/05/05	03/01/05	05/09/05	07/07/05	09/07/05	01/10/06	01/10/06
Sampling Round			Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 6 Duplicate
Chemical Name																	
Total Metals (UG/L)																	
Aluminum	713	--	302	400	397	30.9 B	25.3 B	85.1 B	98 B	144 J	968	112 B	11.4 U	35.8 B	89.4 B	63.6 B	50.3 B
Antimony	ND	6	2 U	4 B	3.1 B	1.3 U	3.7 U	1.7 U	2.5 U	2 U	2.8 U	2.7 B	1.3 U	3.7 U	1.7 U	2.5 U	2.5 U
Arsenic	4	10	1.8 U	2.9 U	2.1 U	1.6 U	3.7 U	3.8 J	3.6 U	1.8 U	3.4 B	23.7	20.7	19	1.9 U	23.6	22.7
Barium	55,000	2,000	11.8 J	15.6 B	5.3 B	11.6 J	13.9 J	19.5 J	11.2 J	24.7 J	124 B	24.2 B	24.4 J	24.4 J	18.1 J	25.6 J	25.6 J
Beryllium	0.5	4	0.1 U	0.3 U	0.1 U	0.1 U	0.1 U	0.88 B	0.49 B	0.1 U	0.5 B	0.1 U	0.1 U	0.1 U	0.8 B	0.63 B	0.51 B
Cadmium	2.1	5	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	0.2 U	0.3 U	0.2 U	0.3 U	0.34 B	0.2 U	0.5 U	0.2 U	0.3 U	0.3 U
Calcium	129,000	--	7,240	8,440	7,890	7,820	11,200	16,800	7,250	12,700	59,400	41,700	32,300	21,700	14,300	21,900	21,500
Chromium	4.1	100	0.56 J	0.7 U	0.6 U	1.3 J	1.1 U	0.86 B	0.9 U	0.5 U	3.1 B	0.67 B	0.8 U	1.1 U	0.6 U	0.9 U	0.9 U
Cobalt	2.6	--	2.3 J	1.2 B	1.1 B	0.79 J	1.1 U	3.4 J	1.2 B	7.5 J	52.9	7.6 B	2.2 J	5.7 J	2.7 J	3.3 B	3.2 B
Copper	ND	1,300	0.5 U	0.52 B	0.66 B	0.63 J	0.87 J	0.5 U	0.5 U	0.5 U	0.94 B	0.4 U	0.99 J	0.8 U	0.5 U	0.5 U	0.5 U
Cyanide	ND	200	1.6 U	1.6 U	0.8 U	0.8 U	0.8 U	2.8 U	0.7 U	1.6 U	4.5 B	0.8 U	0.8 U	0.8 U	2.8 U	0.7 U	NA
Iron	17,100	--	631	383	651	537	996	6,830	2,000	1,510	57,200	66,700	47,500	49,000	1,240	55,900	56,000
Lead	2.4	15	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1.7 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1.7 U	1.7 U
Magnesium	45,600	--	3,570 J	4,150 B	4,040 B	4,030 J	6,490	8,450	3,620 J	4,980 J	36,600	17,800	12,600	8,940	3,890 J	9,500	9,410
Manganese	1,500	--	130	63.6	114	101	179	655	177	932	8,430	6,190	4,830	3,600	124	3,510	3,460
Mercury	0.3	2	0.1 U	0.1 U	0.1 U	0.17 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	14	--	1.3 J	1.5 B	1.7 B	2.1 J	1.3 J	2.7 J	1 U	4.5 J	6.5 B	0.8 U	0.81 J	1.3 U	2.1 J	1 U	1 U
Potassium	16,600	--	965 J	1,150 B	917 B	1,010 J	1,090 J	1,130 J	879 J	1,430 J	2,760 B	1,170 B	1,380 J	1,170 J	1,550 J	962 J	952 J
Selenium	8	50	2.6 U	3.5 U	2.7 U	2.2 U	4.5 U	3 U	3.9 U	2.6 U	4.7 B	5.1	2.2 U	4.5 U	3 U	3.9 U	3.9 U
Silver	2	--	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U	0.7 U	0.7 U	0.84 B	0.6 U	1.3 U	0.7 U	0.7 U	0.7 U
Sodium	65,000	--	20,300	21,900	20,900	20,500	22,000	19,400	19,400	22,100	58,700	30,900	27,200	22,100	21,700	17,600	17,800
Thallium	2.5	2	1.9 U	5 B	3 U	2.8 U	4 U	2.8 U	6.2 U	1.9 U	4.9 U	3 U	6.2 J	4 U	2.8 U	6.2 U	6.2 U
Vanadium	5	--	1.1 J	1.3 B	1 B	0.3 U	0.8 U	2.4 J	0.4 U	0.51 J	7.1 B	0.5 U	0.57 J	1.2 J	0.6 J	0.83 J	0.55 J
Zinc	59	--	5.6 B	5.1 B	5.1 B	3.5 B	3.2 J	6.3 J	3.6 U	14.9 J	13.5 B	2.8 B	1.3 B	1.3 U	6.9 J	3.6 U	3.6 U
Dissolved Metals (UG/L)																	
Aluminum	58	--	4.4 U	132 U	13.5 U	11.4 U	13 U	63.7 B	54.8 B	4.4 U	409	13.5 U	11.4 U	13 U	55.7 B	28.1 B	38.4 B
Antimony	49	6	2 U	3 B	2.8 B	1.3 U	3.7 U	1.7 U	1.2 U	2 U	2.8 U	3 B	1.3 U	3.7 U	1.7 U	1.2 U	2.5 B
Arsenic	4	10	1.8 U	2.9 U	2.1 U	1.6 U	3.7 U	3.5 J	3.1 B	1.8 U	5 B	18.6	20.3	22.1	22.5	24.6	27.1
Barium	28,000	2,000	10.8 J	12.8 B	4.1 B	12 J	13.8 J	14.7 J	10.8 J	23.9 J	144 B	19.8 B	22.7 J	25.5 J	29.8 J	24.6 J	24.9 J
Beryllium	ND	4	0.1 U	0.3 B	0.1 U	0.1 U	0.1 U	0.9 B	0.67 B	0.1 U	0.44 B	0.1 U	0.1 U	0.1 U	0.77 B	0.34 B	0.5 B
Cadmium	ND	5	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U
Calcium	136,000	--	7,350	8,030	8,250	8,260	11,400	16,600	7,930	12,500	66,200	39,800	31,900	25,600	21,900	21,300	21,700
Chromium	2.1	100	0.5 U	0.7 U	0.6 U	0.8 U	1.1 U	0.6 U	0.4 U	0.5 U	3.4 B	0.6 U	0.8 U	1.1 U	0.6 U	0.4 U	0.4 U
Cobalt	1.9	--	0.52 B	0.3 U	0.85 B	0.52 J	1.4 J	1.5 J	0.92 B	7 J	64.5	4 B	1.7 J	5.3 J	8.3 J	4.3 J	4.1 J
Copper	ND	1,300	0.5 U	0.4 U	0.4 U	0.83 J	0.8 U	0.5 U	0.3 U	0.5 U	0.63 B	0.4 U	1.1 J	0.8 U	0.5 U	0.3 U	0.3 U
Iron	11,200	--	58.5 B	13.6 U	172	279	960	7,070	2,320	1,110	64,000	65,100	46,000	51,400	75,600	62,700	62,800
Lead	ND	15	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U	1 U
Magnesium	49,000	--	3,590 J	3,920 B	4,180 B	4,290 J	6,400	8,550	3,950 J	4,760 J	40,800	17,400	12,400	10,100	9,780	9,370	9,490
Manganese	1,510	--	54.9	27.6	89.4	105	190	670	227	880	9,500	6,070	4,790	4,130	3,690	3,330	3,380
Mercury	ND	2	0.1 U	0.1 U	0.1 U	0.1 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	6	--	0.82 B	0.73 B	1.4 B	1 J	1.3 U	1.1 J	0.9 U	4.2 B	6.6 B	0.8 U	0.8 U	1.3 U	0.9 U	0.9 U	0.9 U
Potassium	35,500	--	937 J	1,080 B	897 B	1,050 J	1,110 J	1,130 J	839 J	1,370 J	2,970 B	1,160 B	1,290 J	1,270 J	1,290 J	899 J	913 J
Selenium	9	50	2.6 U	3.5 U	2.7 U	2.2 U	4.5 U	3 U	3.3 U	2.6 U	8.3	5.8	2.2 U	4.5 U	4.6 J	3.9 B	3.3 U
Sodium	360,000	--	20,400	20,900	21,700	21,600	22,800	19,500	18,700	21,200	65,800	31,400	26,500	24,600	19,900	17,200	17,200
Thallium	4	2	1.9 U	4.9 U	3 U	2.8 U	4 U	2.8 U	3.9 U	1.9 U	13.5	3 U	4.5 J	4 U	2.8 U	3.9 U	5 B
Vanadium	2	--	0.4 U	0.5 U	0.5 U	0.3 U	0.8 U	0.5 U	0.3 U	0.4 U	9.4 B	0.5 U	0.3 U	1 J	0.83 B	0.3 U	0.43 B
Zinc	42	--	3 B	3.5 B	4.1 B	4.4 B	2.5 B	1.8 B	2.4 B	13.5 B	8.5 B	1.8 B	3.6 B	1.3 U	0.5 U	0.3 U	0.3 U

Notes:
U- Analyte not detected
J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is imprecise
UL- Analyte not detected. Quantitation limit is higher
R- Unreliable result
NA- Not analyzed
investigation
Shading exceeds MCL Groundwater Standards
Exceeds Background UTL for Groundwater

Table 3-1
Field Parameters and Analytical Exceedances of Screening Criteria
NAB Little Creek
Virginia Beach, Virginia

			Northern Treatement Area Monitoring Wells																											
Station ID	**LC-Background UTL-Groundwater**	**MCL Ground-water**	LS13-MW03T							LS13-MW14T							LS13-MW21S			LS13-MW26S				LS13-MW28D						
Sample Date			10/26/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/26/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/28/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/26/04	12/21/04	03/01/05	05/09/05	07/07/05	09/06/05	01/10/06
Sampling Round			Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
Chemical Name																														
Wet Chemistry (MG/L)																														
Acetate	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.9	1 U	0.12 J	0.214	NA	NA
Alkalinity	--	--	55.2	53	12.5	63.6	47.4	38.6	28	35.9	35.2	25.7	24.7	21.4	14.7	13.5	31	5.43 B	6.61 J	293	7.09 B	6.64 J	22.5	21.1	62.7	23.2	25.3	33.6	25.7	40.4
Butyrate	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	0.5 U	0.307	NA	NA
Chemical oxygen demand	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	25	--	32.9	24.1	6.24	24.2	25.5	13	13.6	45.9	22.2	40.8	43.9	46.3	55.1	48	11.4	9.65	11.8	10	12.3	15.7	10.9	29.8	8.67	11.2	10.6	14.8	15.7	8.78
Ethane	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.00E-04 B	8.00E-05 B	6.00E-04 J	9.00E-05 B	NA	NA
Ethene	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.00E-04 J	4.00E-04 J	0.003	3.00E-04 B	NA	NA
Hardness	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lactate	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	25 U	25 U	0.5 U	0.294	NA	NA
Methane	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.003 B	0.027	0.16	0.043	NA	NA
Nitrate	--	10	0.285	0.89	0.76	0.635	0.395	0.32	0.575	0.085	1.3	0.415	0.17	1.02	1.62	2.41	0.05 U	0.007 U	0.37	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.695	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Nitrite	--	1	0.05 U	0.014 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.014 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.014 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.014 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Propionate	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	0.5 U	0.2 U	NA	NA
Pyruvate	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10 U	10 U	45.7	54.7	NA	NA
Sulfate	54	--	16.4	19.4	4.33 J	15.1	19.2	25.3	16.5	21	783	56.4	29.9	29.5	33.5	30.4	14.4	9.74	12.1	13.4	15.1	16	15.7	21	575	13.8	14.9	17.7	18.5	18.5
Total dissolved solids (TDS)	--	--	139	148	11	160	154	140	105	140	1,560	167	185	194	215	204	123	68	49	2,580	65	83	113	120	1,450	73	106	109	117	98
Total organic carbon (TOC)	--	--	3.88 J	5.27 B	5 U	3.39 J	3.03 J	8.95	4.32	5.6	192	8.36	12.1	5.93	5.31	8.29	2.93 J	5.87 B	3.3 J	4.37 J	4.15 J	6.57	6.36	4.56 J	218	11.8	11.8	13	8.33	6.13
Field Parameters																														
Dissolved Oxygen (mg/L)	--	--	3.1	NA	12.56	3.85	3.39	0.8	4.24	2.71	NA	19.99	NA*	12.51	6.22	4.83	2	NA	0.12	6.74	4.2	0	2.59	NA	NA	8.52	0.17	0.61	0	1.83
Depth to Water (ft)	--	--	4.3	4.56	3.54	3.87	4.84	4.98	3.35	4.79	5.2	3.94	4.31	5.24	5.52	3.85	4.62	4.65	3.59	3.81	4.8	5.02	3.3	4.21	4.63	3.31	3.69	4.69	4.96	3.43
Oxidation Reduction Potential (mV)	--	--	52	185	72	150	16.8	120	124	105	318	188	173	16.5	237	195	79	299	183	191	148	150	33	56	170	175	-57	-62	-89	-23
Flow Rate (GPM)	--	--	0.06	0.079	0.072	0.05	0.066	0.079	0.092	0.032	0.059	0.079	0.046	0.079	0.072	0.085	0.044	0.053	0.079	0.052	0.079	0.085	0.085	0.049	0.099	0.052	0.059	0.079	0.092	0.092
Gallons Purged (GAL)	--	--	4	3	2.5	4	3.5	NA	4	4	2	3	3.5	4	3	4.5	3	2.5	4	2.5	4.5	3.5	4	3	3	3	2.5	4.2	5.2	5
pH	--	--	6.09	7.28	9.99	6.11	6.84	6.77	5.81	5.58	4.28	5.4	5.5	5.58	5.21	5.39	5.89	5.39	5.03	4.96	5.17	4.9	5.83	5.65	6.2	5.47	5.79	6.35	5.91	5.8
Specific Conductance (ms/cm)	--	--	0.26	0.175	0.057	0.198	0.2	0.158	0.168	0.23	1.72	0.289	0.243	0.243	0.264	0.412	0.149	0.059	0.086	0.074	0.091	0.104	0.219	0.21	1.2	0.114	0.133	0.143	0.147	0.182
Temperature (C)	--	--	24.01	19.8	15.21	19.47	24.6	26.84	18.67	23.42	20.6	17.18	19.2	22.21	25.52	19.5	23.19	19.6	14.97	19	23.74	26.57	18.2	23.49	19.4	16.22	18.74	22.78	24.92	18.93
Turbidity (NTU)	--	--	3.9	20.9	32.7	0	0	-10	0	78.8	67.7	22	221	0.5	11.2	0.427	17.9	58.6	18	23.5	-0.1	0	0	30.1	145	6.7	2	10.7	-10	54.4

Notes:
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UJ- Analyte not detected. Quantitation limit is imprecise
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investigation
Shading exceeds MCL Groundwater Standards
Exceeds Background UTL for Groundwater

Table 3-1
Field Parameters and Analytical Exceedances of Screening Criteria
NAB Little Creek
Virginia Beach, Virginia

			Northern Treatment Area Monitoring Wells							Southern Treatment Area MonitoringWells																			
Station ID	**LC-Background UTL-Groundwater**	**MCL Ground-water**	LS13-MW29D							LS13-MW06S							LS13-MW09S							LS13-MW11D						
Sample Date			10/27/04	12/21/04	03/01/05	05/09/05	07/07/05	09/07/05	01/10/06	10/27/04	01/05/05	02/28/05	05/10/05	07/07/05	09/07/05	01/11/06	10/28/04	01/05/05	02/28/05	05/10/05	07/07/05	09/07/05	01/11/06	10/27/04	01/05/05	03/01/05	05/10/05	07/07/05	09/07/05	01/11/06
Sampling Round			Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
Chemical Name																														
Wet Chemistry (MG/L)																														
Acetate	--	--	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	16	0.5 U	2.12	4.72 L	0.2	1 U	84	200	0.5 U	4.84	46.3 L	60.9	1 U	1 U	6.8	0.934	39.3	0.336 L	0.096 J
Alkalinity	--	--	37.9	33.9	33.2	28.5	32.6	97.9	27.1	30.4	30.7 B	190	218	106	100	173	36.3	135	267	178	170	101	166 J	69.1	79.3	228	265	411	95.6	111
Butyrate	--	--	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	4.7	3.04	0.25	0.2 UL	0.15 J	1 U	38	57	3.18	1.08	0.374 L	0.2 U	1 U	1 U	1 U	0.5 U	2	0.2 UL	0.2 U
Chemical oxygen demand	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	25	--	58.4	41	45.7	40.1	51.7	17.1	37.1	26.2	22.5	17.6	10.2	26.6	18.9	8.75	20.7	9.79	15.4	10.9	11.9	17	12.7 J	29	20.2	22.1	21.8	18.5	14.9	24.7
Ethane	--	--	NA	NA	NA	NA	NA	NA	NA	5.00E-05 J	7.00E-05 B	3.00E-04 J	1.00E-04 B	9.00E-05 B	1.00E-04 B	0.002 U	2.00E-04 J	0.002 B	5.00E-04 J	5.00E-04 J	5.00E-04 B	3.00E-04 B	1.00E-04 B	0.002 U	7.00E-05 B	0.002 U	0.0001 B	3.00E-04 B	4.00E-05 B	4.00E-05 B
Ethene	--	--	NA	NA	NA	NA	NA	NA	NA	0.002 U	6.00E-05 B	9.00E-05 J	1.00E-04 J	4.00E-05 B	1.00E-04 B	1.00E-04 J	1.00E-04 B	5.00E-04 B	6.00E-04 J	7.00E-04 J	0.002 B	0.002 B	6.00E-04 J	0.002 U	5.00E-05 B	7.00E-05 J	0.00009 J	1.00E-04 B	7.00E-05 B	0.002 U
Hardness	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lactate	--	--	NA	NA	NA	NA	NA	NA	NA	25 U	25 U	25 U	0.5 U	1.72	3.22 L	0.59	25 U	25 U	100	0.5 U	33.8	27.8 L	49.3	25 U	25 U	25 U	0.969	23.4	0.448 L	0.13 J
Methane	--	--	NA	NA	NA	NA	NA	NA	NA	0.006 L	0.014 B	0.005	0.022	0.056	0.21 J	1.4	0.007 L	0.003 B	0.027	0.45	0.78	1.1	0.87	0.006 L	0.007 B	0.009	0.54	0.61	0.21	0.048
Nitrate	--	10	0.05 U	0.007 U	0.05 U	0.05 U	0.05 U	0.05 U	0.125	1.25	0.07	0.05 U	0.155	0.05 U	0.05 U	0.05 U	0.865	0.04 J	0.05 U	0.05 U	0.675	0.05 U	0.205	0.05 U	0.16	0.3	0.05 U	0.05 U	0.05 U	0.05 U
Nitrite	--	1	0.05 U	0.16	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.16	0.05 U	0.05 U	0.075	0.05 U	0.05 U	0.05 U	0.105	0.05 U	0.05 U	1.05	0.05 U	0.05 U	0.05 U	0.055	0.05 U	0.05 U	2.98	0.05 U	0.05 U
Propionate	--	--	NA	NA	NA	NA	NA	NA	NA	0.81 J	1 U	15	3.93	0.469	0.2 UL	NA	0.8 J	30	91	2.04	1.35	0.2 UL	NA	0.73 J	1 U	1 J	2.9	31.6	0.2 UL	NA
Pyruvate	--	--	NA	NA	NA	NA	NA	NA	NA	10 U	10 U	10 U	56.4	142	118 L	28.3	10 U	10 U	10 U	56.6	70.2	49 L	72.5	10 U	10 U	10 U	85.2	74.2	45.4 L	84.6
Sulfate	54	--	11.3	12.4	13.3	12.9	11.3	7.68	14.8	18.3	20.2	11.1	5.22	3.21 J	7.59	4.71	30.4	5.28	0.595 J	2.2 J	1.08 J	1.03 J	2.53	11.8	6.53	2.29 J	5 U	1.97 J	5.88	8.59
Total dissolved solids (TDS)	--	--	174	162	160	196	111	214	164	117	106	265	355	184	169	287	96	235	482	292	273	201	374	137	142	218	305	20,400	148	209
Total organic carbon (TOC)	--	--	8.61	2.96 B	5 U	5 U	2.79 J	5 U	2.56	6.37	5 U	58.4	126	7.54	13.3	27.2	2.87 J	137	216	98.8	79.4	45.8	84.8 J	3.21 J	4.83 B	11.5	14.6	129	7.69	3.48
Field Parameters																														
Dissolved Oxygen (mg/L)	--	--	2.06	NA	0	0.87	0	0	1.79	1.99	0	0	0	0	0	0	1.97	0	0	0	0	0	1.29	1.88	0	0	0	0	0	0
Depth to Water (ft)	--	--	4.92	5.18	4	4.43	5.31	5.59	3.86	4.64	4.78	3.87	4.31	4.99	5.28	3.69	5.11	5.2	4.39	4.76	5.41	5.65	4.12	6.24	7.14	5.69	6.2	6.91	7.04	4.96
Oxidation Reduction Potential (mV)	--	--	6.8	100	126	117	59	98	144	31	49	-126	-144	-188	-172	-158	167	-159	-118	-126	-131	-140	-168	16	79	-111	-155	-153	18	-112
Flow Rate (GPM)	--	--	0.044	0.079	0.079	0.046	0.079	0.066	0.092	0.072	0.079	0.066	0.05	0.079	0.092	0.079	0.044	0.079	0.079	0.046	0.079	0.079	350	0.055	0.079	0.066	0.046	0.052	0.079	0.085
Gallons Purged (GAL)	--	--	2	3	2.5	3.5	2	4.8	4.5	3	2	3	2.5	2.5	5	4	3	2.5	3.5	2	2	3	5	3	3	2	2	2.75	5	4
pH	--	--	5.76	6.3	5.8	5.29	6.12	6.21	5.58	5.86	5.8	6.67	6.6	7.78	7.7	7.09	5.74	5.53	6.22	6.42	7.16	6.75	6.6	6.29	6.48	6.58	6.6	7.02	6.75	6.86
Specific Conductance (ms/cm)	--	--	0.321	0.175	0.243	0.218	0.239	0.169	0.229	0.241	0.162	0.482	0.579	0.373	0.358	0.801	0.217	0.246	0.548	0.429	0.429	0.446	0.697	0.289	0.137	0.293	0.421	0.293	0.111	0.487
Temperature (C)	--	--	21.24	19.2	17.17	17.06	20.12	23.32	18.51	24.3	18.3	15.94	18.2	22.69	25.58	18.4	23.1	17.04	15.59	17.96	24.2	26.17	17.5	23.56	20.82	17.64	18.49	23.1	23.85	21.5
Turbidity (NTU)	--	--	8.9	74.7	30.1	0.5	7.2	8	0	46.5	107	37.3	0.2	8.4	4.16	9.3	0	5.7	15.2	12.2	62.1	0	135	1.9	2.1	0	26.7	19.6	-1.1	0

Notes:
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J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is imprecise
UL- Analyte not detected. Quantitation limit is higher
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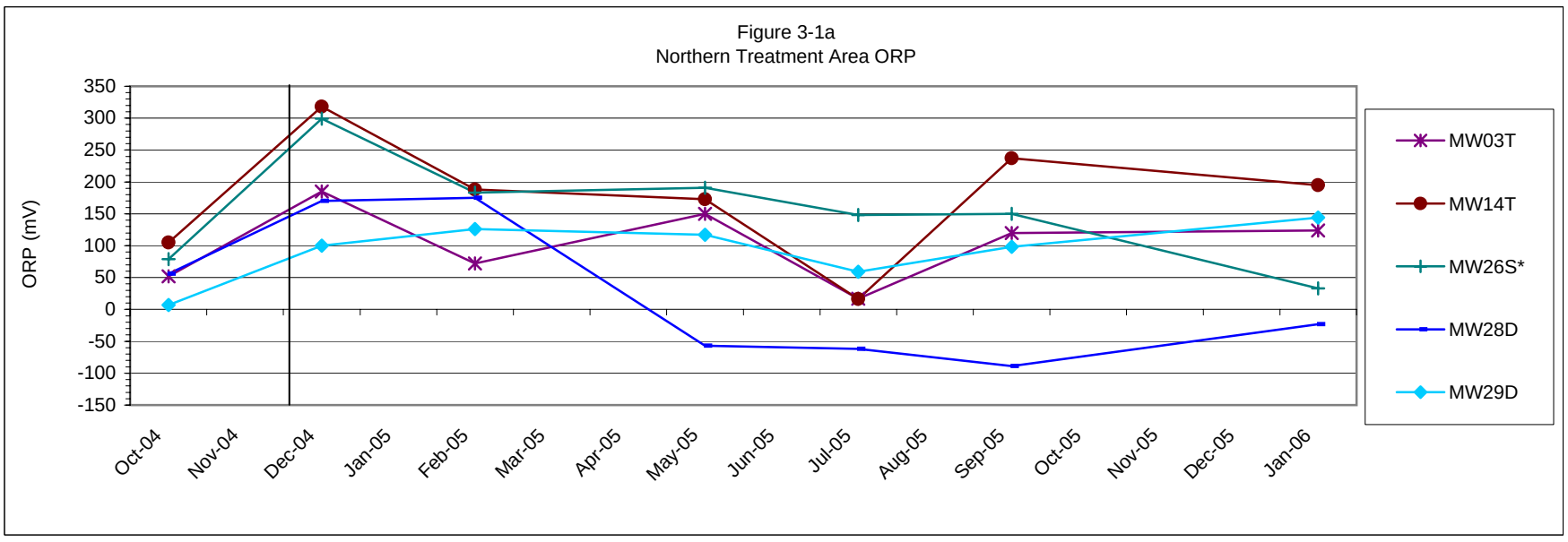
investigation
Shading exceeds MCL Groundwater Standards
Exceeds Background UTL for Groundwater

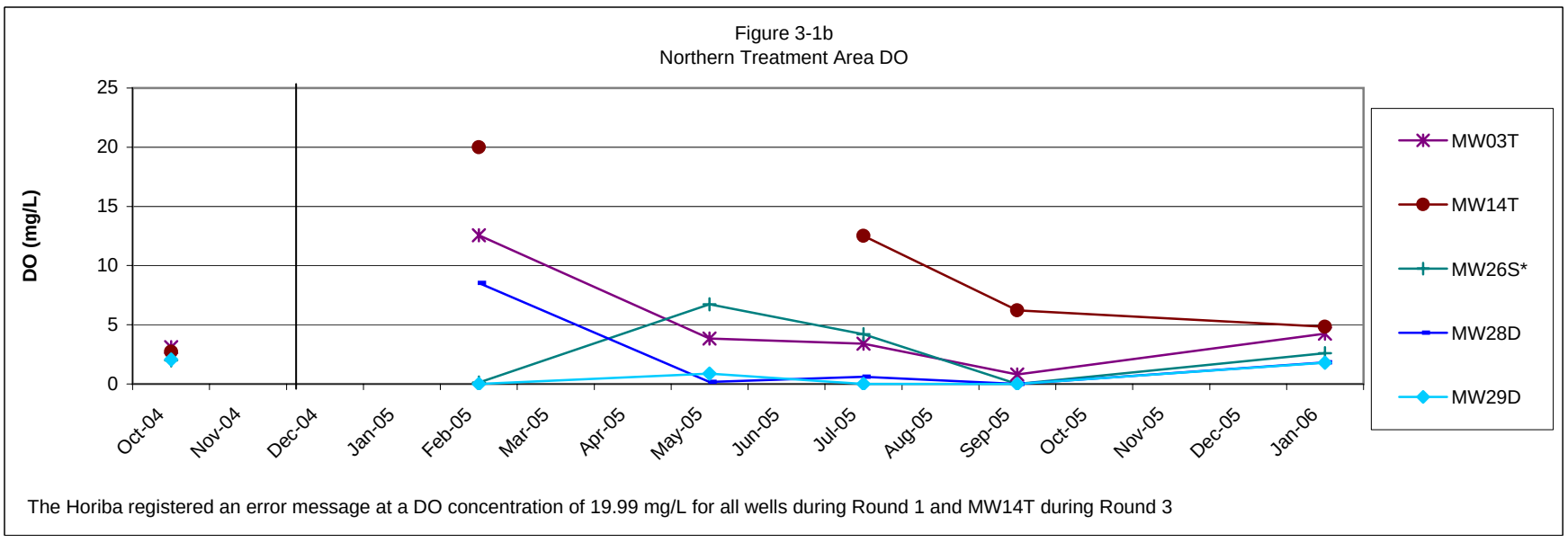
Table 3-1
Field Parameters and Analytical Exceedances of Screening Criteria
NAB Little Creek
Virginia Beach, Virginia

			Southern Treatment Area Monitoring Wells														
Station ID	**LC-Background UTL-Groundwater**	**MCL Ground-water**	LS13-MW18T							LS13-MW30D							
Sample Date			10/27/04	01/05/05	03/01/05	05/10/05	07/07/05	09/07/05	01/11/06	10/27/04	01/05/05	03/01/05	05/09/05	07/07/05	09/07/05	01/10/06	01/10/06
Sampling Round			Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 6 Duplicate
Chemical Name																	
Wet Chemistry (MG/L)																	
Acetate	--	--	1 U	1 U	1 U	0.5 U	0.434	1.01 L	0.2 U	NA	NA	NA	NA	NA	40.9 L	0.32	NA
Alkalinity	--	--	30	21.5 B	24.7	24.6	47.7	60.7	20	26.7	403	192	136	104	24.4	83.1	NA
Butyrate	--	--	1 U	1 U	1 U	0.5 U	0.29	0.2 UL	0.2 U	NA	NA	NA	NA	NA	0.2 UL	0.2 U	NA
Chemical oxygen demand	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	25	--	25.1	0.01	21.6	22.3	22.3	25.8	20.6	26.8	11.7	25.9	24.3	20.8	33.7	16.4	NA
Ethane	--	--	4.00E-05 J	0.002 U	0.002 U	4.00E-05 B	1.00E-04 B	3.00E-05 B	3.00E-05 B	NA	NA	NA	NA	NA	6.00E-05 B	3.00E-05 B	NA
Ethene	--	--	4.00E-05 B	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	NA	NA	NA	NA	NA	1.00E-04 B	8.00E-05 J	NA
Hardness	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lactate	--	--	25 U	25 U	25 U	0.5 U	0.503	1.01 L	0.2 U	NA	NA	NA	NA	NA	25.7 L	0.49	NA
Methane	--	--	0.003 L	0.006 B	0.011	0.009	0.01	0.011	0.041	NA	NA	NA	NA	NA	0.52	0.52	NA
Nitrate	--	10	0.05 U	0.13	0.405	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.02 J	0.05 U	0.135	0.05 U	0.05 U	0.05 U	NA
Nitrite	--	1	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.475	0.05 U	0.05 U	0.225	0.05 U	0.05 U	NA
Propionate	--	--	0.73 J	1 U	1 U	0.5 U	1.09	0.2 UL	NA	NA	NA	NA	NA	NA	0.2 UL	NA	NA
Pyruvate	--	--	10 U	10 U	10 U	95.5	91.5	96.9 L	97.6	NA	NA	NA	NA	NA	30.5 L	54.9	NA
Sulfate	54	--	15.5	17.6	14.7	13	12.1	7.88	11.3	32.5	11.7	10.6	11.5	10	13.9	8.63	NA
Total dissolved solids (TDS)	--	--	118	105	111	118	129	141	66	136	766	341	214	196	130	187	NA
Total organic carbon (TOC)	--	--	6.28	5 U	4.67 J	2.77 J	10.4	4.55 J	5 U	6.47	199	69.9	11.4	22.2	48	5.63	NA
Field Parameters																	
Dissolved Oxygen (mg/L)	--	--	2.61	0	0	0	0	0	1.34	2.89	3.89	0	1.09	0	0	0	NA
Depth to Water (ft)	--	--	4.51	5.73	5.02	5.27	5.86	6.09	4.55	5.85	6.19	5.39	5.47	5.82	6.48	4.95	NA
Oxidation Reduction Potential (mV)	--	--	172	172	128	141	-47	-69	44	89	-169	-153	-176	-150	-133	-152	NA
Flow Rate (GPM)	--	--	0.066	0.066	0.052	0.05	0.066	0.066	0.079	0.038	0.066	0.105	0.046	0.079	0.079	0.079	NA
Gallons Purged (GAL)	--	--	NA	2.5	3	2	3	3.5	4	2.5	2.5	2.5	2.5	3.9	3	3.5	NA
pH	--	--	5.4	5.63	5.69	5.82	6.47	6.38	5.87	5.75	5.93	6.65	6.67	7.37	6.75	6.87	NA
Specific Conductance (ms/cm)	--	--	0.2	0.147	0.15	0.143	0.175	0.187	0.168	0.262	0.448	0.525	0.398	0.3	0.305	0.499	NA
Temperature (C)	--	--	21.9	19.46	17.51	17.21	20.01	21.96	19.22	23.2	19.39	17.8	18.38	21.09	25.23	19.1	NA
Turbidity (NTU)	--	--	10.1	5.5	1.8	0.7	11.8	16.6	12.1	7	18.9	65.7	0	70	0	5.8	NA

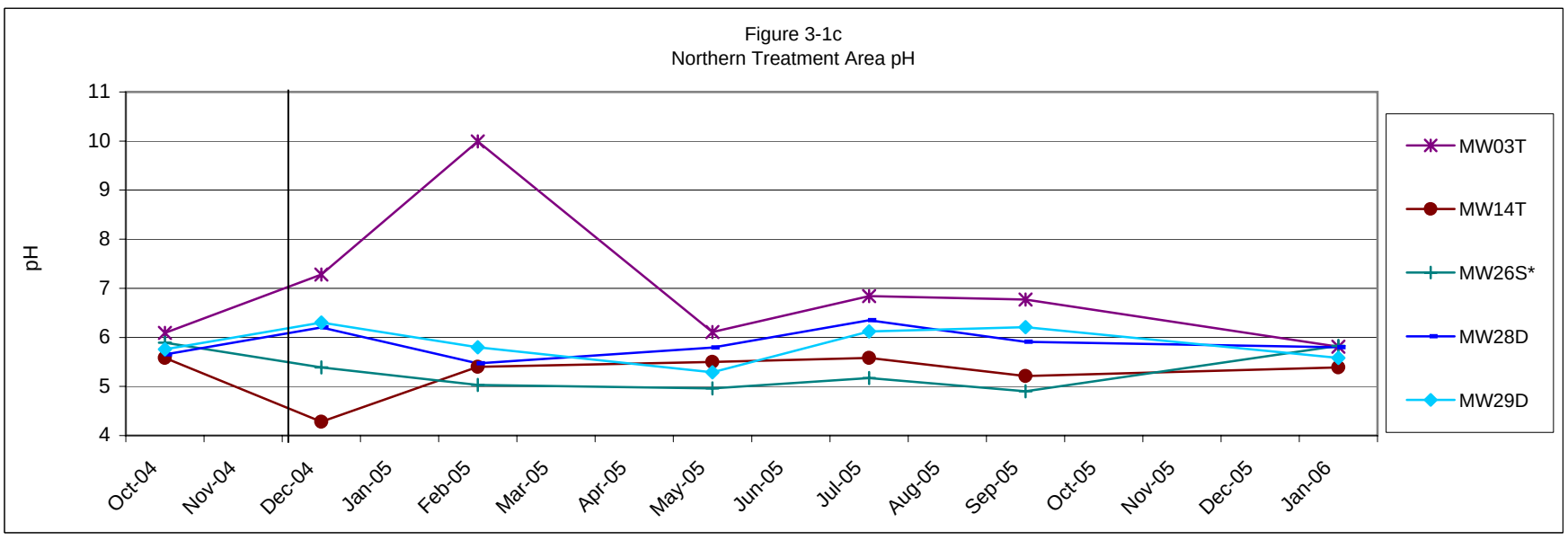
Notes:
U- Analyte not detected
J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is imprecise
UL- Analyte not detected. Quantitation limit is higher
R- Unreliable result
NA- Not analyzed
investigation
Shading exceeds MCL Groundwater Standards
Exceeds Background UTL for Groundwater

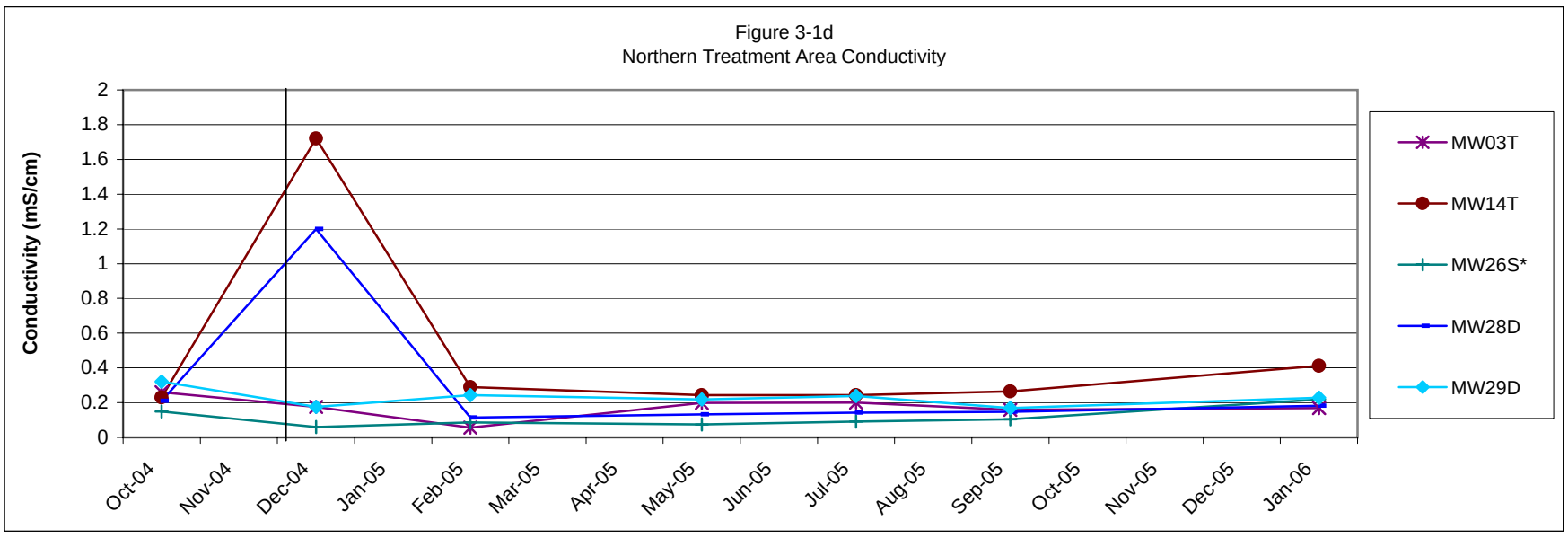
Figure 3-1
Northern Treatment Area Field Parameter Trends
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia





The Horiba registered an error message at a DO concentration of 19.99 mg/L for all wells during Round 1 and MW14T during Round 3

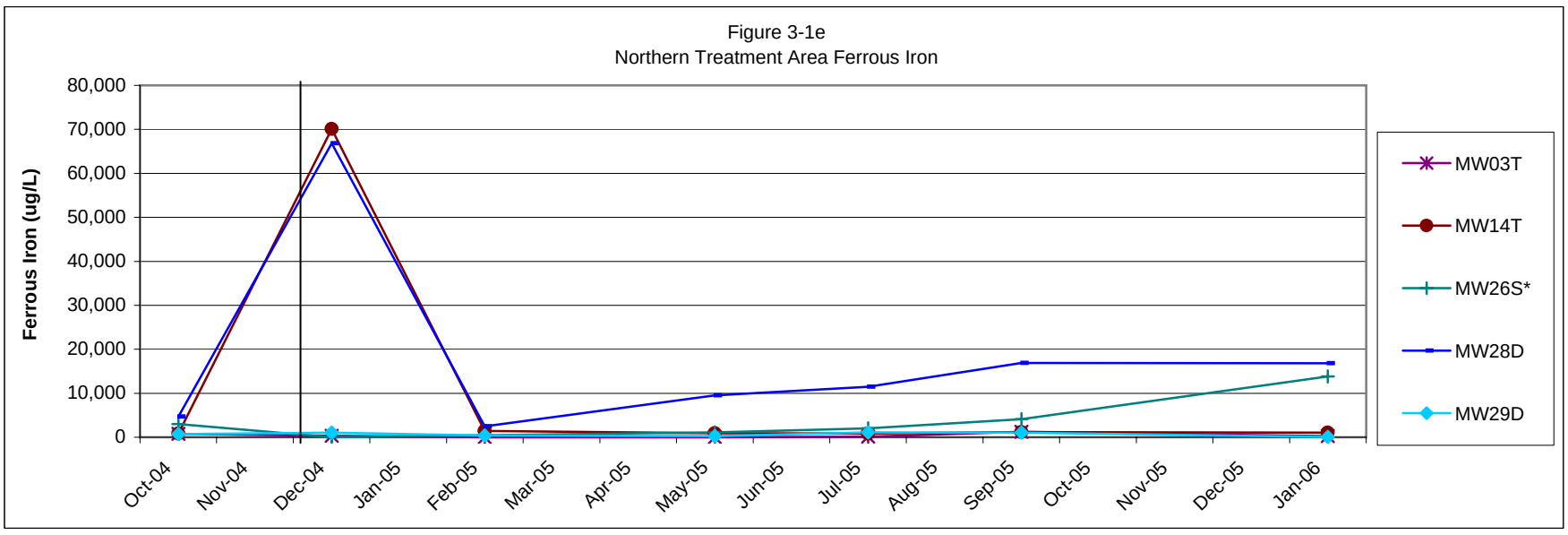


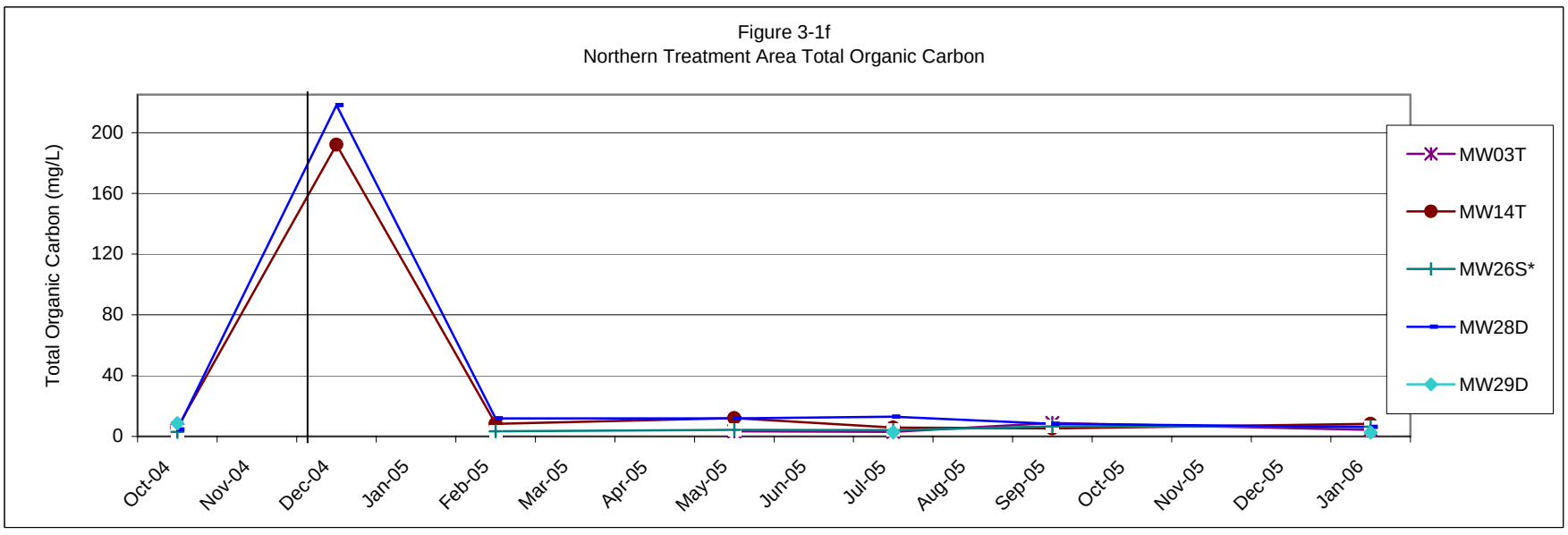


——— ISCO Injection

* Adjacent monitoring well MW21S was sampled during Round 1.

Figure 3-1
Northern Treatment Area Field Parameter Trends
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia





——— ISCO Injection

* Adjacent monitoring well MW21S was sampled during Round 1.

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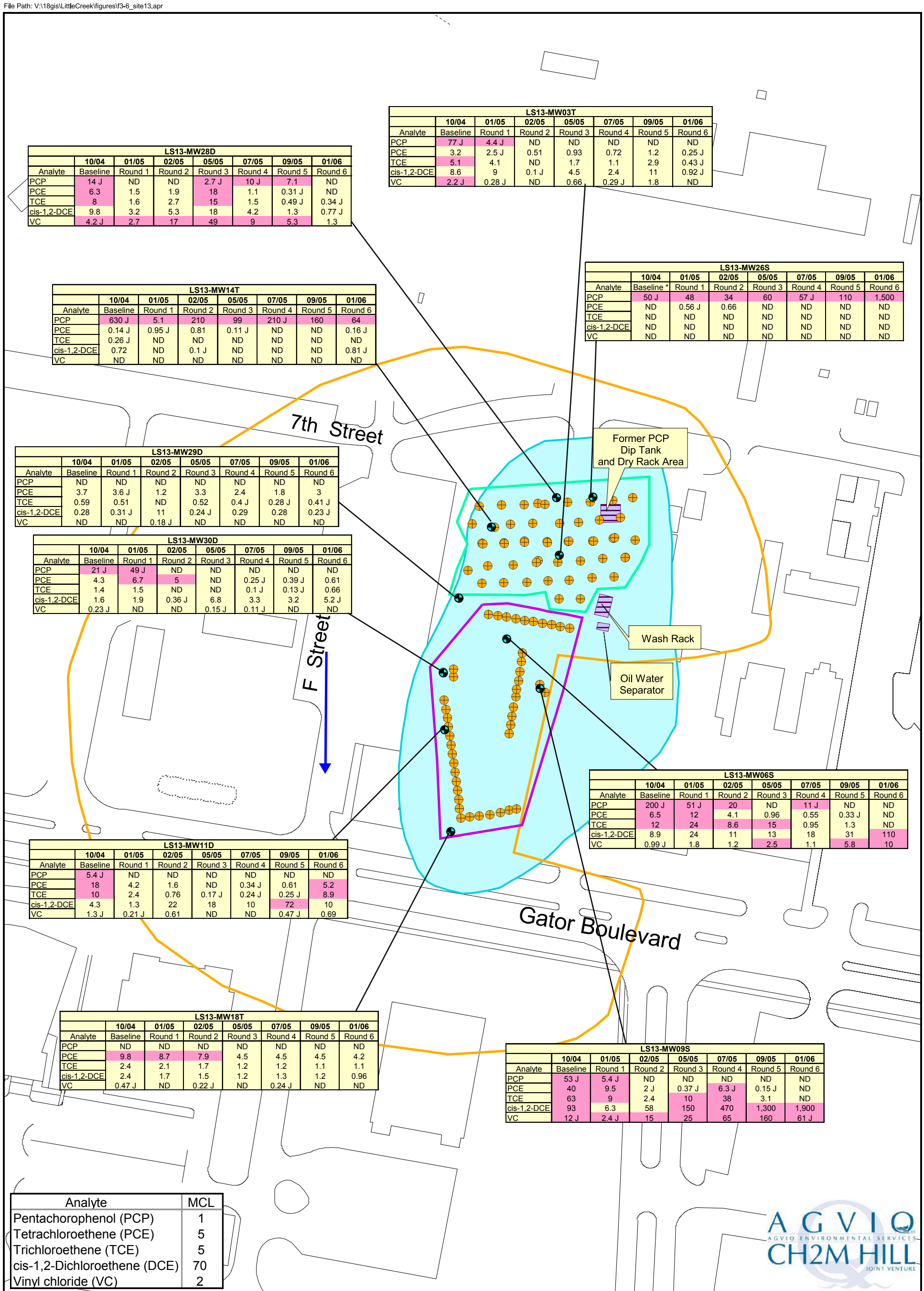


LS13-MW03T	10/04	01/05	02/05	05/05	07/05	09/05	01/06
Analyte	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
PCP	77 J	4.4 J	ND	ND	ND	ND	ND
PCE	3.2	2.5 J	0.51	0.93	0.72	1.2	0.25 J
TCE	5.1	4.1	ND	1.7	1.1	2.9	0.43 J
cis-1,2-DCE	8.6	9	0.1 J	4.5	2.4	11	0.92 J
VC	2.2 J	0.28 J	ND	0.66	0.29 J	1.8	ND

LS13-MW28D	10/04	01/05	02/05	05/05	07/05	09/05	01/06
Analyte	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
PCP	14 J	ND	ND	2.7 J	10 J	7.1	ND
PCE	6.3	1.5	1.9	18	1.1	0.31 J	ND
TCE	8	1.6	2.7	15	1.5	0.49 J	0.34 J
cis-1,2-DCE	9.8	3.2	5.3	18	4.2	1.3	0.77 J
VC	4.2 J	2.7	17	49	9	5.3	1.3

LS13-MW26S	10/04	01/05	02/05	05/05	07/05	09/05	01/06
Analyte	Baseline *	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
PCP	50 J	48	34	60	57 J	110	1,500
PCE	ND	0.56 J	0.66	ND	ND	ND	ND
TCE	ND	ND	ND	ND	ND	ND	ND
cis-1,2-DCE	ND	ND	ND	ND	ND	ND	ND
VC	ND	ND	ND	ND	ND	ND	ND

LS13-MW14T	10/04	01/05	02/05	05/05	07/05	09/05	01/06
Analyte	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
PCP	630 J	5.1	210	99	210 J	160	64
PCE	0.14 J	0.95 J	0.81	0.11 J	ND	ND	0.16 J
TCE	0.26 J	ND	ND	ND	ND	ND	ND
cis-1,2-DCE	0.72	ND	0.1 J	ND	ND	ND	0.81 J
VC	ND	ND	ND	ND	ND	ND	ND

LS13-MW29D	10/04	01/05	02/05	05/05	07/05	09/05	01/06
Analyte	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
PCP	ND	ND	ND	ND	ND	ND	ND
PCE	3.7	3.6 J	1.2	3.3	2.4	1.8	3
TCE	0.59	0.51	ND	0.52	0.4 J	0.28 J	0.41 J
cis-1,2-DCE	0.28	0.31 J	11	0.24 J	0.29	0.28	0.23 J
VC	ND	ND	0.18 J	ND	ND	ND	ND

LS13-MW30D	10/04	01/05	02/05	05/05	07/05	09/05	01/06
Analyte	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
PCP	21 J	49 J	ND	ND	ND	ND	ND
PCE	4.3	6.7	5	ND	0.25 J	0.39 J	0.61
TCE	1.4	1.5	ND	ND	0.1 J	0.13 J	0.66
cis-1,2-DCE	1.6	1.9	0.36 J	6.8	3.3	3.2	5.2 J
VC	0.23 J	ND	ND	0.15 J	0.11 J	ND	ND

LS13-MW06S	10/04	01/05	02/05	05/05	07/05	09/05	01/06
Analyte	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
PCP	200 J	51 J	20	ND	11 J	ND	ND
PCE	6.5	12	4.1	0.96	0.55	0.33 J	ND
TCE	12	24	8.6	15	0.95	1.3	ND
cis-1,2-DCE	8.9	24	11	13	18	31	110
VC	0.99 J	1.8	1.2	2.5	1.1	5.8	10

LS13-MW11D	10/04	01/05	02/05	05/05	07/05	09/05	01/06
Analyte	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
PCP	5.4 J	ND	ND	ND	ND	ND	ND
PCE	18	4.2	1.6	ND	0.34 J	0.61	5.2
TCE	10	2.4	0.76	0.17 J	0.24 J	0.25 J	8.9
cis-1,2-DCE	4.3	1.3	22	18	10	72	10
VC	1.3 J	0.21 J	0.61	ND	ND	0.47 J	0.69

LS13-MW18T	10/04	01/05	02/05	05/05	07/05	09/05	01/06
Analyte	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
PCP	ND	ND	ND	ND	ND	ND	ND
PCE	9.8	8.7	7.9	4.5	4.5	4.5	4.2
TCE	2.4	2.1	1.7	1.2	1.2	1.1	1.1
cis-1,2-DCE	2.4	1.7	1.5	1.2	1.3	1.2	0.96
VC	0.47 J	ND	0.22 J	ND	0.24 J	ND	ND

LS13-MW09S	10/04	01/05	02/05	05/05	07/05	09/05	01/06
Analyte	Baseline	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
PCP	53 J	5.4 J	ND	ND	ND	ND	ND
PCE	40	9.5	2 J	0.37 J	6.3 J	0.15 J	ND
TCE	63	9	2.4	10	38	3.1	ND
cis-1,2-DCE	93	6.3	58	150	470	1,300	1,900
VC	12 J	2.4 J	15	25	65	160	61 J

Analyte	MCL
Pentachorophenol (PCP)	1
Tetrachloroethene (PCE)	5
Trichloroethene (TCE)	5
cis-1,2-Dichloroethene (DCE)	70
Vinyl chloride (VC)	2

LEGEND

- Site 13 Area of Investigation
- Injection Points
- Treatability Study Monitoring Well Locations
- Site 13 Groundwater Plume (January 2006)
- Groundwater Flow Direction (April 2006)
- ISCO Treatment Area
- ERD Treatment Area

* Sampled adjacent MW21S

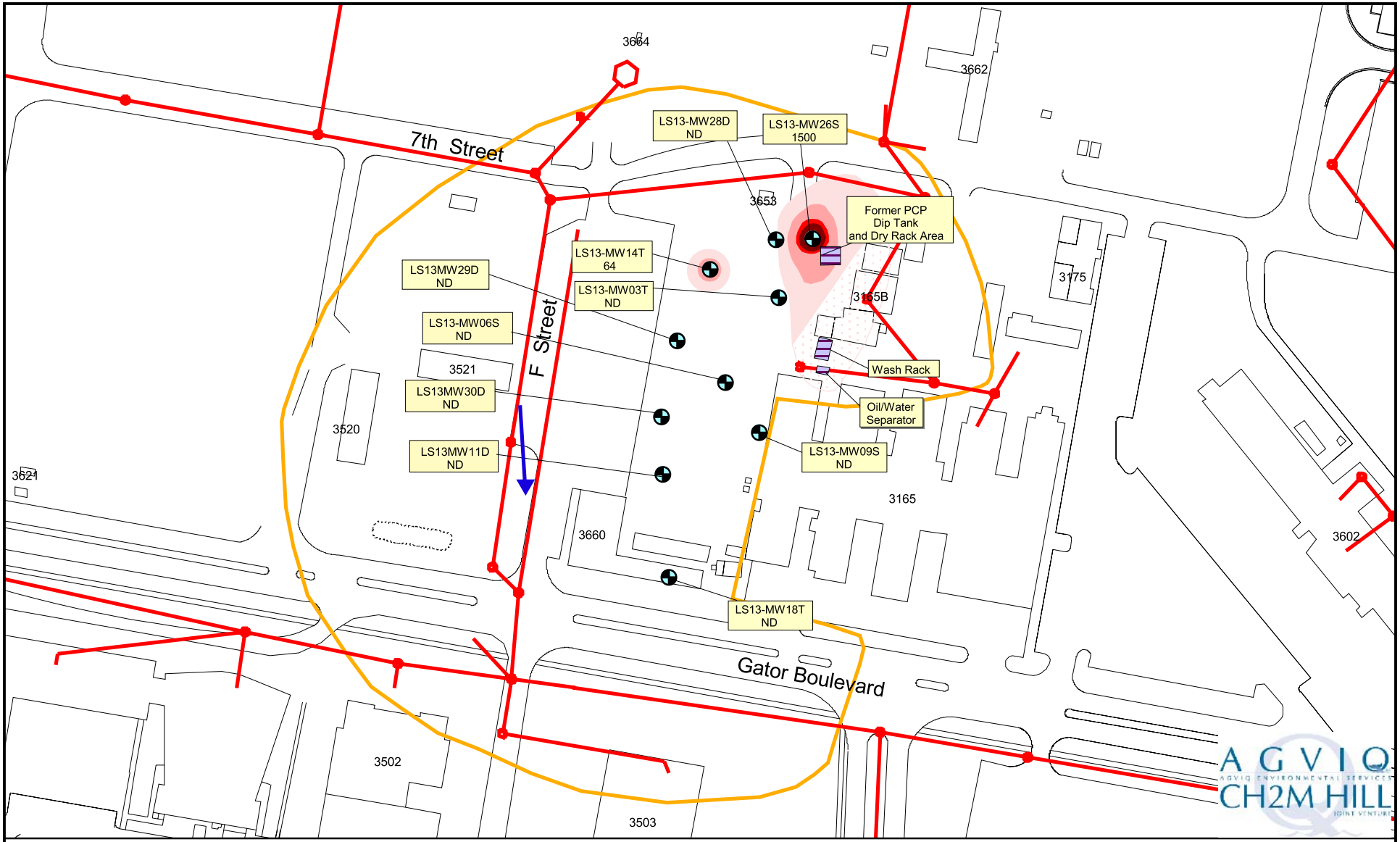
Concentrations are in µg/L.

N

0 100 200 Feet

Figure 3-2
Analytical Results
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

File Path: V:\18gis\LittleCreek\figures\lc_site13_fs.apr



LEGEND

- Site 13 Area of Investigation
- 1-10 µg/L
- 10-100 µg/L
- 100-1000 µg/L
- 1000+ µg/L
- Inferred from 2003 data
- Sanitary Sewer Lines
- Groundwater Flow Direction (April 2006)

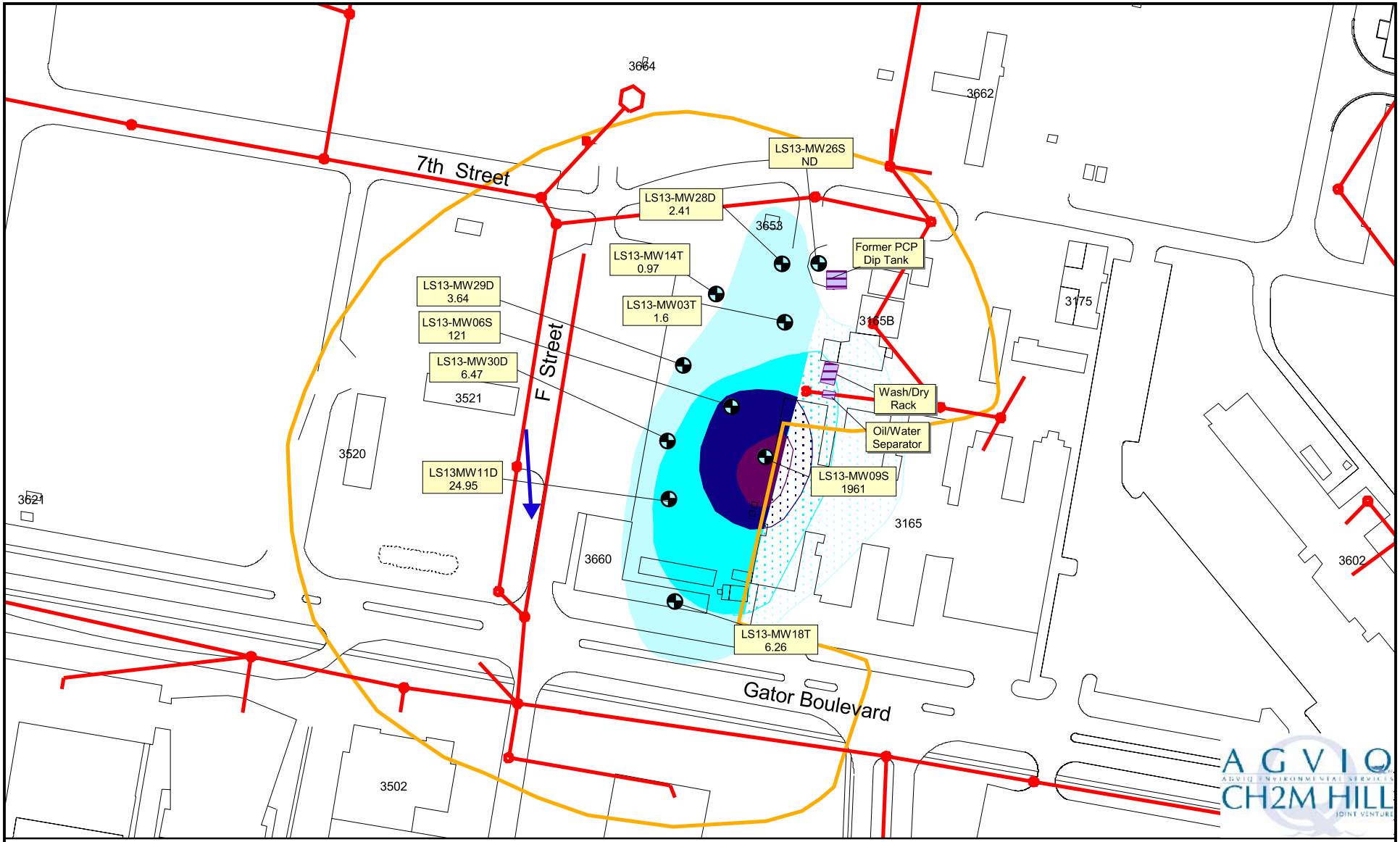
ND - Not Detected
7 PCP Concentration µg/L

N

0 75 150 Feet

Figure 3-3
PCP Isoconcentration
Columbia Aquifer, January 2006
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

File Path: V:\18gis\LittleCreek\figures\lc_site13_fs.apr



LEGEND

- Site 13 Area of Investigation
- 1-10 ug/L
- 10-100 ug/L
- 100-1000 ug/L
- 1000+ ug/L
- Sanitary Sewer Lines
- Groundwater Flow Direction (April 2006)

ND- Not Detected

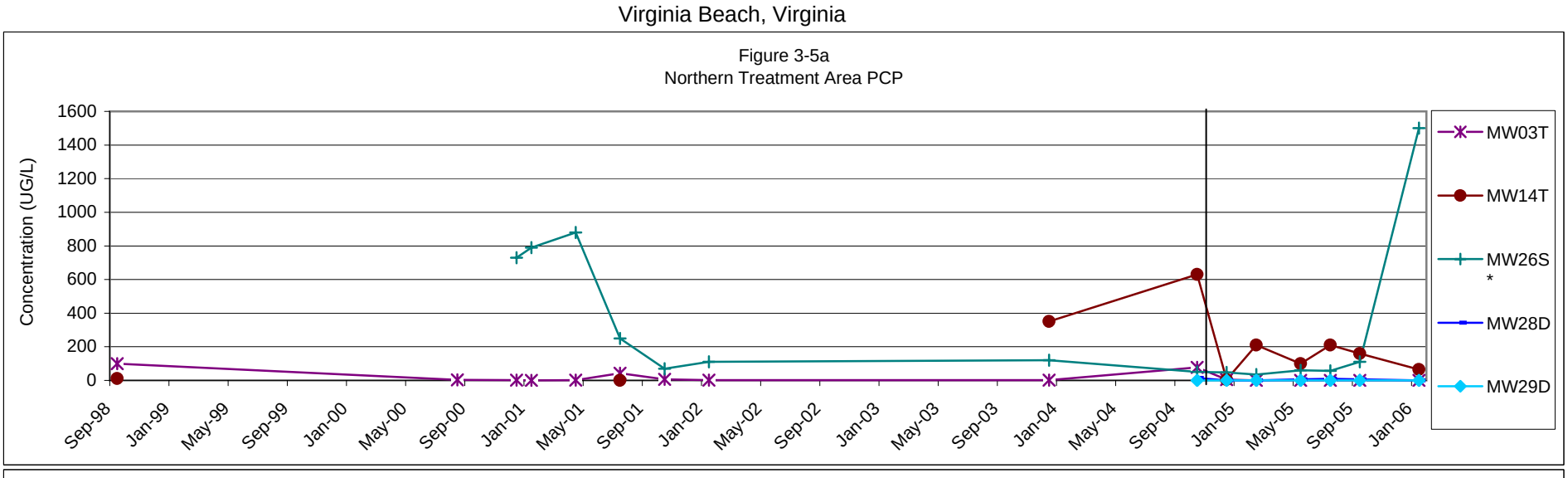
1.6 Total Chlorinated Ethene Concentration (PCE, TCE, DCE, VC) ug/L

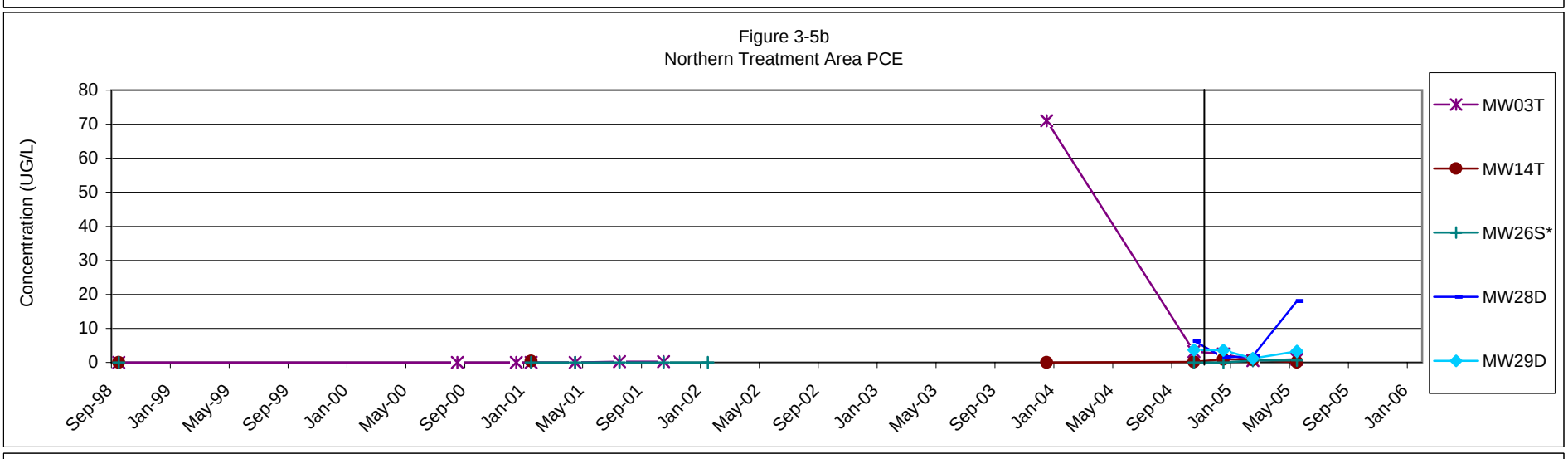
N

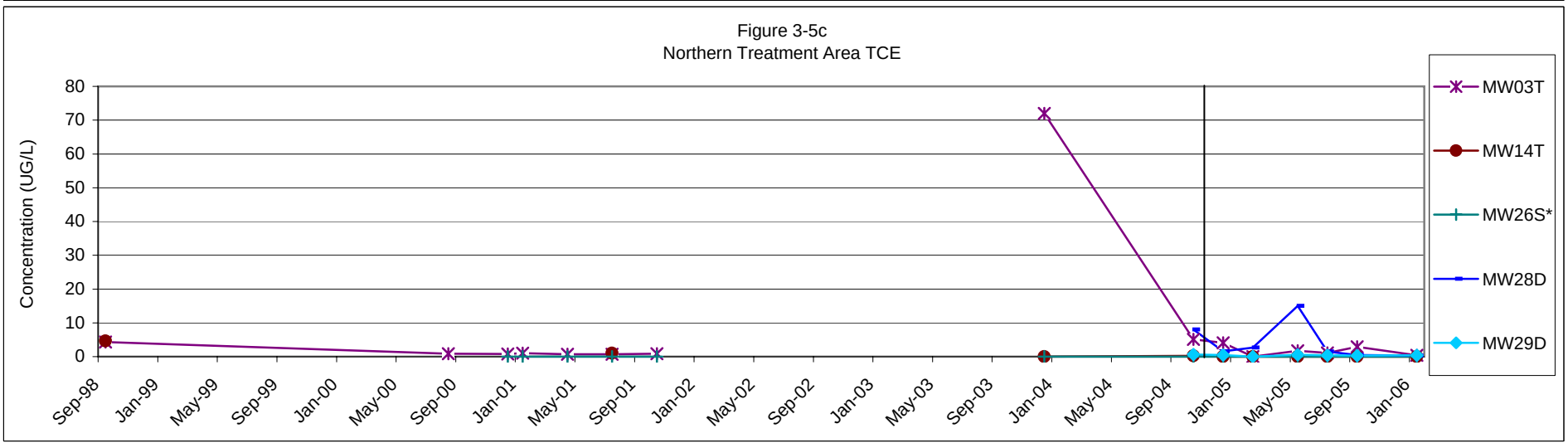
0 75 150 Feet

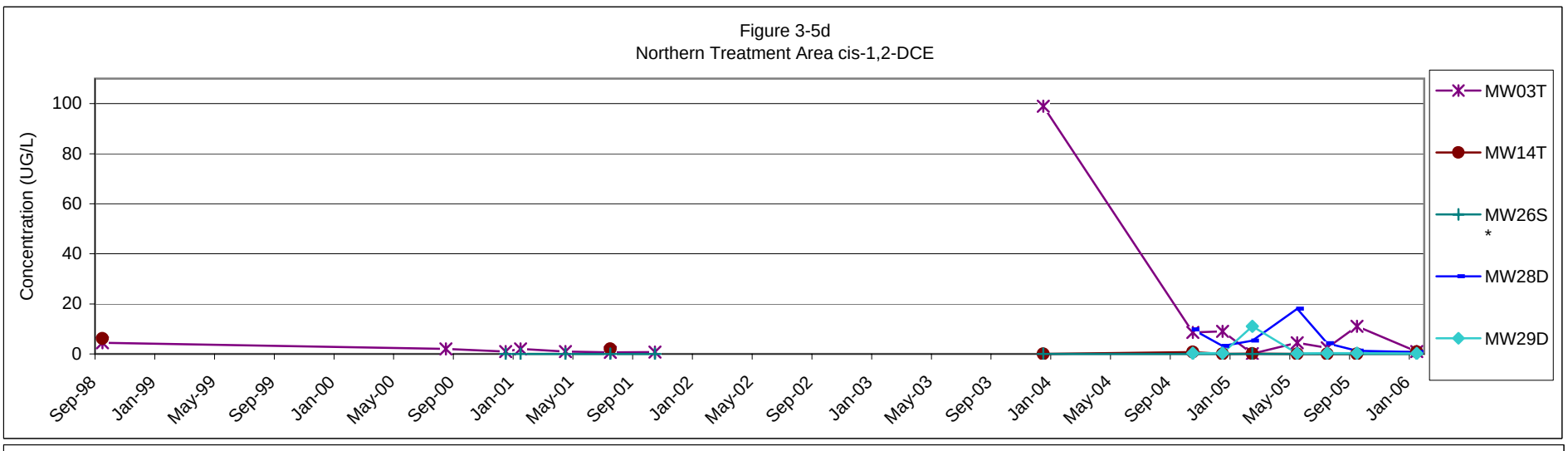
Figure 3-4
Total Chlorinated Ethenes Isoconcentration
Columbia Aquifer, January 2006
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

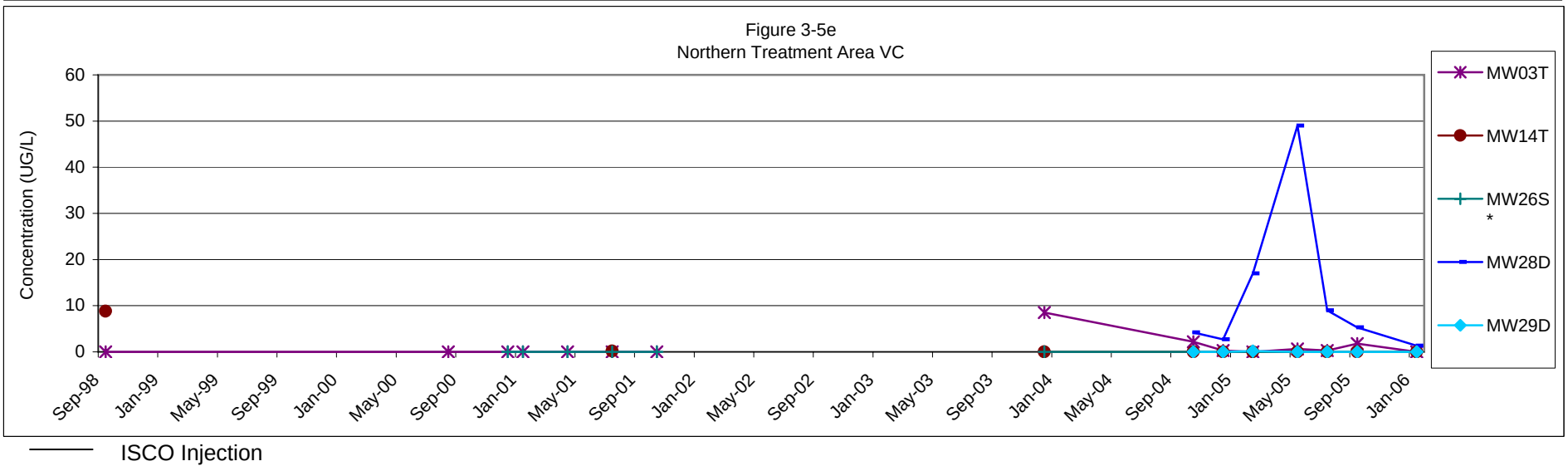
Figure 3-5
Northern Treatment Area PCP and VOC Concentration Trends
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia







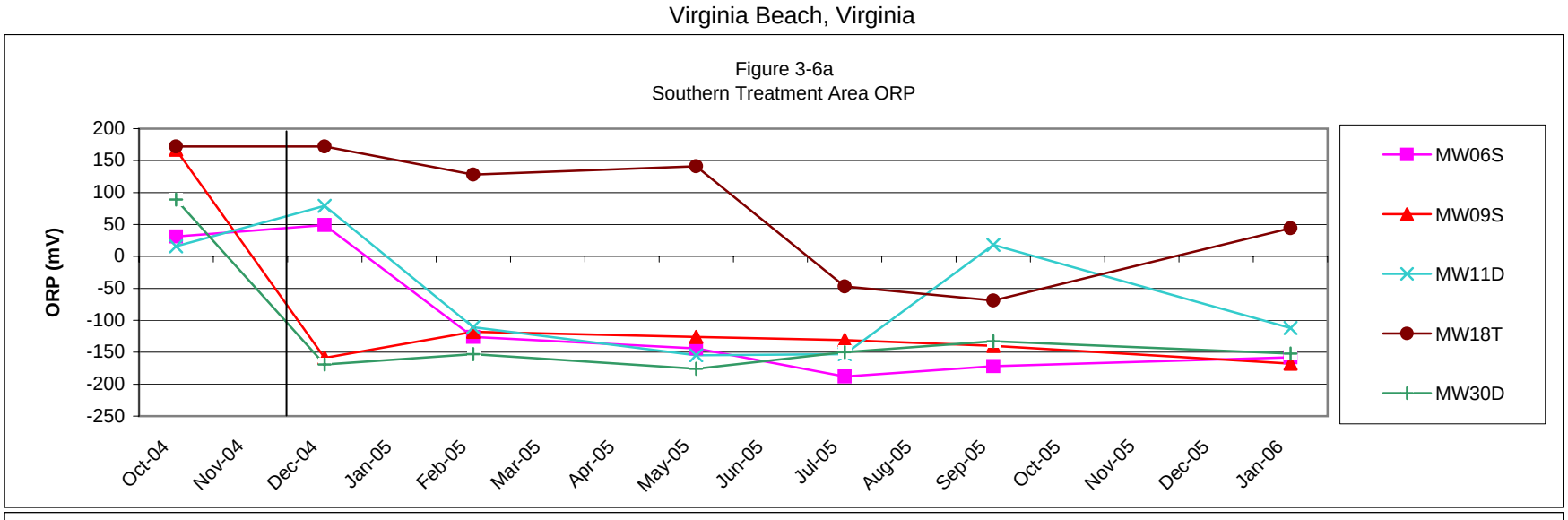


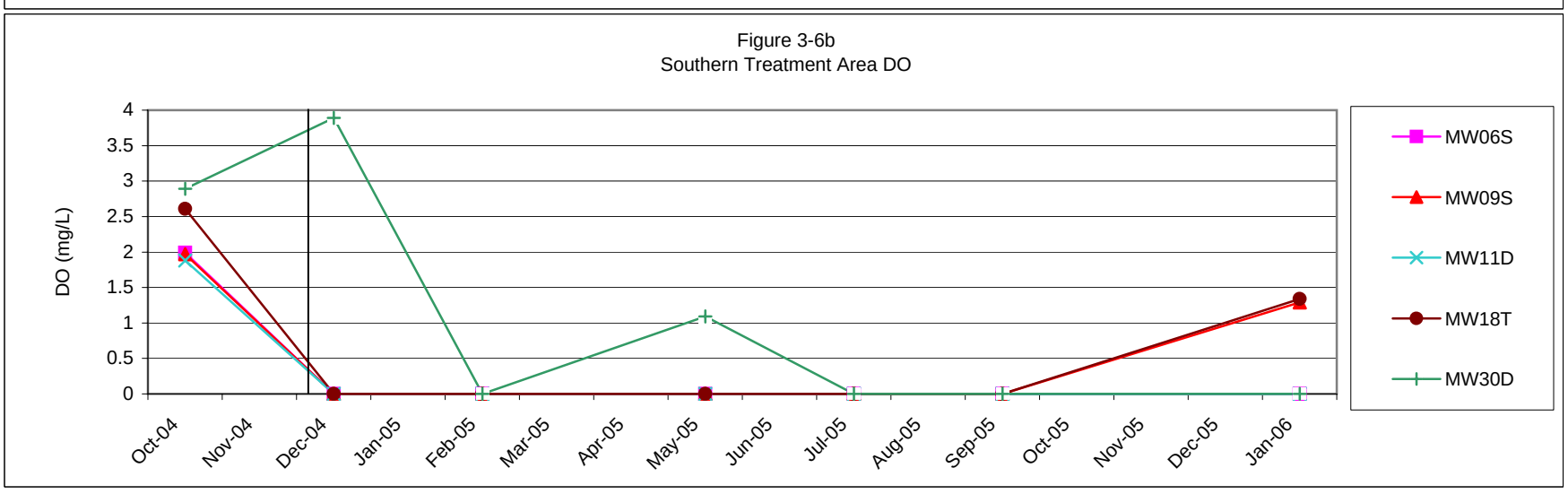


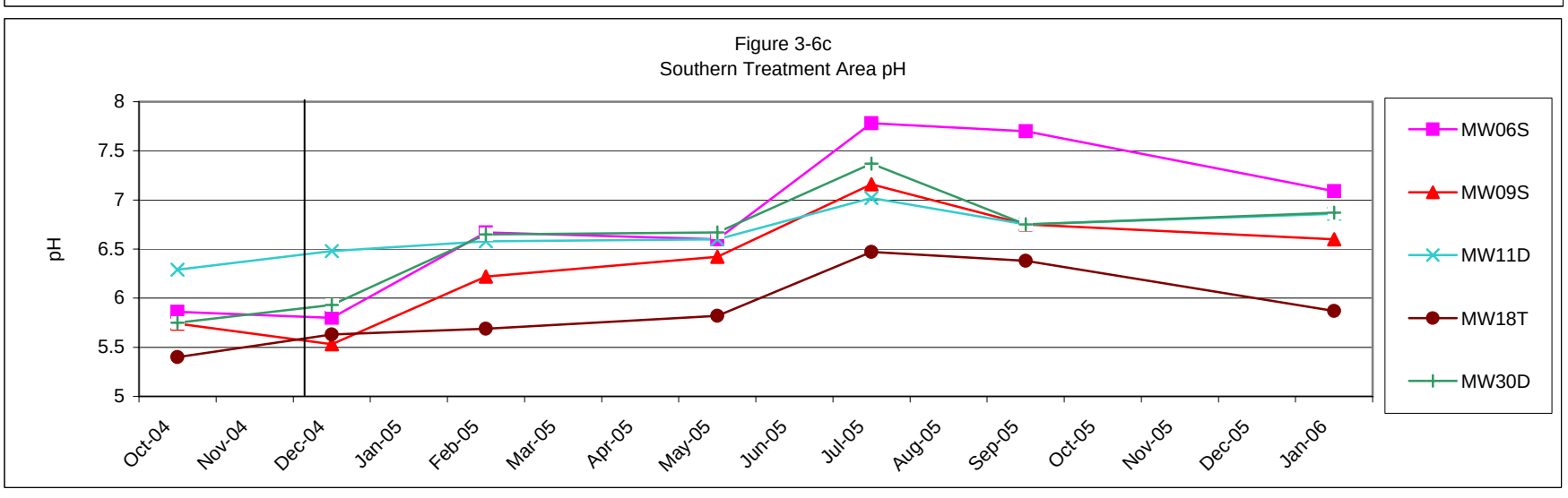
——— ISCO Injection

* Adjacent monitoring well MW21S was sampled during Round 1.

Figure 3-6
Southern Treatment Area Field Parameter Trends
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

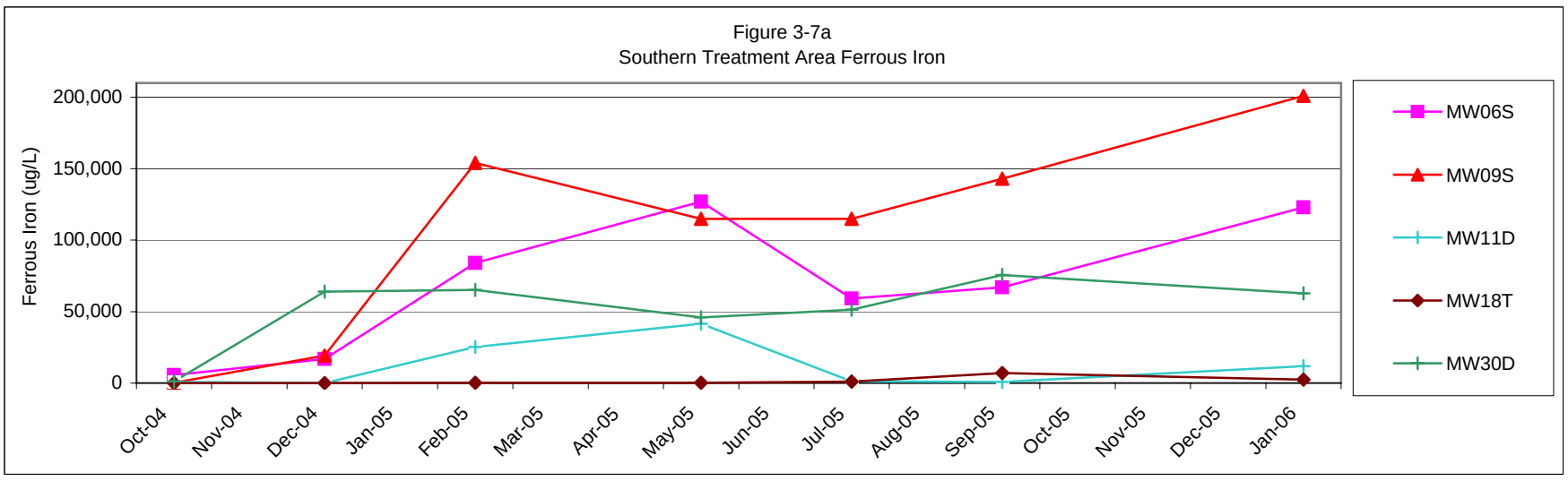


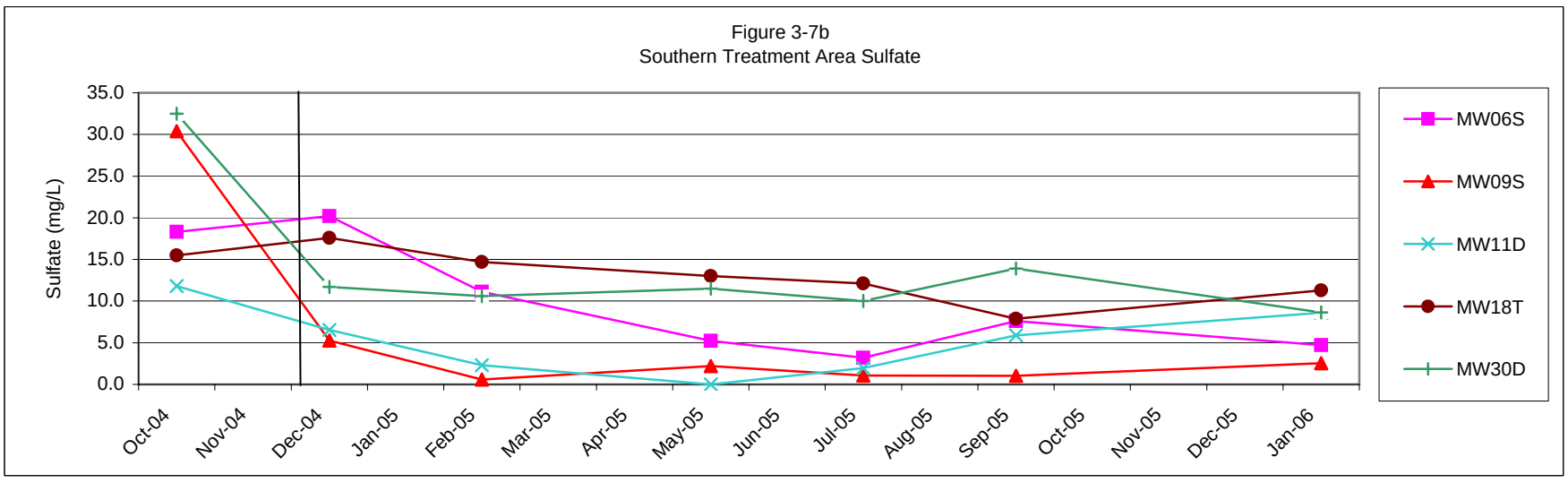


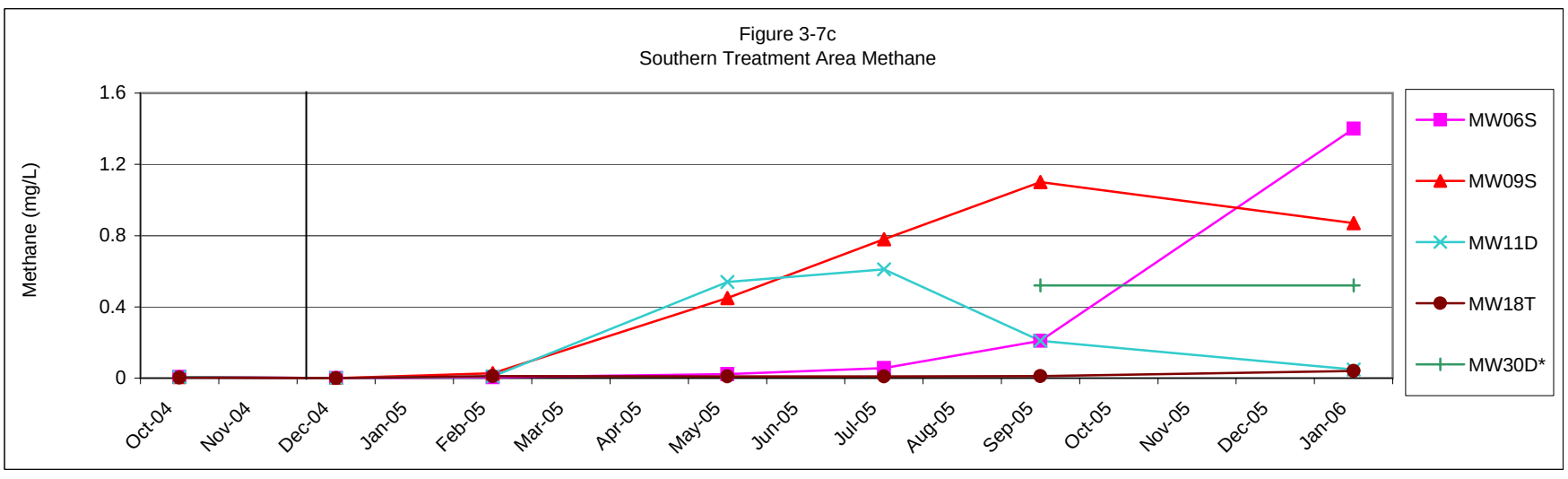


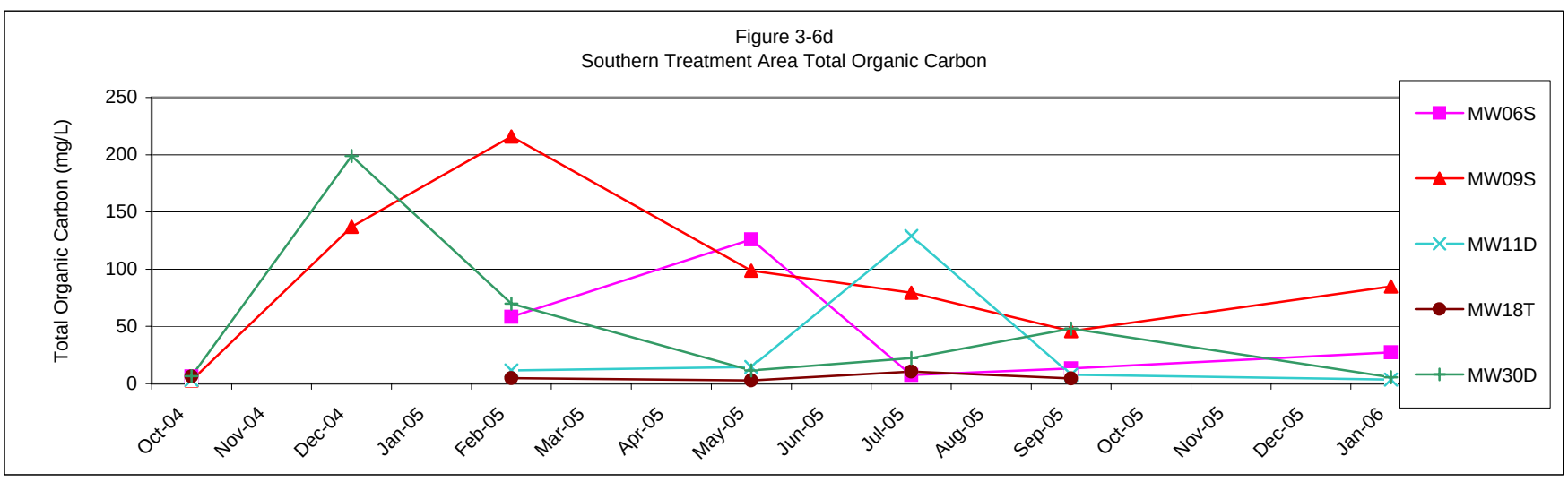
EOS Injection

Figure 3-7
Southern Treatment Area Attenuation Parameter Trends
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia



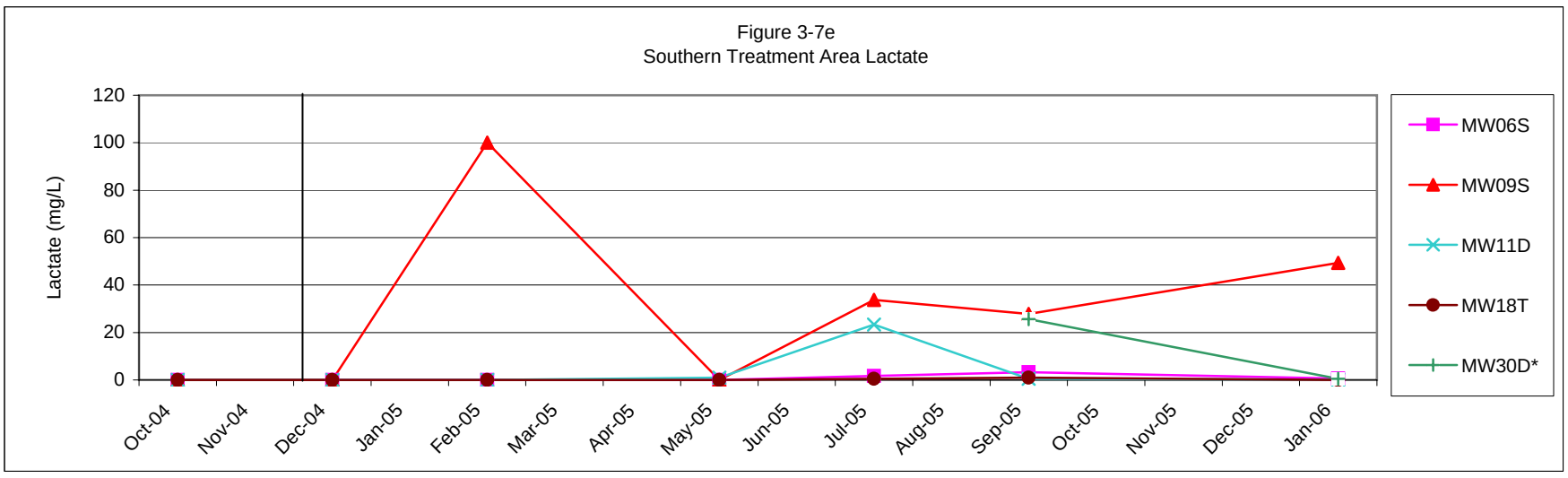


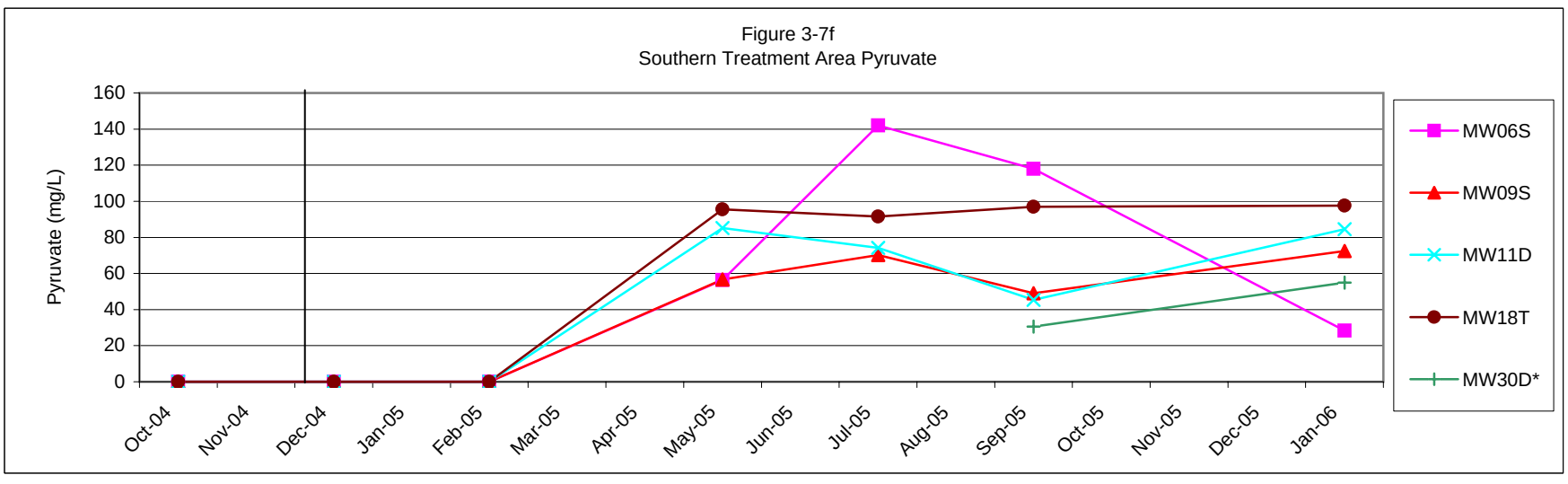


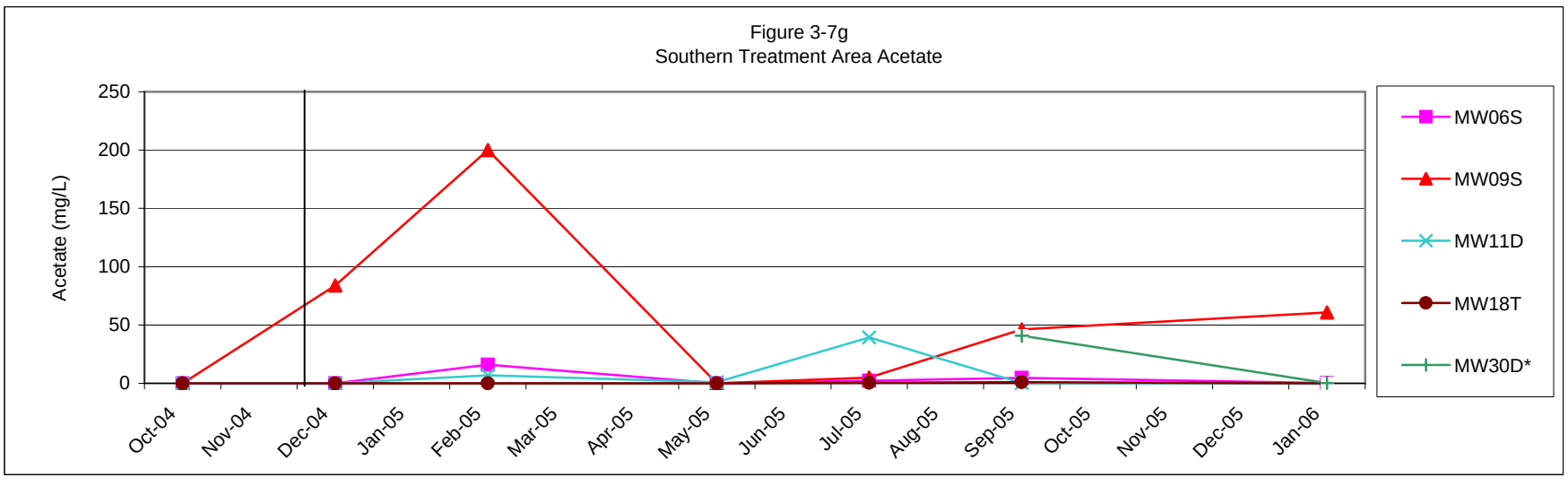


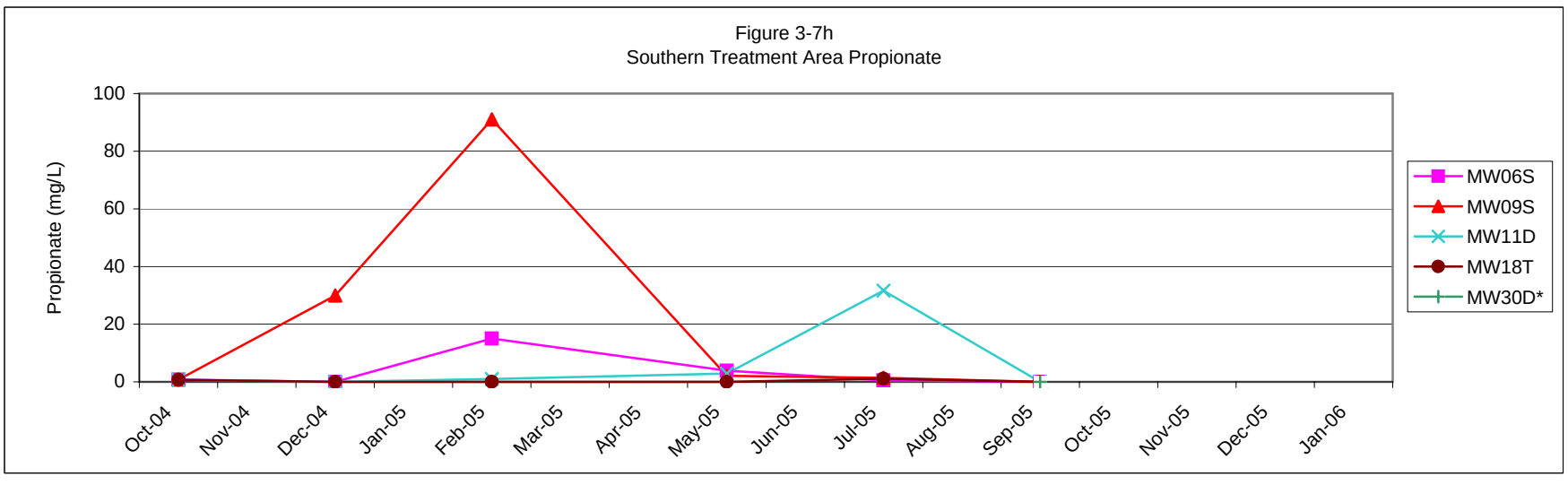
——— EOS Injection
* MW30D sampled only during Round 5 and 6.

Figure 3-7
Southern Treatment Area Attenuation Parameter Trends
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia



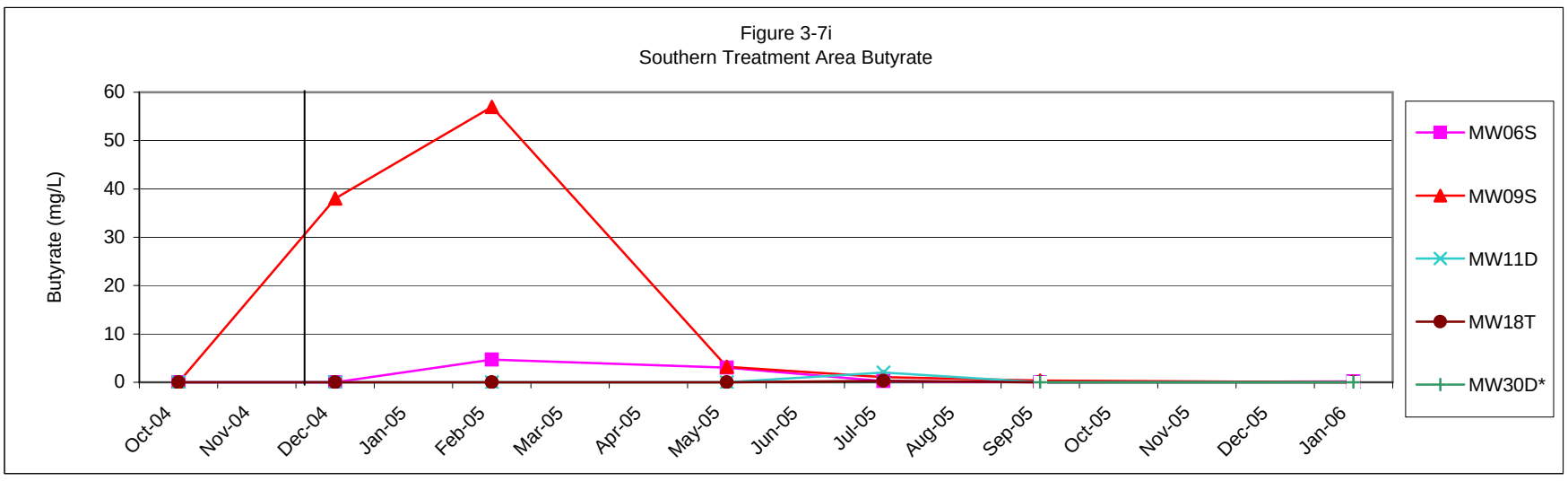


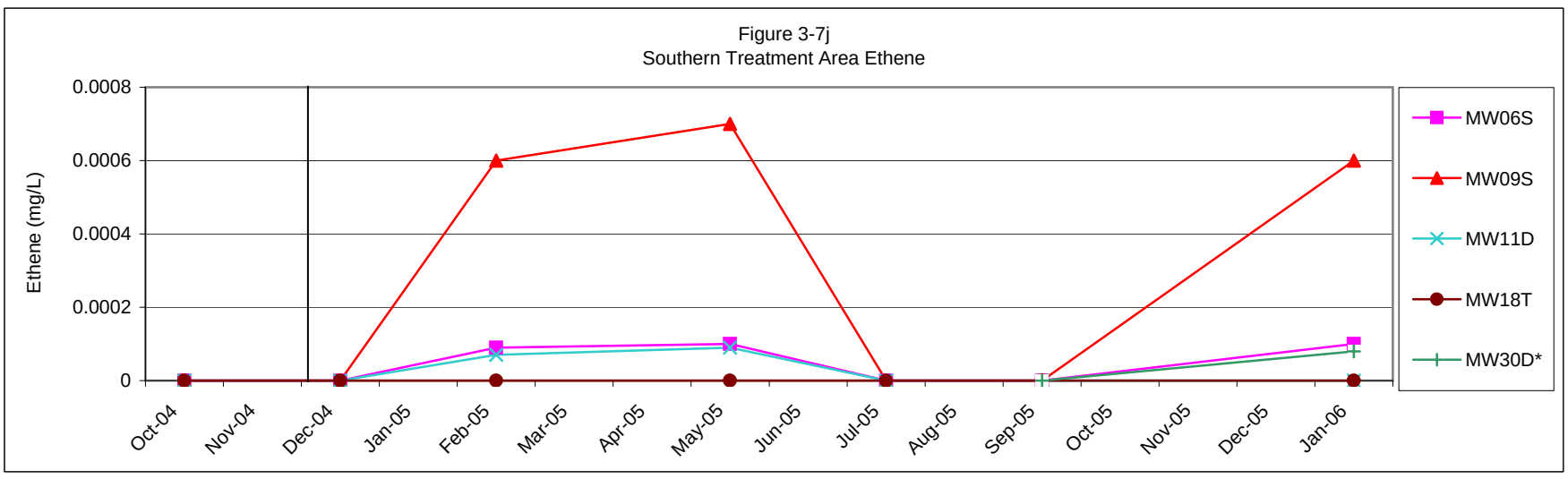


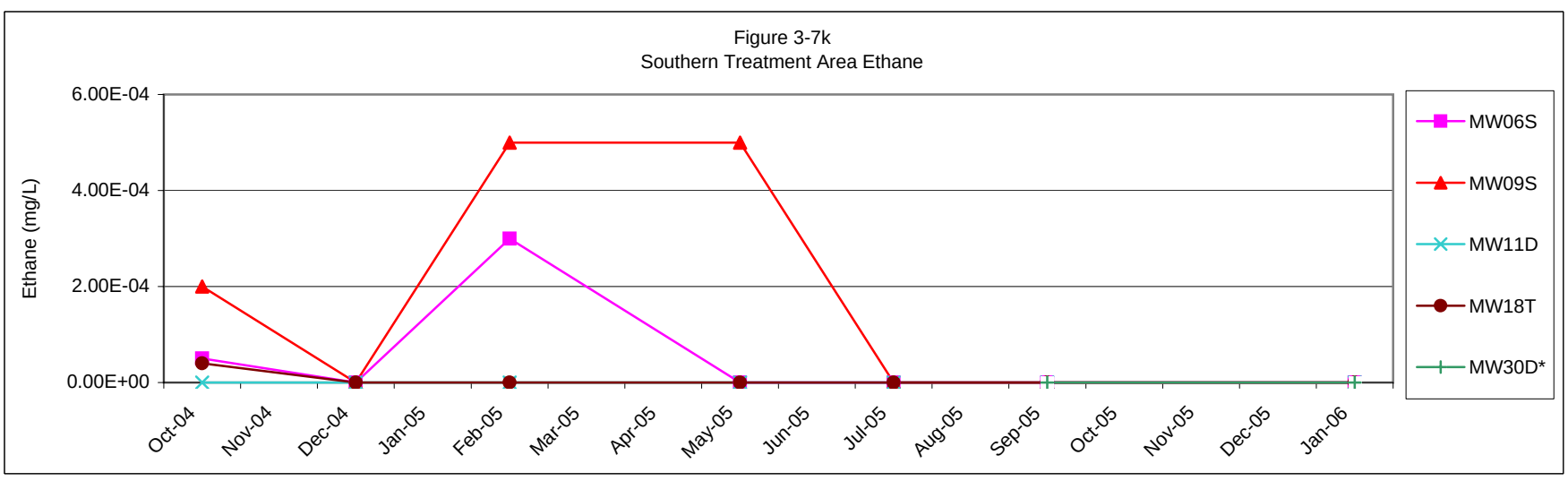


——— EOS Injection
* MW30D sampled only during Round 5 and 6.

Figure 3-7
Southern Treatment Area Attenuation Parameter Trends
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

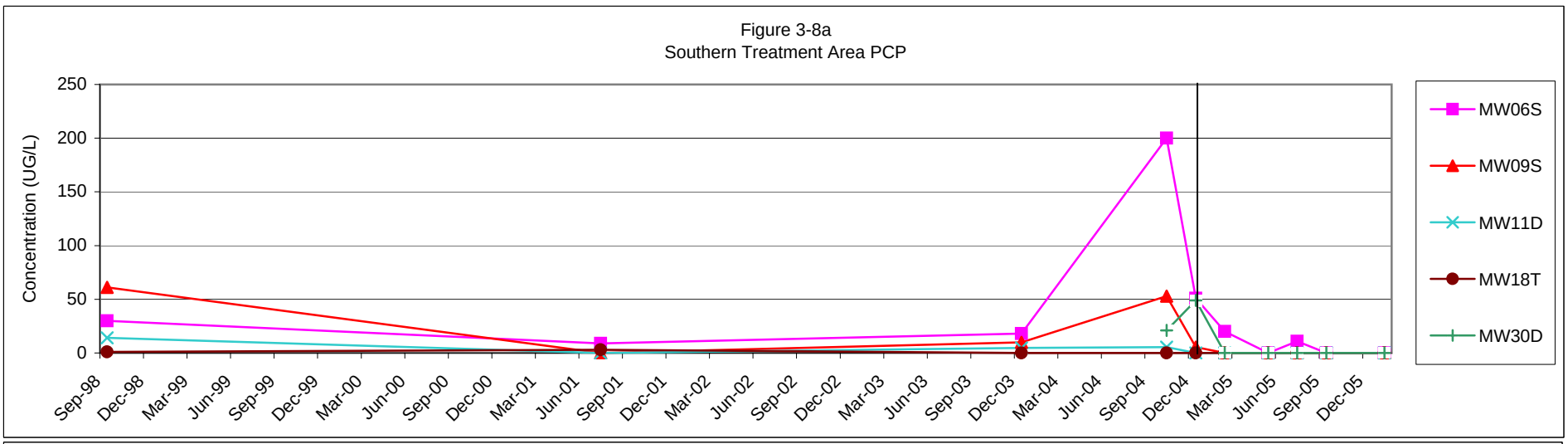


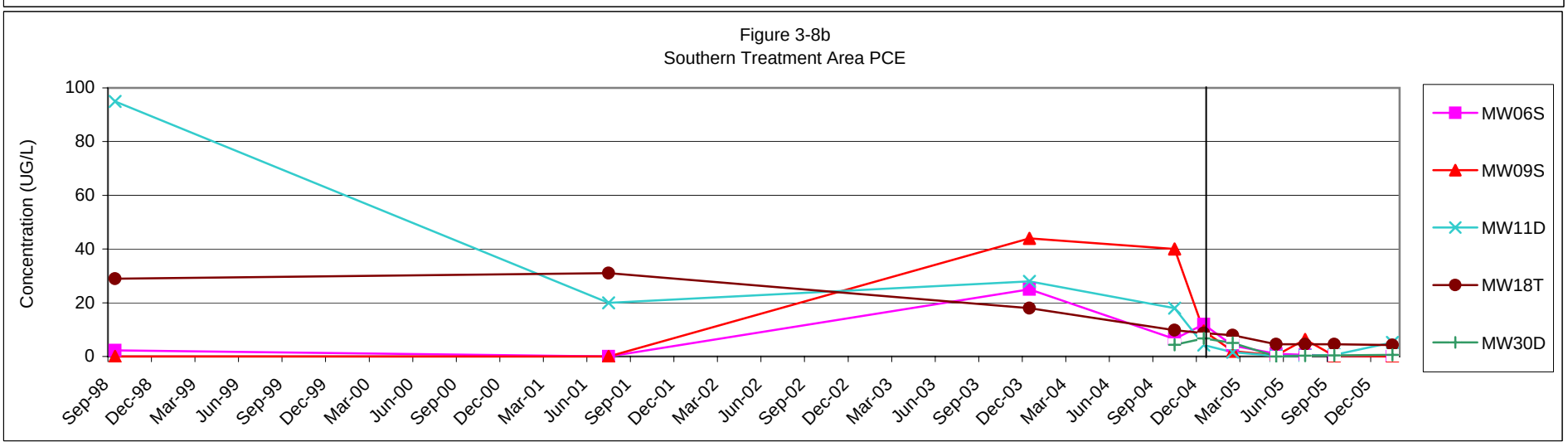


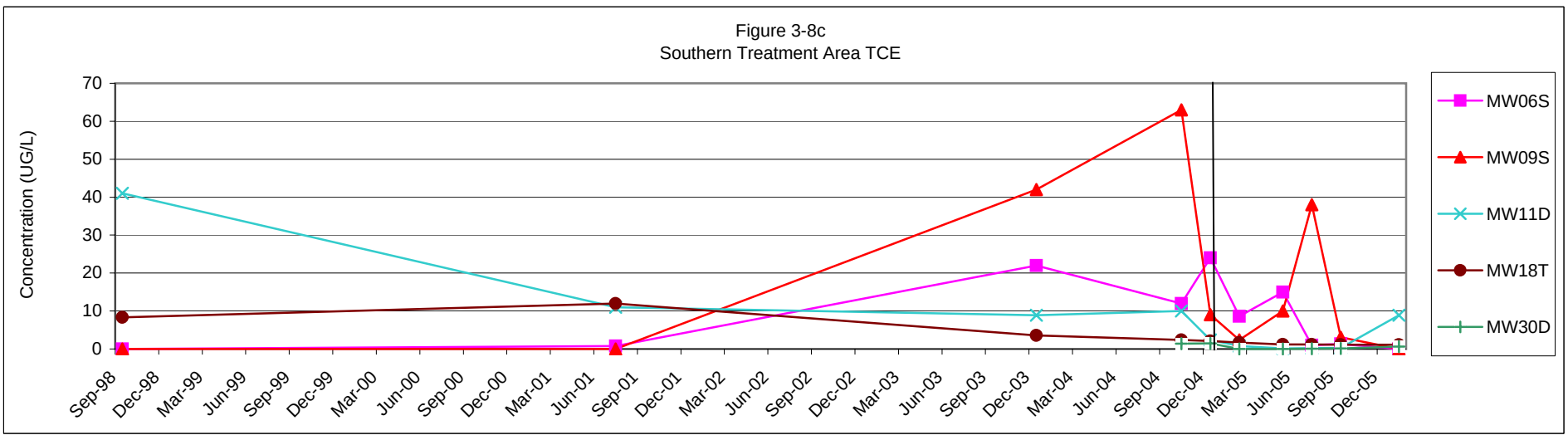


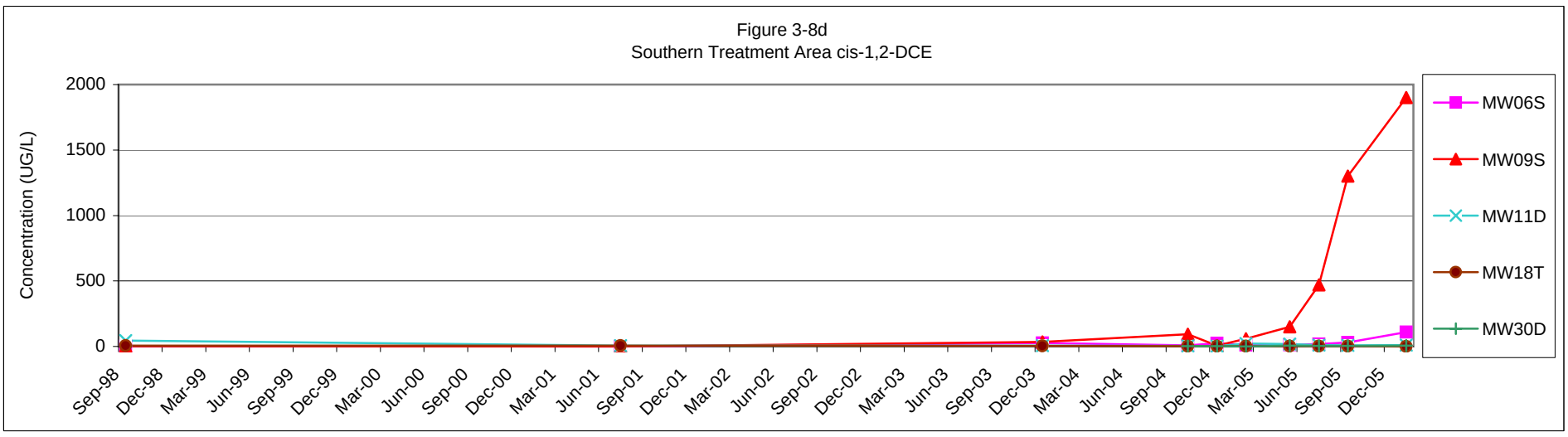
——— EOS Injection
* MW30D sampled only during Round 5 and 6.

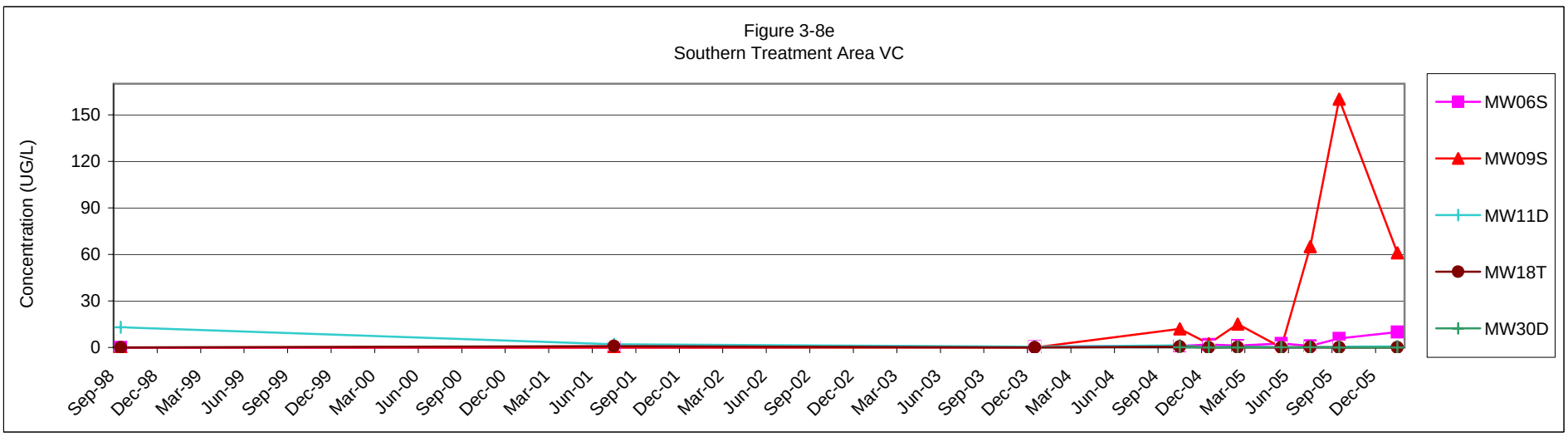
Figure 3-8
Southern Treatment Area PCP and VOC Concentration Trends
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia











EOS Injection

SECTION 4

Conclusions and Recommendations

The modified Fenton's ISCO approach employed in the northern treatment area and the ERD approach employed in the southern treatment area were both moderately effective in reducing concentrations of PCP and chlorinated ethenes at Site 13. In the northern treatment area, VOC concentrations decreased to below the MCL in all monitoring wells. However, because adequate distribution of reagent could not be verified, baseline VOC concentrations were relatively low, and the groundwater concentrations historically fluctuated, it is uncertain if the decrease in VOC concentrations resulted from the ISCO application. The ISCO approach was not as effective on PCP concentrations given PCP increased to 1,500 µg/L in MW26S. Prior to implementing ORC or ISCO, PCP concentrations were elevated in saturated soils as evidenced by post-removal action (1998) confirmation samples at the bottom (8 ft bgs) of the excavation; increased PCP concentrations in groundwater following ISCO treatment may be attributable to desorption of residual PCP in saturated soils.. Based on the expected treatment time associated with modified Fenton's oxidation, the reagent is no longer active.

In the southern treatment area, the ERD application was effective in treating PCP because concentrations decreased to below the MCL in all monitoring wells. The ERD application was also effective in treating PCE and TCE because concentrations were reduced to below the MCL by Round 5 in all wells, with the exception of MW11D. Degradation products (cis-1,2-DCE and VC) are present in several monitoring wells in the southern treatment area as expected with an ERD approach. However, the concentrations of cis-1,2-DCE in MW09S were greater than expected based on the stoichiometric degradation of observed PCE and/or TCE concentrations. The increased concentrations of daughter products may be attributed to degradation of larger than anticipated upgradient concentrations of PCE and/or TCE and desorption caused by the injection of the ERD substrate. Nonetheless, based on Round 6 field and analytical data, conditions and substrate suitable for reductive dechlorination are present in the southern treatment area of Site 13, and continued degradation is expected.

Following completion of the treatability study, total and dissolved cadmium were detected above the MCL in the northern treatment area and total antimony, and total and dissolved arsenic concentrations were detected above the MCLs in the southern treatment area. These metals are expected to return to near baseline conditions as the aquifer re-equilibrates.

Further remedial action is warranted at Site 13 because PCP and chlorinated ethenes in Site 13 groundwater remain above the established PRGs (MCL). Before this treatability study, an FS was completed to evaluate alternatives applicable to the constituents and conditions at Site 13. The alternatives that ranked most favorable were enhanced aerobic biodegradation for PCP and monitored natural attenuation (Alternative 5) for PCP and VOCs, enhanced anaerobic biodegradation (Alternative 4), and monitored natural attenuation (Alternative 1a); all alternatives included groundwater monitoring to verify treatment effectiveness and land use controls until RAOs are achieved.

Both enhance aerobic and anaerobic biodegradation will alter the redox potential of the aquifer, and both alternatives may result in the mobilization of select metals inherent to the soils at NAB Little Creek. However, after treatment is concluded and the aquifer re-equilibrates, metals are expected to return to pretreatment states.

In the northern treatment area, the three most favorable alternatives remain valid for the following reasons:

- Monitoring data from MW28D suggest aquifer conditions are becoming anaerobic and natural attenuation is occurring;
- In general, the oxidation reduction potential of the aquifer returned to baseline conditions in the northern treatment area; and
- PCP biodegrades under aerobic and anaerobic conditions
- Residual concentrations of PCP are amenable to enhanced and natural degradation.

For the southern treatment area, MNA and enhanced anaerobic biodedgradation remain valid remedial alternatives for the following reasons:

- EOS® is still providing anaerobic conditions and substrate and attenuation of VOCs is occurring;
- Implementation of aerobic degradation will require additional substrate to overcome anaerobic conditions; and
- Elevated concentrations of cis-1,2-DCE suggest the presence of elevated concentrations of PCE and/or TCE not detected during previous investigations. PCE and TCE are not biologically degraded under aerobic conditions.
- Residual concentrations of VOCs are amenable to enhanced and natural degradation.

Therefore, based on alternative evaluations in the FS and the results of the treatability study, the most favorable remedial alternatives for treating the groundwater plume across the site are MNA and enhanced anaerobic biodegradation. A Vapor Intrusion Assessment is recommended prior to development of the Proposed Plan (PP), Record of Decision (ROD) to document the preferred alternative, and implementation of a groundwater remedy.

SECTION 5

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Appendix A
Construction Completion Report

Treatability Study Construction Complete Summary

PREPARED FOR: NAB1 Little Creek Tier 1 Partnering Team

PREPARED BY: AGVIQ-CH2M HILL JV I

COPIES: David Leadenham/AGVIQ-CH2M HILL JV I

DATE: April 22, 2005

A Treatability Study was developed to assess the effectiveness of combined treatment processes at Site 13, NAB Little Creek, utilizing chemical oxidation and bioremediation. The treatability study was completed in response to the Navy's Scope of Work dated 17 March 2004 under AGVIQ-CH2M HILL Joint Venture I (JVI), Contract (N62740-03-D-4401), Task Order 0026. This Technical Memorandum documents the completion of construction activities as part of the Treatability Study at Site 13 in accordance with the *Final Work Plan for Treatability Study at Site 13 Naval Amphibious, Base Little Creek, Virginia Beach, Virginia* (October 2004).

Construction activities documented in this Technical Memorandum include:

- Pre-injection activities including utility clearance, groundwater and soil sampling, and monitoring well installation
- Type and quantity of materials injected into the groundwater for each of the treatment areas/applications
- Equipment and means utilized to complete the injections
- Survey coordinates (GPS) of injection locations
- Figures demonstrating injections locations within Site 13
- Pertinent subcontractor information

Pre-mobilization Coordination

To enhance the timely mobilization of JVI resources and subcontractors and to meet operational schedule commitments, pre-mobilization activities began immediately upon award of the scope for Site 13. Equipment and materials staged within the work area were approved by the Navy. Miss Utility was utilized for utility mark-out under dig ticket numbers B434100765-00B and B434100765-00B prior to beginning intrusive activities. The Site 13 field kick off meeting was held on October 25, 2004 and was attended by JVI, the Navy, and subcontractors to JVI, ISOTEC and Solutions IES, who completed treatability study activities.

Prior to groundwater treatment and baseline groundwater sampling three additional wells were installed in September 2004. Groundwater and soil samples were collected in the immediate vicinity of proposed monitoring well LS13-MW28D to confirm the results of the 2003 MIP data and determine the location for LS13-MW28D (Figure 1). Soil sample results did not indicate the presence of CVOCs (Table 1). In-situ groundwater sample results from LS13-GP502 (8 ft bgs) indicated the highest detections of CVOCs: cis-1,2-dichloroethene at 1,100 ug/l, pentachlorophenol at 850 ug/l, trichloroethene at 690 ug/l, and vinyl chloride at 290 ug/l. In -situ groundwater data are presented in Table 2. Boring logs and well construction diagrams for the three new monitoring wells are provided in Attachment A.LS13-MW28D was installed in the northern part of the site where a 2003 membrane interface probe (MIP) sample detected elevated concentrations of chlorinated volatile organic compounds (CVOCs). Boundary wells LS13-MW29D and LS13-MW30D were installed to monitor potential groundwater migration of the Pentachlorophenol and CVOC plume to the west of known plume areas, between the site and the sanitary sewer line. Monitoring well locations and the sanitary sewer are depicted on Figure 1.

The structural integrity of the sanitary sewer line to the west of Site 13 (Figure 1) was investigated by the Navy prior to groundwater treatment activities by conducting a closed circuit television inspection (CCTV). The inspection results are documented in Attachment B. The results concluded that the sewer is in good condition with very little infiltration at cracks or joints. Consequently, no further action to the sanitary sewer was recommended and it was not necessary for JVI to slip-line the sanitary sewer prior to completing injection activities.

Baseline Groundwater Sampling

Baseline groundwater sampling of monitoring wells within the treatability study plume was completed the week of October 26, 2004. Results of this sampling will be used to assess the effectiveness of groundwater treatment. These data are documented in the first interim report summarizing pre- and post-injection groundwater concentrations (Technical Memorandum *Interim Report 1: Pre-injection Baseline Results, Round 1 Post-Injection Results, and Round 2 Post-Injection Results for the Treatability Study at Site 13,*CH2M HILL, May 2005).

Injection Processes

Two separate technologies were chosen for groundwater treatment at Site 13. The northern portion of the plume, where the highest concentrations of CVOCs (tetrachloroethene, trichloroethene, and vinyl chloride) and (PCP) are found, was treated via in-situ chemical oxidation (ISCO). This portion of the field effort was conducted by ISOTEC of Greenwood Village, CO. The southern portion of the plume with lower concentrations was treated with an edible oil substrate (EOS®) to enhance reductive dechlorination via bioremediation. Solutions IES of Raleigh, NC completed this portion of the field effort. The chemical oxidation and bioremediation injection process began on November 30, 2004 and was completed on December 16, 2004. The northern and southern plume areas and injection locations are depicted on Figure 2 and injection coordinate locations are provided in Table 3.

ISOTEC Injection Process

ISOTEC mobilized to the site on November 30, 2004. Prior to the injection process, a hydrogen peroxide solution, delivered to the site in a tanker, was diluted from 35% to 12% in large 500 gallon poly-tanks. Poly tanks, used as temporary storage vessels for the injection process, were filled with water, hydrogen peroxide, or iron catalyst and were stored in rental trucks for moving around the site to injection locations. The hoses were put inside the tanks and the containerized liquids were pumped to the injection points for injection with a track mounted Direct Push Technology (DPT) rig. The reagent delivery for each injection point varied depending on the injection flow rate, pressure, radial effects, and depth to the bottom of the shallow aquifer (Yorktown Confining Unit). DPT was used to deliver water and the reagents at 43 injection points (Figure 2). Each injection point consisted of two temporary bore holes that were installed to 13 ft and 23 ft respectively. Detailed information is available in the construction summary report provided by ISOTEC (Attachment C). The injection process to deliver via DPT water and reagents into each injection bore hole consisted of:

- Ten to 15 gallons of water.
- 100 gallons of hydrogen peroxide.
- Ten gallons of water to flush the reagent from the injection point.
- 100 gallons of iron catalyst.
- A final 15-gallon water injection to flush the reagents from the injection points.

Two points were injected at a time with an average flow rate of four to five gallons per minute (gpm). ISOTEC completed the injection process on Wednesday, December 8, 2004.

Solutions IES Injection Process

Solutions IES mobilized to the site on Monday, December 6, 2004. In addition to the 40 injections wells proposed in the work plan, four additional injection well locations were identified to provide treatment near LS13MW09S and LS13-MW30D, where Pentachlorophenol was detected during the baseline sampling round. These monitoring wells were installed to provide a western "boundary" for the treatment area. A total of 44 injection wells were installed by Solutions IES (Figure 2). Detailed information is available in the construction completion report provided by EOS Solutions (Attachment D).

Injection Well Installation

Temporary injection wells were installed with a Geoprobe®. A 2.125" outer diameter Geoprobe® casing with expendable conical tip was driven through the asphalt pavement at the designated locations. Additional sections of casing were added and driven until the cone tip was positioned at the bottom of the shallow aquifer, at approximately 22.5 feet below the ground surface (ft bgs). One 10-foot and one 5-foot section of 1-inch diameter machine slotted PVC screen (0.020-inch slot) were screwed together and inserted into the Geoprobe® casing. A 10-foot section of Schedule 40 1-inch diameter PVC casing was attached to the top of the screen. The Geoprobe® casing was then removed from the ground leaving the PVC well components installed in the aquifer. The formation materials were

allowed to "cave" in around the screen after the metal casing was removed. The annular space within the unsaturated zone was filled with granulated bentonite clay. Water was added to hydrate the clay and the clay was compacted to aid in sealing the top of the well. The PVC casing was cut off flush with the paved ground surface and covered with a PVC cap.

Well Development

A section of polyethylene tubing was installed in each injection well and attached to a peristaltic pump. The injection wells were developed until the turbidity of the discharge stream was greatly reduced. The tubing was removed and a surge block constructed from ½ inch PVC pipe was pushed to the bottom of the well and then pulled up to the water surface in the well. This surge-block development method was repeated several times until the surge block was removed from the well. The well was pumped with the peristaltic pump until the water was clear. If the water was still turbid, the surging process was repeated. Water from this process was containerized in 55-gallon drums for contractor disposal as Investigation Derived Waste (IDW). Manifests and certifications for disposal of all IDW (monitoring well installation and development/sampling) are provided as Attachment E.

EOS® Preparation and Injection

The concentrated EOS® solution was pumped into plastic pools with secondary containment and diluted with four parts water. The EOS® was pumped from the pools into the injection wells through an injection loop that consisted of a pressure gauge, valve gate/ball, air release valve, water meter, and a flow meter.

The prescribed amount of EOS® (approximately 150 gallons) was injected under low pressure into each of the wells. After the EOS® was injected, approximately 285 milliliters of pre-mixed vitamin B-12 solution, provided by EOS Remediation, was added to each of the injection wells. Additional water was injected after the emulsion to move the emulsion away from the injection point and into the formation. The original work plan specified approximately 2,200 gallons of water to follow the emulsion at each location. After a site meeting and further review of the site conditions, Solutions-IES found this volume of water to be excessive and reduced the volume of water to 1,100 gallons per injection point. The flow rate for the injection of the EOS® ranged from 2 gpm to 9.5 gpm with an average flow rate of 5.7 gpm. The flow rate for the injection of the water ranged from 2 gpm to 17.6 gpm with an average flow rate of 8.3 gpm. When the injection rate varied for a given injection point, the calculated average was used to establish the low, average, and high values provided in this summary.

Groundwater levels were measured periodically in selected adjacent and nearby injections wells to evaluate the mounding of the water table during injection of EOS® and flush water. Some mounding of the water table was observed 10 feet from the injection points with a maximum mounding of two feet above the static water level.

Samples of groundwater were collected periodically from selected monitor and nearby injection wells to evaluate breakthrough of the emulsion. Dilute EOS® was not observed in any adjacent permanent wells during the injection process with the exception of MW09S. Groundwater collected from MW09S, approximately 2.5 hours after the completion of the

water injection, contained a slight whitish tint which appeared to be related to the EOS® that was injected into in nearest injection points, IW-41 and IW-42.

Well Abandonment

Following the injection process, all of the injections wells were abandoned by filling the well with granular bentonite clay to within 12 inches of the ground surface. The PVC casing was cut off below grade and the remaining hole was filled with neat cement grout. Solutions IES completed the final site cleanup and demobilization on Thursday, December 16, 2004.

Post-Treatability Study Groundwater Monitoring

Groundwater monitoring to verify the efficacy of the treatability study was conducted two weeks following completion of field activities. Additional rounds of monitoring for a period of 12 months following groundwater treatment application will be completed. Results of pre- and post- groundwater monitoring will be documented in interim technical memorandums.

Table 1-1
Summary of RME Cancer Risks and Hazard Indices
Site 13 Treatability Study Report
NAB Little Creek

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Hazard Index	Chemicals with HI>1
Construction Worker	Surface and Subsurface Soil	Ingestion	2.9E-07		0.2	
		Dermal Contact	2.2E-08		0.02	
		Inhalation	NA		NA	
		Total	3.1E-07		0.2	
	Groundwater	Ingestion	NA		NA	
		Dermal Contact	2.8E-04	Pentachlorophenol (2.8E-4)	6.8	Pentachlorophenol (5.4)
		Inhalation	1.5E-08		0.001	
		Total	2.8E-04		6.8	
	All Media	Total	2.8E-04		7.0	
Industrial Worker	Surface Soil	Ingestion	1.0E-06		1.8E-04	
		Dermal Contact	7.8E-07		6.1E-04	
		Inhalation	NA		NA	
		Total	1.8E-06		7.9E-04	
	Surface and Subsurface Soil	Ingestion	3.0E-06		0.08	
		Dermal Contact	1.5E-06		0.06	
		Inhalation	NA		NA	
		Total	4.5E-06		0.14	
	Groundwater	Ingestion	2.9E-04	Pentachlorophenol (1.3E-4)	1.9	All individual constituents <1
		Dermal Contact	NA		NA	
		Inhalation	NA		NA	
		Total	2.9E-04		1.9	
	All Media	Total	2.9E-04		2.0	
Resident Adult	Surface and Subsurface Soil	Ingestion	NA		0.11	
		Dermal Contact	NA		0.07	
		Inhalation	NA		NA	
		Total	NA		0.18	
	Groundwater	Ingestion	NA		5.4	Iron (1.9)
		Dermal Contact	NA		9.9	Pentachlorophenol (9.0)
		Inhalation	NA		0.28	
		Total	NA		16	
	All Media	Total	NA		16	
Resident Child	Surface and Subsurface Soil	Ingestion	NA		1.1	
		Dermal Contact	NA		0.09	
		Inhalation	NA		NA	
		Total	NA		1.1	
	Groundwater	Ingestion	NA		13	Tetrachloroethene (2.2), Trichloroethene (1.6), Iron (4.3), Manganese (2.3)
		Dermal Contact	NA		22	Tetrachloroethene (1.2), Pentachlorophenol (20)
		Inhalation	NA		NA	
		Total	NA		35	
	All Media	Total	NA		36	

Table 1-1
Summary of RME Cancer Risks and Hazard Indices
Site 13 Treatability Study Report
NAB Little Creek

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Hazard Index	Chemicals with HI>1
Resident Child/Adult	Surface and Subsurface Soil	Ingestion	1.3E-05		NA	
		Dermal Contact	2.1E-06		NA	
		Inhalation	NA		NA	
		Total	1.5E-05		NA	
	Groundwater	Ingestion	1.6E-03	Tetrachloroethene (2.7E-4), Vinyl Chloride (6.5E-4), Pentachlorophenol (5.7E-4)	NA	
		Dermal Contact	1.8E-02	Tetrachloroethene (1.5E-4), Pentachlorophenol (1.7E-2)	NA	
		Inhalation	7.6E-05		NA	
		Total	1.9E-02		NA	
	All Media	Total	1.9E-02		NA	

NA - Exposure media/route not analyzed

Table 1-2
Summary of CTE Cancer Risks and Hazard Indices
Site 13
Treatability Study Report
NAB Little Creek

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Hazard Index	Chemicals with HI>1
Construction Worker	Groundwater	Ingestion	NA		NA	
		Dermal Contact	7.5E-05		1.7	Pentachlorophenol (1.4)
		Inhalation	NA		NA	
		Total	7.5E-05		1.7	
	All Media	Total	7.5E-05		1.7	
Industrial Worker	Groundwater	Ingestion	4.2E-05		0.72	
		Dermal Contact	NA		NA	
		Inhalation	NA		NA	
		Total	4.2E-05		0.72	
	All Media	Total	4.2E-05		0.72	
Resident Adult	Groundwater	Ingestion	NA		1.1	All individual constituents <1
		Dermal Contact	NA		5.8	Pentachlorophenol (5.4)
		Inhalation	NA		NA	
		Total	NA		6.9	
	All Media	Total	NA		6.9	
Resident Child	Surface and Subsurface Soil	Ingestion	NA		0.35	
		Dermal Contact	NA		0.05	
		Inhalation	NA		NA	
		Total	NA		0.40	
	Groundwater	Ingestion	NA		3.6	All individual constituents <1
		Dermal Contact	NA		12	Pentachlorophenol (12)
		Inhalation	NA		NA	
		Total	NA		16	
	All Media	Total	NA		16	
Resident Child/Adult	Groundwater	Ingestion	4.4E-04	Vinyl Chloride (1.6E-4), Pentachlorophenol (2.0E-4)	NA	
		Dermal Contact	1.8E-02	Pentachlorophenol (6.1E-3)	NA	
		Inhalation	1.3E-05		NA	
		Total	1.8E-02		NA	
	All Media	Total	1.8E-02		NA	

NA - Exposure media/route not analyzed

Table 3
Injection Point Locational Information
Site 13 Construction Completion Report
NAB Little Creek
Virginia Beach, Virginia

ISOTEC Injection Points	EASTING	NORTHING
1	12168669	3501102
2	12168671	3501092
3	12168672	3501083
4	12168673	3501073
5	12168675	3501063
6	12168676	3501053
7	12168678	3501043
8	12168679	3501033
9	12168680	3501023
10	12168682	3501013
11	12168683	3501004
12	12168685	3500994
13	12168685	3500984
14	12168687	3500973
15	12168697	3500975
16	12168707	3500976
17	12168727	3500995
18	12168730	3500989
19	12168739	3500986
20	12168748	3500985
21	12168740	3501065
22	12168741	3501075
23	12168743	3501084
24	12168744	3501094
25	12168747	3501106
26	12168747	3501114
27	12168750	3501123
28	12168751	3501133
29	12168753	3501144
30	12168754	3501153
31	12168717	3501195
32	12168727	3501194
33	12168737	3501193
34	12168747	3501191
35	12168756	3501189
36	12168766	3501188
37	12168776	3501186
38	12168786	3501184
39	12168795	3501182
40	12168805	3501180
41	12168773	3501119
42	12168779	3501110
43	12168652	3501121
44	12168653	3501129

Solutions Temporary Well Points	EASTING	NORTHING
A2	12168707	3501313
A3	12168731	3501315
A4	12168756	3501315
A5	12168779	3501315
A6	12168803	3501318
A7	12168828	3501318
A8	12168853	3501320
A9	12168874	3501323
B1	12168699	3501294
B2	12168724	3501290
B3	12168741	3501294
B4	12168765	3501295
B5	12168794	3501295
B6	12168815	3501296
B7	12168838	3501298
B8	12168861	3501301
C2	12168710	3501273
C2	12168711	3501272
C3	12168734	3501273
C3	12168734	3501273
C4	12168756	3501275
C4	12168756	3501274
C5	12168781	3501275
C5	12168781	3501274
C6	12168804	3501275
C6	12168804	3501275
C7	12168831	3501275
C7	12168832	3501276
C8	12168853	3501278
C8	12168854	3501279
C9	12168877	3501276
D1	12168694	3501243
D2	12168716	3501248
D3	12168744	3501249
D4	12168771	3501254
D4	12168769	3501252
D5	12168793	3501253
D6	12168817	3501254
D7	12168842	3501256
D8	12168866	3501257
E1	12168710	3501229
E2	12168734	3501230
E3	12168759	3501230
E4	12168782	3501232
E5	12168805	3501233
E6	12168830	3501235
E7	12168854	3501236
E8	12168866	3501258
F1	12168794	3501212
F2	12168817	3501212

Attachment A

PROJECT NUMBER	BORING NUMBER	
Task Order 026	**MW28D**	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Site 13 Little Creek DRILLING CONTRACTOR : Parratt Wolff LOCATION : Little Creek

ELEVATION : NORTHING: EASTING:

DRILLING METHOD AND EQUIPMENT USED : Hollow stem augering/split spoon sampling

WATER LEVELS : 5' START : 9/9/04 @ 1150 END : 9/9/04 @ 1250 LOGGER : Terra Pascarosa

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
	0-2'					
5		6"				
	6'6"-7'				2.5Y 4/3 OH gray, dense, high plasticity silty clay	
10	10'-11'2""	24"			2.5Y 6/8 SM yellow brown saturated, silty sand	
	11'2"-11'8"				2.5Y 5/3 OH gray, moist clay inclusion	
	11'8"-12'				2.5Y 6/8 SM yellow brown saturated, silty sand	
	11'-12'					
15	15'-16'	24"			2.5Y 6/6 SM tan/light brown, moist silty sand	
	16'-16'8"				10YR 6/6 SM orange brown, moist silty clay	
	16'8"-17'				2.5Y 5/2 OH gray, dense, moist silty clay with grave	
20					End of boring @ 20' bgs.	
25						

PROJECT NUMBER	WELL NUMBER	
Task Order 026	**MW28D**	SHEET 1 OF 1

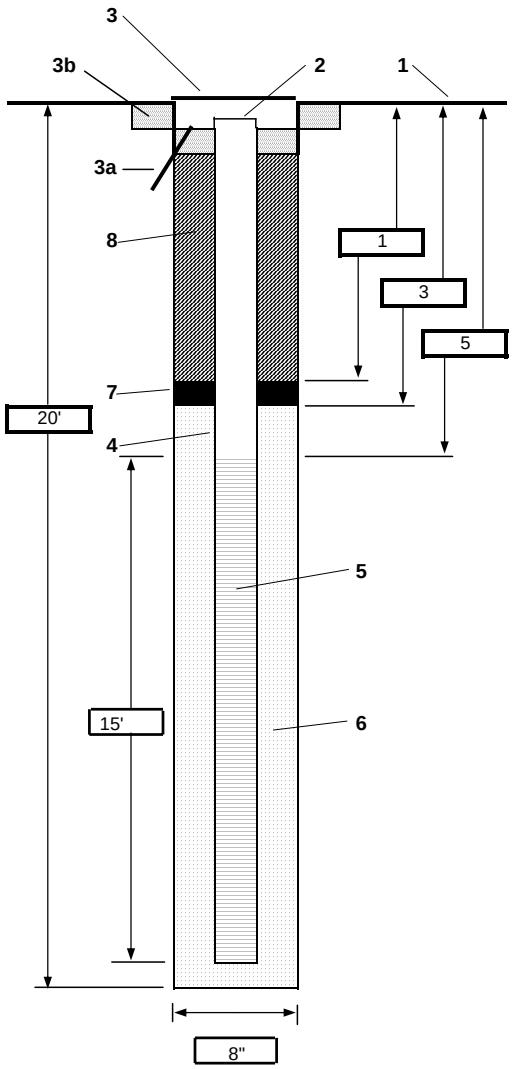
WELL COMPLETION DIAGRAM

PROJECT : Site 13 LOCATION : Little Creek

DRILLING CONTRACTOR : Parratt Wolff NORTHING: EASTING:

DRILLING METHOD AND EQUIPMENT USED : Hollow stem augers/split spoon sampling

WATER LEVELS : 5' START : 9/9/04 @ 1150 END : 9/9/04 @ 1355 LOGGER : Terra Pascarosa



1- Ground elevation at well: 3' MSL

2- Top of casing elevation: 5/10

3- Wellhead protection cover type: flush mount
- a) drain tube?: N/A
- b) concrete pad dimensions: 2' x 4" thick

4- Dia./type of well casing: 2"/40 PVC

5- Type/slot size of screen: 5 ft .010

6- Type screen filter: 10/20 sieve sand
- a) Quantity used: 8 bags

7- Type of seal: bentonite
- a) Quantity used: 1/2 bag

8- Grout
- a) Grout mix used: portland cement
- b) Method of placement: trimming
- c) Vol. of well casing grout: 45 gallons

Development method: purging

Development time: 25 minutes

Estimated purge volume: 20 gallons

Comments

PROJECT NUMBER	BORING NUMBER	
Task Order 026	**MW29D**	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Site 13 Little Creek DRILLING CONTRACTOR : Parratt Wolff LOCATION : Little Creek

ELEVATION : NORTHING: EASTING:

DRILLING METHOD AND EQUIPMENT USED : Hollow stem augering/split spoon sampling

WATER LEVELS : 4.5' START : 9/8/04 @ 1248 END : 9/8/04 @ 1425 LOGGER : Terra Pascarosa

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
	0-2'					
5	5-5'4"	24"			2.5Y 5/6 ML tan brown friable silty clay	
	5'4"-6'9"				2.5Y 6/6 CL yellow tan moderately moist clay	
	6'9"-7'				2.5Y 5/6 ML medium tan silty clay	
10	10'-10'6"	24"			2.5Y 6/6 SM yellow brown saturated, silty sand	
	10'6"-11'				10YR 6/6 SM yellow brown moderate clay	
	11'-12'				2.5Y 7/6 SM yellow brown saturated, coarse sand with some fines	
15	15'-16'9"	24"			Same as above	
	16.5-17'				10YR 6/8 SC yellow brown, saturated sand with clayey lens	
20	20'-20'6"	24"			Same as above	
	20'6"-21'				2.5Y 5/1 OH gray moist clay	
	21'-21'6"				2.5Y 5/4 OL light gray, saturated clayey sandy silt	
	21'6"-22'				2.5Y 3/1 OH dark gray, moist clayey, silty, sand	
					End of boring @ 23' bgs.	
25						

PROJECT NUMBER	WELL NUMBER	
Task Order 026	**MW29D**	SHEET 1 OF 1

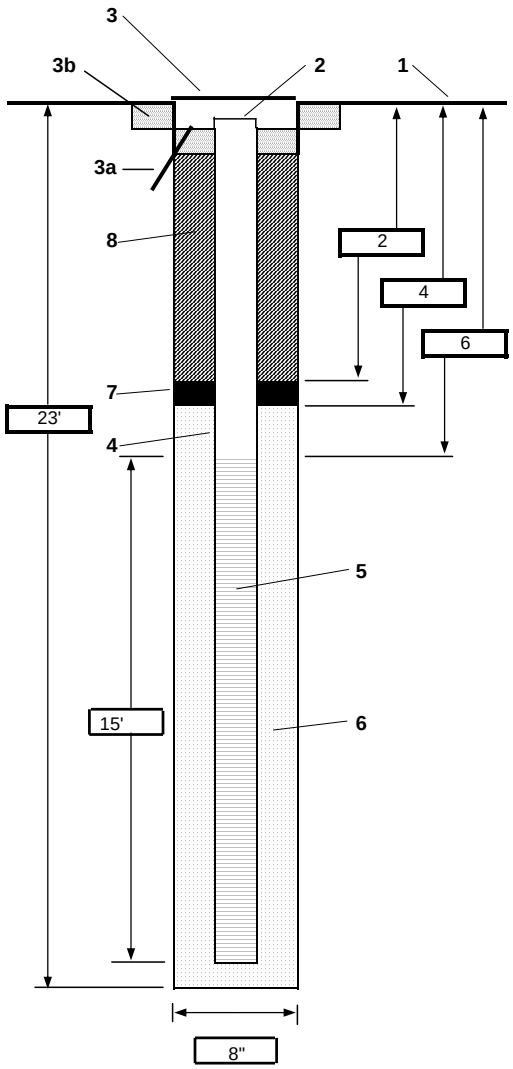
WELL COMPLETION DIAGRAM

PROJECT : Site 13 LOCATION : Little Creek

DRILLING CONTRACTOR : Parratt Wolff NORTHING: EASTING:

DRILLING METHOD AND EQUIPMENT USED : Hollow stem augers/split spoon sampling

WATER LEVELS : 5' START : 9/8/04 @ 1200 END : 9/8/04 @ 1455 LOGGER : Terra Pascarosa



1- Ground elevation at well: 3' MSL

2- Top of casing elevation: 5/10

3- Wellhead protection cover type: flush mount
- a) drain tube?: N/A
- b) concrete pad dimensions: 2' x 4" thick

4- Dia./type of well casing: 2"/40 PVC

5- Type/slot size of screen: 5 ft .010

6- Type screen filter: 10/20 sieve sand
- a) Quantity used: 8 bags

7- Type of seal: bentonite
- a) Quantity used: 1/2 bag

8- Grout
- a) Grout mix used: portland cement
- b) Method of placement: trimming
- c) Vol. of well casing grout: 50 gallons

Development method: purging

Development time: 25 minutes

Estimated purge volume: 20 gallons

Comments

PROJECT NUMBER	BORING NUMBER	
Task Order 026	**MW30D**	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Site 13 Little Creek DRILLING CONTRACTOR : Parratt Wolff LOCATION : Little Creek

ELEVATION : NORTHING: EASTING:

DRILLING METHOD AND EQUIPMENT USED : Hollow stem augering/split spoon sampling

WATER LEVELS : 4.5' START : 9/8/04 @ 1555 END : 9/8/04 @ 1730 LOGGER : Terra Pascarosa

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
	0-2'					contacted the Utilities Department on base immediately. The line was never marked. MW30D was offset 2' from original mark.
5	5-5'5"	24"			10YR 3/2 CL grayish brown stiff silty clay	
	5'5"-7'				10YR 5/8 ML tannish brown moist, dense silty sand	
10	10'-12'	24"			10YR 6/4 SM orange brown, wet, medium to coarse sand-poorly graded in first 12"	
15	15'-15'6"	18"			10YR 5/4 OH gray, moist, silty clay	
	15'6"-16'				No recovery	
	16'-16'10"				2.5Y 4/3 OH brown, moist silty clay	
	16'10"-17'				10YR 5/6 SM brown/orange, medium coarse sand	
20	20'-20'6"	24"			Same as above	
	20'6"-22'				2.5Y 2.5/1 OH gray soft clay-Yorktown Formation	
	22'-24'	20"			Same as above	
					End of boring @ 24' bgs.	
25						

PROJECT NUMBER	WELL NUMBER	
Task Order 026	**MW30D**	SHEET 1 OF 1

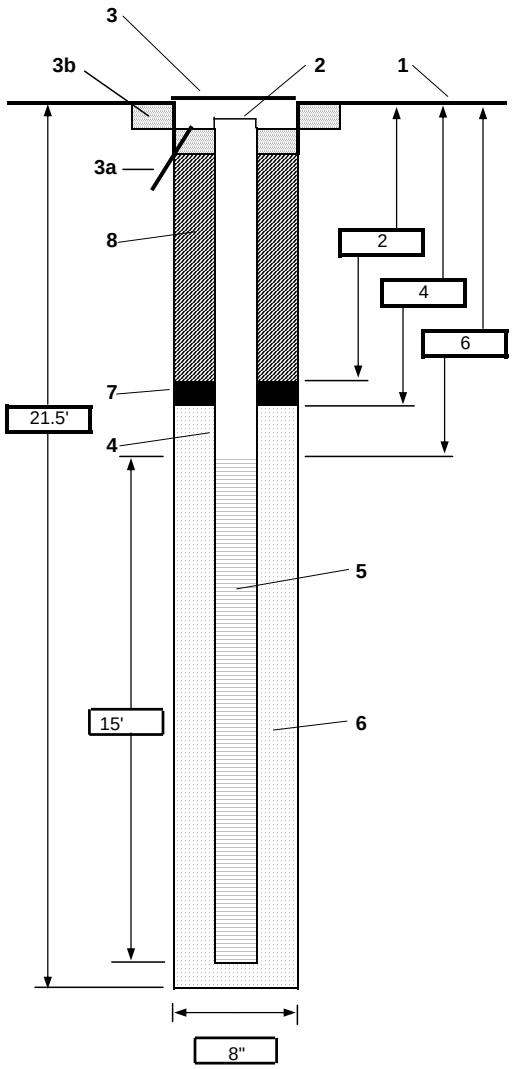
WELL COMPLETION DIAGRAM

PROJECT : Site 13 LOCATION : Little Creek

DRILLING CONTRACTOR : Parratt Wolff NORTHING: EASTING:

DRILLING METHOD AND EQUIPMENT USED : Hollow stem augers/split spoon sampling

WATER LEVELS : 5' START : 9/8/04 @ 1525 END : 9/9/04 @ 1000 LOGGER : Terra Pascarosa



1- Ground elevation at well	3' MSL
2- Top of casing elevation	5/10
3- Wellhead protection cover type	Flush Mount
a) drain tube?	N/A
b) concrete pad dimensions	2' x 4" thick
4- Dia./type of well casing	2"/40 PVC
5- Type/slot size of screen	5 ft .010
6- Type screen filter	10/20 sieve sand
a) Quantity used	8 bags
7- Type of seal	bentonite
a) Quantity used	1/2 bag
8- Grout	
a) Grout mix used	portland cement
b) Method of placement	trimming
c) Vol. of well casing grout	45 gallons
Development method	purging
Development time	25 minutes
Estimated purge volume	20 gallons

Comments

Attachment B

NAB Little Creek Site 13 - Sanitary Sewer Evaluation

PREPARED FOR: Paul Landin/VBO

PREPARED BY: Felix Wang/NJO

DATE: November 22, 2004

PROJECT NUMBER: 181704.SI.FQ

The purpose of this memorandum is to summarize the results of the closed circuit television (CCTV) inspection performed of the sanitary sewer at the NAB Little Creek Site 13, and to present recommendations for further action if found necessary.

There have been historical reports indicating that the sanitary sewer at the project site was affecting local groundwater flow. The easternmost sewer line was sealed and abandoned, and will no longer affect groundwater flow. The western sewer line is active, and was CCTV-inspected in this effort to assess if this section of sewer may be affecting groundwater flow.

Figure 3-6 presents a plan of the site showing the designated manhole ID numbers.

On October 28, 2004, Tri-State Utilities of Chesapeake, Virginia, conducted a CCTV inspection of the below sanitary sewer sections at the site:

TABLE 1
Summary of Sanitary Sewer Sections in CCTV Inspection
Inspection performed by Tri-State Utilities of Chesapeake, VA, 10/28/2004

Start Manhole	End Manhole	Distance, ft.
MH-50	MH-49	262.2
MH-49	MH-48	134
MH-48	MH-47	38.6

The inspection video and logs was submitted by Tri-State Utilities on a DVD; however, the DVD is not provided in this memorandum.

The sanitary sewer between manholes MH-50 and MH-47 is constructed of 12-inch clay pipe. The sewer is located under an asphalt-covered parking lot. There was very low flow going through the sanitary sewer at the time of inspection (early to late-AM, weekday). The sewer invert was noted to be approximately 6 to 7 feet below ground surface. Groundwater is at the same approximate depth as the sewer.

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The CCTV inspection indicates that the sewer is in good condition. There was very little evidence of infiltration at cracks or joints. There was only one case of infiltration observed during the CCTV inspection, at 214 feet south of manhole MH-50, and the degree of infiltration was considered light. Groundwater is at the same approximate depth as the sewer, and would have contributed to infiltration in the presence of cracks and joint leaks.

Based upon the review of the CCTV inspection video and logs, we recommend no further action to the sanitary sewer section between manholes MH-50 and MH-47. The sewer section is in good condition, and there is very little evidence of groundwater infiltration. It is unlikely that the presence of this sewer has significant effects to local groundwater flow.

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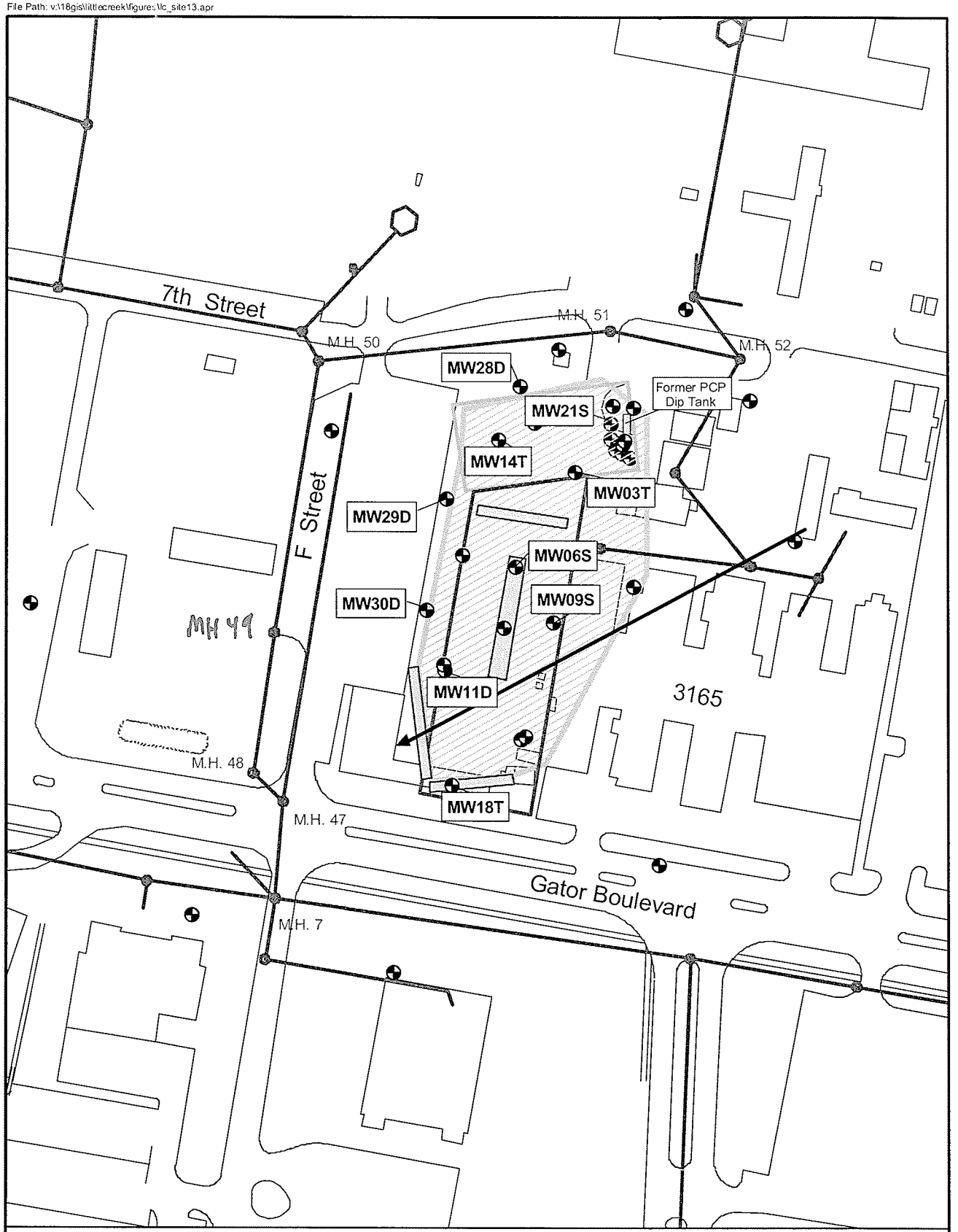


LEGEND

- Approximate December 2003 Maximum Groundwater Plume Extent (detected above (1 ug/L)
- Sanitary Sewer Lines
- Groundwater Flow Direction
- Existing Monitoring Wells
- Proposed Monitoring Well
- Northern Plume Treatment Area
- Southern Plume Treatment Area
- Southern Plume Treatment

N

0 60 120 Feet

Figure 3-6
Groundwater Treatment Applications
Groundwater Monitoring Network
Site 13 Treatability Study Work Plan
NAB Little Creek
Virginia Beach, Virginia

AGVIQ-CH2MHILL JVI

Posm Summary Report

ProjectName	Date	Faults	Severity	OperatorName	Distance	Comments	RunNumber	UseOfSewe
20599 CH2M Hill	10/28/2004 8:52:45 AM	0	None	S. Vaughan	262.2			Sanitary Sewer
20599 CH2M Hill	10/28/2004 8:52:45 AM	0	None	S. Vaughan	134	Light Grease Throughout		Sanitary Sewer
20599 CH2M Hill	10/28/2004 9:49:26 AM	0	None	S. Vaughan	38.6			Sanitary Sewer
Total ProjectName	Total Date	Total Faults	Total Severity	Total OperatorName	Total Distance	Total Comments	Total RunNumber	Total UseOfSewe
1	1	0	None	1	434.8	1	0	1

TRI-STATE UTILITIES, INC.
2111 Smith Avenue
Chesapeake, VA 23320
PH: 757.366.9505
FX: 757.366.5110

20599 CH2M Hill

Tri State Utilities

10/28/2004 8:52:45 AM

Contact
Tri State Utilities
757-366-9505

Address
2111 Smith Avenue
Chesapeake , Virginia
23320

Operator
S. Vaughan

Session Information			
Project Name	20599 CH2M Hill		
Location	(Little Creek Amphibious Base) F Street	**Run Number**	
		Pipe Name	12 Inch Clay
VCR Tape Number	Pre-Tv Tape #1	**Flow Direction**	Downstream
Truck Number	24	**Distance Traveled**	134
Comments	Light Grease Throughout		

Pipe Information	
Pipe Name	12 Inch Clay
Type Of Pipe	Clay
Size Of Pipe	12 Inch

Manhole Information			
Start Manhole Number	49	**End Manhole Number**	48
SMH Depth	6 Ft. 7 In.	**EMH Depth**	6 Ft. 7 In.
SMH Location	Street Area	**EMH Location**	Grass Area At Intersection Of F St. & Gator Blvd.
Amount of Flow:		**Signs Of Surcharge:**	No
Manhole Condition			

TRI-STATE UTILITIES, INC.
2111 Smith Avenue
Chesapeake, VA 23320
PH: 757.366.9505
FX: 757.366.5110

20599 CH2M Hill

Tri State Utilities

10/28/2004 8:52:45 AM

Contact
Tri State Utilities
757-366-9505

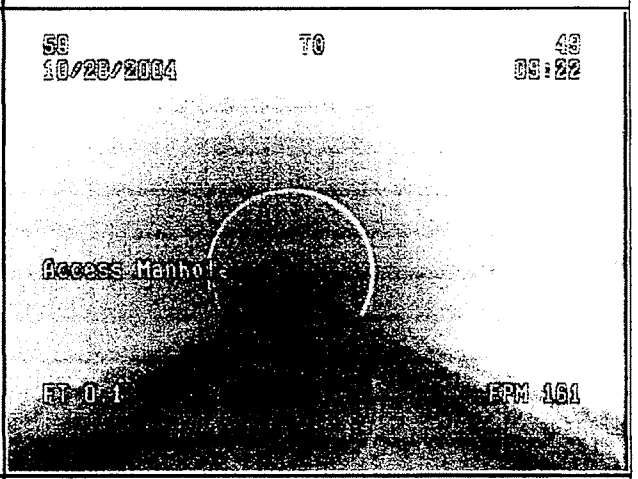
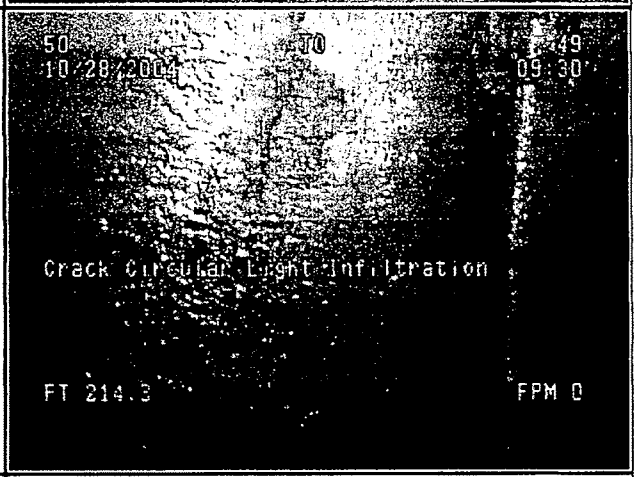
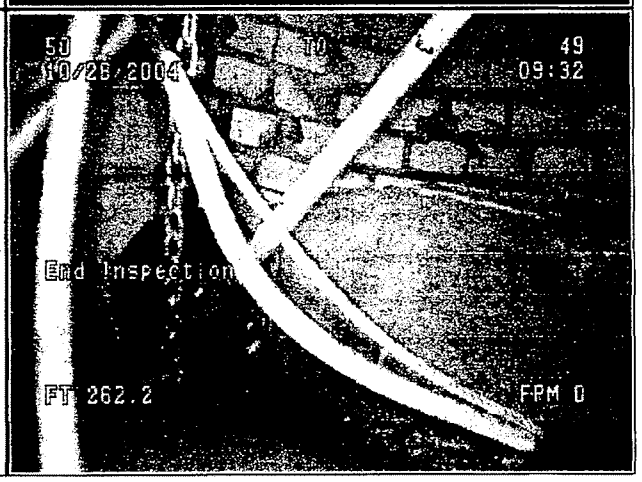
Address
2111 Smith Avenue
Chesapeake , Virginia
23320

Operator
S. Vaughan

Session Information			
Project Name	20599 CH2M Hill		
Location	(Little Creek Amphibious Base) F Street	**Run Number**	
		Pipe Name	12 Inch Clay
VCR Tape Number	Pre-Tv Tape #1	**Flow Direction**	Upstream
Truck Number	24	**Distance Traveled**	262.2
Comments			

Pipe Information	
Pipe Name	12 Inch Clay
Type Of Pipe	Clay
Size Of Pipe	12 Inch

Manhole Information			
Start Manhole Number	49	**End Manhole Number**	50
SMH Depth	6 Ft. 7 In.	**EMH Depth**	6 Ft. 5 In.
SMH Location	Street Area	**EMH Location**	Street Area
Amount of Flow:		**Signs Of Surcharge:**	No
Manhole Condition			

20599 C H2M Hill -- 10 28 2004 8:52:45 AM - Page 1			
Footage	Fault Observation	Time	Picture
0.1	**Access Manhole** **Severity: None** **Value Percent: 0**	00:01:14	
214.3	**Crack Circular Light Infiltration** **Position: 7 To 11** **Severity: None** **Value Percent: 0**	00:08:18	
262.2	**End Inspection**	00:10:02	

Plot generated for 20599 CH2M Hill

Date of Run: 10/28/2004 8:52:45 AM

Location: (Little Creek Amphibious Base) F Street

Start ID: 50

Total Distance: 262.2

End ID: 49

Run Number:

Flow Direction: Upstream

Severity
Light
Moderate
Heavy
Severe

Manhole Number: 49

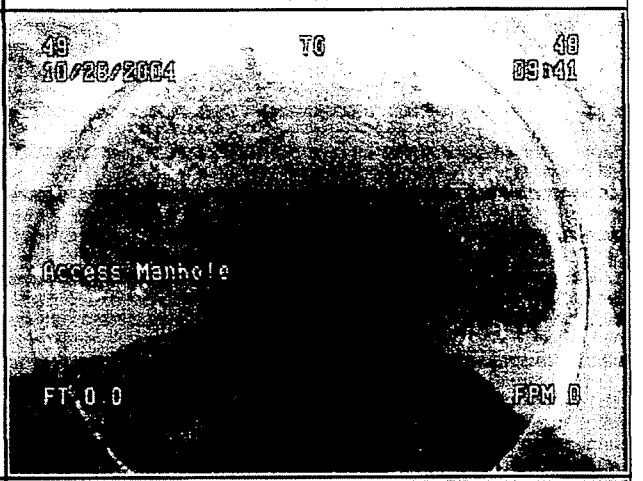
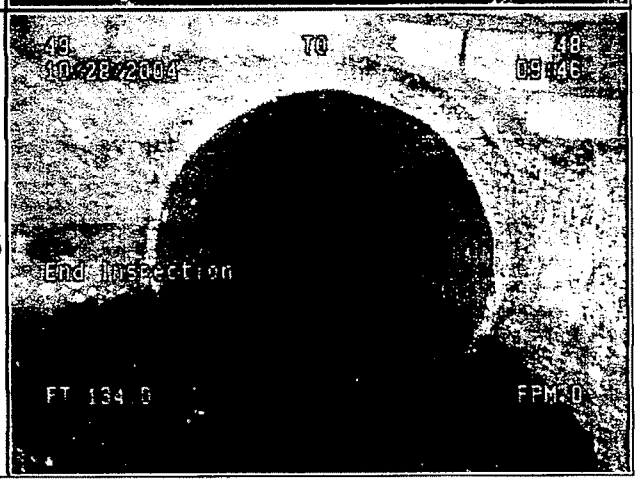
(0.1) - Access Manhole

214.3 - (214.3) C - Crack Circular Light Infiltration - Position: 5 To 1

(262.2) EI - End Inspection

Total Distance: 262.2

Manhole Number: 50

20599 CH2M Hill -- 10/28/2004 8:52:45 AM - Page 1			
Footage	Fault Observation	Time	Picture
0	**Access Manhole** **Severity: None** **Value Percent: 0**	**00:11:39**	
134	**End Inspection**	**00:16:36**	

Plot generated for 20599 CH2M Hill

Date of Run: 10/28/2004 8:52:45 AM

Location: (Little Creek Amphibious Base) F Street

Start ID: 49

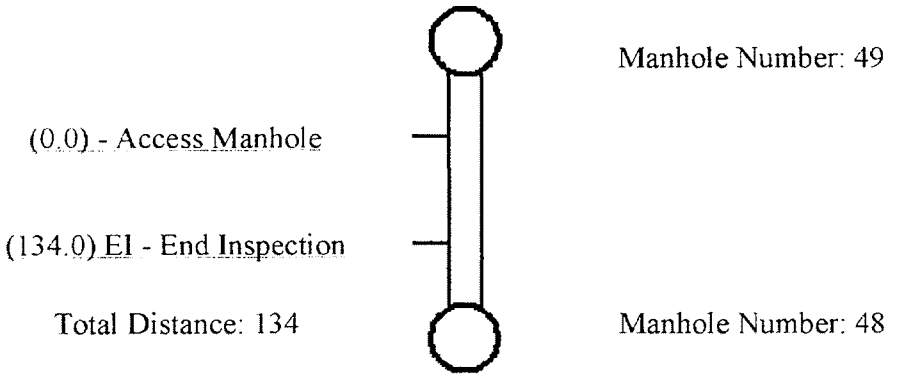
Total Distance: 134

End ID: 48

Run Number:

Flow Direction: Downstream

Severity
Light
Moderate
Heavy
Severe



TRI-STATE UTILITIES, INC.
2111 Smith Avenue
Chesapeake, VA 23320
PH: 757.366.9505
FX: 757.366.5110

20599 CH2M Hill

Tri State Utilities

10/28/2004 9:49:26 AM

Contact
Tri State Utilities
757-366-9505

Address
2111 Smith Avenue
Chesapeake , Virginia
23320

Operator
S. Vaughan

Session Information			
Project Name	20599 CH2M Hill		
Location	(Little Creek Amphibious Base) F Street	**Run Number**	
		Pipe Name	12 Inch Clay
VCR Tape Number	Pre-Tv Tape #1	**Flow Direction**	Downstream
Truck Number	24	**Distance Traveled**	38.6
Comments			

Pipe Information	
Pipe Name	12 Inch Clay
Type Of Pipe	Clay
Size Of Pipe	12 Inch

Manhole Information			
Start Manhole Number	48	**End Manhole Number**	47
SMH Depth	6 Ft. 7 In.	**EMH Depth**	7 Ft.
SMH Location	Grass Area At Intersection Of F St. & Gator Blvd.	**EMH Location**	Grass Area At Intersection Of F St. & Gator Blvd.
Amount of Flow:		**Signs Of Surcharge:**	No
Manhole Condition			

Plot generated for 20599 CH2M Hill

Date of Run: 10/28/2004 9:49:26 AM

Location: (Little Creek Amphibious Base) F Street

Start ID: 48

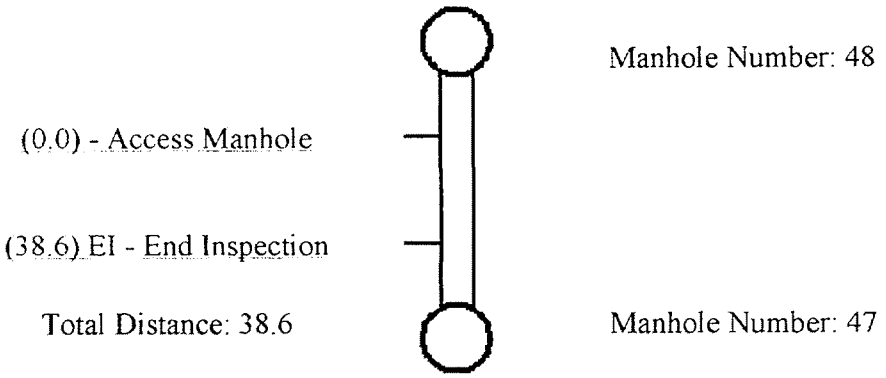
Total Distance: 38.6

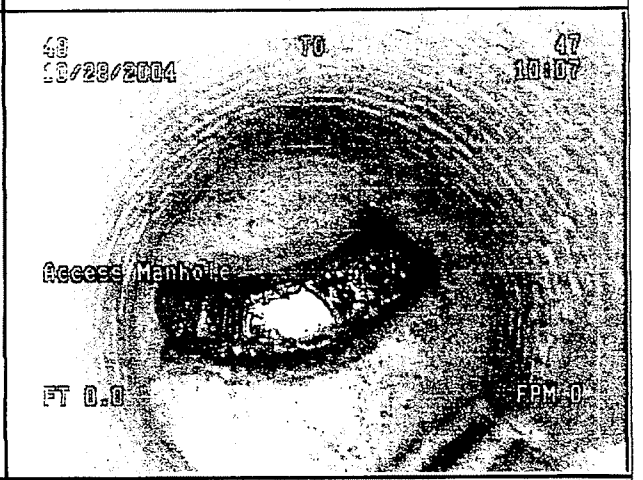
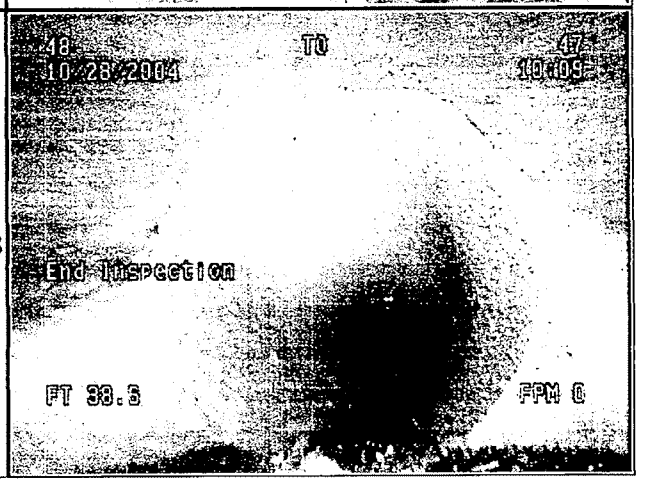
End ID: 47

Run Number:

Flow Direction: Downstream

Severity
Light
Moderate
Heavy
Severe



20599 CH2M HILL -- 10 28 2004 9:49:26 AM - Page 1			
Footage	Fault Observation	Time	Picture
0	**Access Manhole** **Severity: None** **Value Percent: 0**	00:17:59	
38.6	**End Inspection**	00:20:18	

Posm Summary Report

ProjectName	Date	Faults	Severity	OperatorName	Distance	Comments	RunNumber	UseOfSewe
20599 CH2M Hill	10/28/2004 8:52:45 AM	0	None	S. Vaughan	262.2			Sanitary Sewer
20599 CH2M Hill	10/28/2004 8:52:45 AM	0	None	S. Vaughan	134	Light Grease Throughout		Sanitary Sewer
20599 CH2M Hill	10/28/2004 9:49:26 AM	0	None	S. Vaughan	38.6			Sanitary Sewer
Total ProjectName	**Total Date**	**Total Faults**	**Total Severity**	**Total OperatorName**	**Total Distance**	**Total Comments**	**Total RunNumber**	**Total UseOfSewe**
1	1	0	None	1	434.8	1	0	1

TRI-STATE UTILITIES, INC.
2111 Smith Avenue
Chesapeake, VA 23320
PH: 757.366.9505
FX: 757.366.5110

20599 CH2M Hill

Tri State Utilities

10/28/2004 8:52:45 AM

Contact
Tri State Utilities
757-366-9505

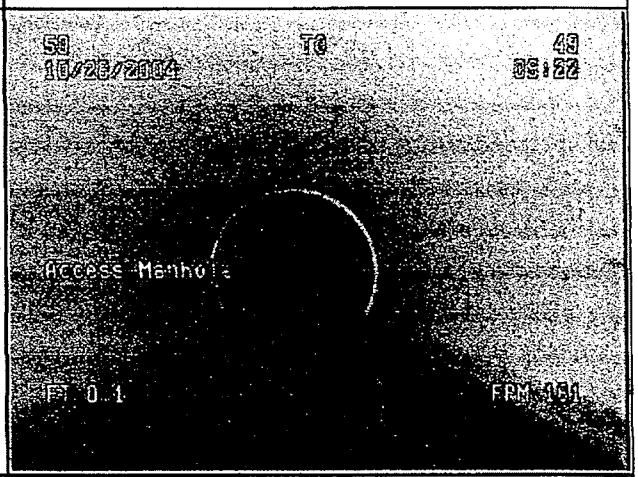
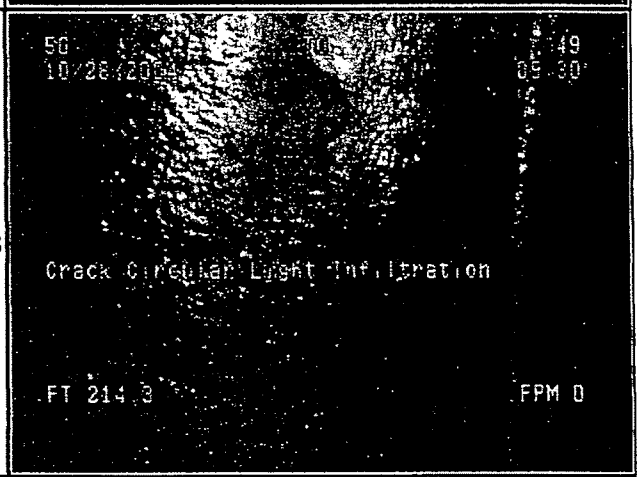
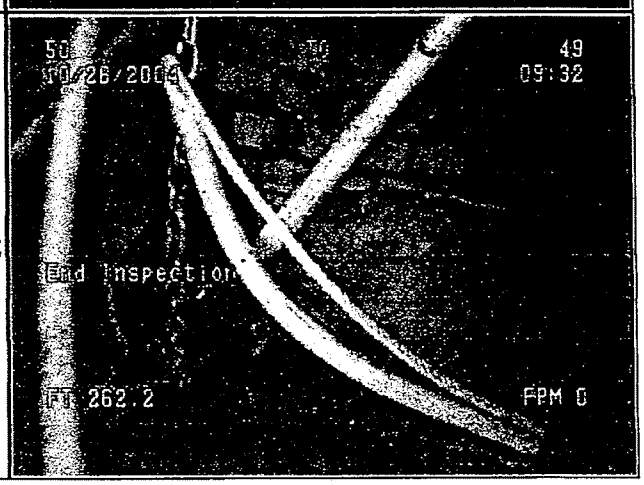
Address
2111 Smith Avenue
Chesapeake , Virginia
23320

Operator
S. Vaughan

Session Information			
Project Name	20599 CH2M Hill		
Location	(Little Creek Amphibious Base) F Street	**Run Number**	
		Pipe Name	12 Inch Clay
VCR Tape Number	Pre-Tv Tape #1	**Flow Direction**	Upstream
Truck Number	24	**Distance Traveled**	262.2
Comments			

Pipe Information	
Pipe Name	12 Inch Clay
Type Of Pipe	Clay
Size Of Pipe	12 Inch

Manhole Information			
Start Manhole Number	49	**End Manhole Number**	50
SMH Depth	6 Ft. 7 In.	**EMH Depth**	6 Ft. 5 In.
SMH Location	Street Area	**EMH Location**	Street Area
Amount of Flow:		**Signs Of Surcharge:**	No
Manhole Condition			

20599 CH2M Hill -- 10/28/2004 8:52:45 AM - Page 1			
Footage	Fault Observation	Time	Picture
0.1	**Access Manhole** **Severity: None** **Value Percent: 0**	00:01:14	
214.3	**Crack Circular Light Infiltration** **Position: 7 To 11** **Severity: None** **Value Percent: 0**	00:08:18	
262.2	**End Inspection**	00:10:02	

Plot generated for 20599 CH2M Hill

Date of Run: 10/28/2004 8:52:45 AM

Location: (Little Creek Amphibious Base) F Street

Start ID: 50

Total Distance: 262.2

End ID: 49

Run Number:

Flow Direction: Upstream

Severity
Light
Moderate
Heavy
Severe

Manhole Number: 49

(0.1) - Access Manhole

214.3 - (214.3) C - Crack Circular Light Infiltration - Position: 5 To 1

(262.2) EI - End Inspection

Total Distance: 262.2

Manhole Number: 50

TRI-STATE UTILITIES, INC.
2111 Smith Avenue
Chesapeake, VA 23320
PH: 757.366.9505
FX: 757.366.5110

20599 CH2M Hill

Tri State Utilities

10/28/2004 8:52:45 AM

Contact
Tri State Utilities
757-366-9505

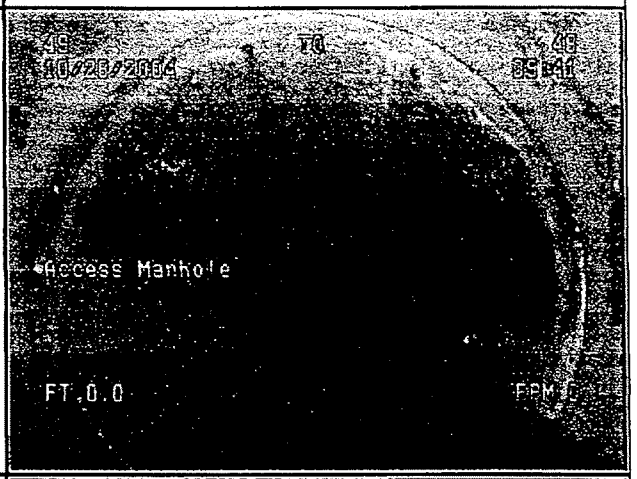
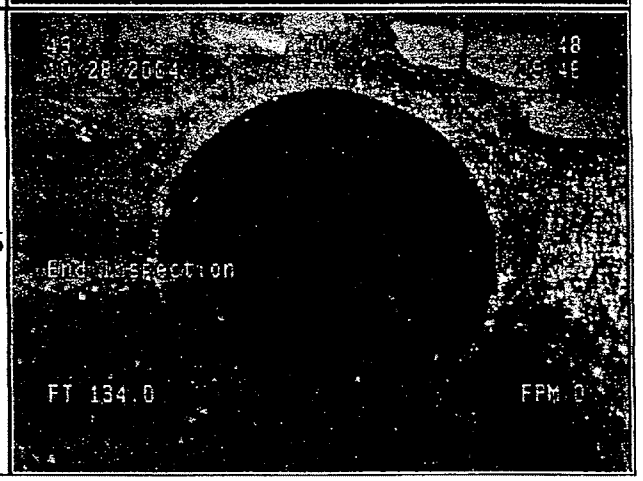
Address
2111 Smith Avenue
Chesapeake , Virginia
23320

Operator
S. Vaughan

Session Information			
Project Name	20599 CH2M Hill		
Location	(Little Creek Amphibious Base) F Street	**Run Number**	
		Pipe Name	12 Inch Clay
VCR Tape Number	Pre-Tv Tape #1	**Flow Direction**	Downstream
Truck Number	24	**Distance Traveled**	134
Comments	Light Grease Throughout		

Pipe Information	
Pipe Name	12 Inch Clay
Type Of Pipe	Clay
Size Of Pipe	12 Inch

Manhole Information			
Start Manhole Number	49	**End Manhole Number**	48
SMH Depth	6 Ft. 7 In.	**EMH Depth**	6 Ft. 7 In.
SMH Location	Street Area	**EMH Location**	Grass Area At Intersection Of F St. & Gator Blvd.
Amount of Flow:		**Signs Of Surcharge:**	No
Manhole Condition			

20599 CH2M Hill -- 10/28/2004 8:52:45 AM - Page 1			
Footage	Fault Observation	Time	Picture
0	**Access Manhole** **Severity: None** **Value Percent: 0**	00:11:39	
134	**End Inspection**	00:16:36	

Plot generated for 20599 CH2M Hill

Date of Run: 10/28/2004 8:52:45 AM

Location: (Little Creek Amphibious Base) F Street

Start ID: 49

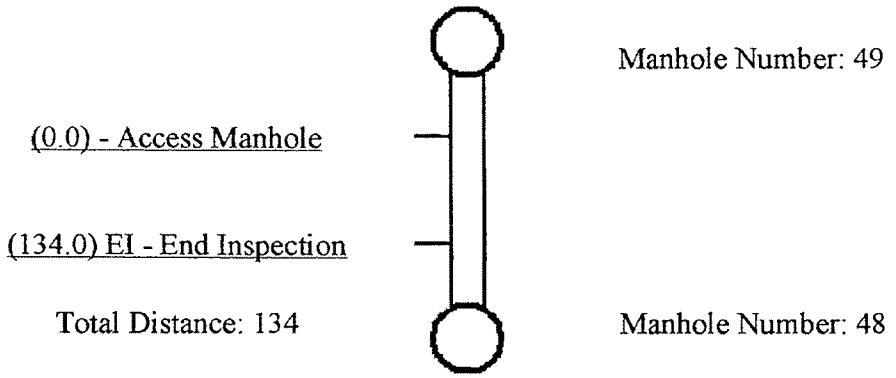
Total Distance: 134

End ID: 48

Run Number:

Flow Direction: Downstream

Severity
Light
Moderate
Heavy
Severe



TRI-STATE UTILITIES, INC.
2111 Smith Avenue
Chesapeake, VA 23320
PH: 757.366.9505
FX: 757.366.5110

20599 CH2M Hill

Tri State Utilities

10/28/2004 9:49:26 AM

Contact
Tri State Utilities
757-366-9505

Address
2111 Smith Avenue
Chesapeake , Virginia
23320

Operator
S. Vaughan

Session Information			
Project Name	20599 CH2M Hill		
Location	(Little Creek Amphibious Base) F Street	**Run Number**	
		Pipe Name	12 Inch Clay
VCR Tape Number	Pre-Tv Tape #1	**Flow Direction**	Downstream
Truck Number	24	**Distance Traveled**	38.6
Comments			

Pipe Information	
Pipe Name	12 Inch Clay
Type Of Pipe	Clay
Size Of Pipe	12 Inch

Manhole Information			
Start Manhole Number	48	**End Manhole Number**	47
SMH Depth	6 Ft. 7 In.	**EMH Depth**	7 Ft.
SMH Location	Grass Area At Intersection Of F St. & Gator Blvd.	**EMH Location**	Grass Area At Intersection Of F St. & Gator Blvd.
Amount of Flow:		**Signs Of Surcharge:**	No
Manhole Condition			

20599 CH2M Hill -- 10/28/2004 9:49:26 AM - Page 1			
Footage	Fault Observation	Time	Picture
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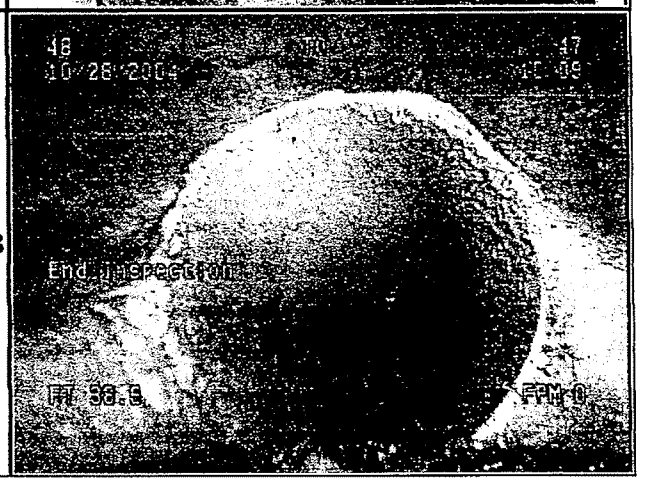
38.6	**End Inspection**	00:20:18	

Plot generated for 20599 CH2M Hill

Date of Run: 10/28/2004 9:49:26 AM

Location: (Little Creek Amphibious Base) F Street

Start ID: 48

Total Distance: 38.6

End ID: 47

Run Number:

Flow Direction: Downstream

Severity
Light
Moderate
Heavy
Severe

Manhole Number: 48

(0.0) - Access Manhole

(38.6) EI - End Inspection

Total Distance: 38.6

Manhole Number: 47

Attachment C

DRAFT
REMEDIATION PROGRAM REPORT

SITE 13
NAB LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

MARCH 10, 2005

PREPARED FOR

AGVIQ LLC,
CH2M HILL CONSTRUCTORS, INC.
AND
CH2M HILL, INC.
13921 PARK CENTER ROAD, SUITE 600
HERNDON, VA 20171

PREPARED BY

IN-SITU OXIDATIVE TECHNOLOGIES, INC.
5600 SOUTH QUEBEC STREET, SUITE 320 D
GREENWOOD VILLAGE, COLORADO 80111

ISOTEC PROJECT NO. 900676

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1.0 INTRODUCTION

In-Situ Oxidative Technologies, Inc. (ISOTEC) has been retained by AGVIQ LLC, CH2M HILL Constructors, Inc., and CH2M HILL, Inc. (AGVIQ/CH2M HILL) to conduct an in-situ chemical oxidation remediation program to treat groundwater contamination at Site 13, Naval Amphibious Base (NAB) Little Creek, located in Virginia Beach, Virginia. The contaminants of concern (COCs) at Site 13 include pentachlorophenol (PCP), trichloroethylene (TCE), tetrachloroethylene (PCE) and cis-1,2-dichloroethene (cis-1,2-DCE).

This remediation program report contains details of ISOTEC's field activities associated with the injection of ISOTEC reagents. Reagents were injected in order to treat the COCs through the use of in-situ chemical oxidation. The field activities occurred during one injection event from December 1 through December 8, 2004.

1.1 FULL-SCALE REMEDIATION OBJECTIVES

The primary objective of the remediation program at Site 13 is to achieve mass reduction of groundwater contaminant concentrations to below their respective Maximum Contaminant Levels (MCLs) through in-situ chemical oxidation. The MCLs for the COCs are 5 micrograms per liter (ug/L) for PCP, TCE and PCE and 70 ug/L for cis-1,2-DCE.

1.2 PROJECT BACKGROUND AND SITE CONDITIONS

The treatment area for the ISCO remediation program was the northern portion of the Site 13 groundwater plume. The northern portion of the plume covers approximately 20,000 square feet (100 ft. by 200 ft.) and is located within an area encompassing the former dip tank and monitoring wells LS13-MW03T and LS13-MW14T (**Figure 1**).

The subsurface at Site 13 is comprised of undifferentiated silty sands, clayey sands, sands, gravels and interbedded clays to a depth of approximately 23 feet below ground surface (bgs). A confining unit (Yorktown Confining Unit) is present at approximately 23 feet bgs. The estimated depth of impacted groundwater is from approximately 7-23 feet bgs.

1.3 REMEDIATION PROGRAM DESIGN

The remediation program was designed to distribute reagents across the entire treatment area through the use of 43 direct-push injection locations installed by a geo-probe drilling subcontractor. The injection locations were placed on a grid pattern with 24-feet between centers. In order to uniformly distribute reagents across the treatment interval of 7-23 feet bgs, ISOTEC planned to use two temporary injection points at each injection location. Each point, with an attached ISOTEC injection screen of varying length, would be advanced to a specific depth. The two screened injection points at each location would allow treatment over the entire 7-23 feet bgs interval.

The injection goal for total reagent volume was approximately 4,300 to 17,200 gallons of hydrogen peroxide and catalyst. The goal for each injection location was between 100 and 400 gallons of total reagent. These volumes were based on review of applicable data and ISOTEC's past field experience.

2.0 TECHNOLOGY OVERVIEW

The ISOTEC process is an in-situ remedial technology that destroys organic contamination using Fenton's reagent-based oxidation chemistry. Fenton's chemistry was first documented by H.J.H. Fenton in 1894. It is characterized by the combination of soluble iron with low concentrations of hydrogen peroxide to produce hydroxyl radicals ($OH^{\bullet}$). These hydroxyl radicals are very powerful and short-lived oxidizers. Similar to the reaction of other oxidizers, the hydroxyl radicals attack the carbon double bonds of the chlorinated hydrocarbon molecule. Under certain conditions reductive species can also be formed by Fenton's chemistry. This gives Fenton's reagent two separate pathways to attack a wide range of contaminants. The summary equation for Fenton's chemistry is shown below.

$$Fe^{+2} + H_2O_2 \rightarrow Fe^{+3} + OH^- + OH^{\bullet}$$

Where H_2O_2 is hydrogen peroxide, Fe^{+2} is ferrous iron, Fe^{+3} is ferric iron, $OH^{\bullet}$ is hydroxyl free radical and OH^- is hydroxide ion.

Iron is used to catalyze the reaction. Maintaining iron in solution is important for the process to be successful in an in-situ application. To eliminate the necessity of performing the reaction under low pH conditions, as is the case with traditional Fenton's chemistry, complexed iron is used in in-situ applications via the ISOTEC process. The hydrogen peroxide and dissolved iron solutions are injected through a site-specific delivery system providing sufficient distribution to selectively treat the area of concern. Reaction time is very fast, with oxidation capacity of the reagent being used up in a matter of a few days. Hydrogen peroxide breaks down into water and oxygen and the iron catalyst is oxidized and precipitates out of solution. It is important to note that the concentration of hydrogen peroxide will be relatively dilute, generally less than 17%, which eliminates the potential for significant exothermic reactions that are associated with higher concentrations of hydrogen peroxide. Experience with this process using low hydrogen peroxide concentrations and complexed iron has resulted in less than a 25° F temperature increase in field applications.

Fenton-based oxidation processes have been shown to effectively treat a wide range of contaminants including hard-to-treat compounds such as chlorinated solvents, pentachlorophenol, petroleum hydrocarbons, gasoline additives including benzene, toluene, ethylbenzene, xylene (BTEX), and pesticides. Hydroxyl radicals and reductive species generated by the Fenton-based reagent will treat nearly all contaminants with carbon/carbon double bonds (i.e., dichloroethene and tetrachloroethene) and single bonded contaminants with extractable hydrogen (i.e., trichloroethane).

The stoichiometric relationship between trichloroethene (TCE) oxidation and hydrogen peroxide consumption can be predicted from the oxidative reaction:

$$\mathbf{C_2Cl_3H + 3H_2O_2 \rightarrow 2CO_2 + 2H_2O + 3Cl^- + 3H^+}$$

Where C_2Cl_3H is TCE, H_2O_2 is hydrogen peroxide, CO_2 is carbon dioxide, Cl^- is chloride ion, and H^+ is hydrogen ion. Hydrogen peroxide not consumed in the above reaction will continue to oxidize the groundwater contaminants and will naturally degrade along with the contaminant to oxygen and water.

The ISOTEC process consists of injecting stabilized hydrogen peroxide and complexed iron catalysts into contaminated aquifers or vadose zones. As compared to conventional Fenton's Reagent, which requires acidic conditions (pH $\leq$ 3), the ISOTEC process is effective at neutral (pH = 7) conditions. This is an important consideration in full-scale application since acidifying an aquifer is typically impractical. ISOTEC's oxidation method utilizes a site-specific delivery system(s) designed to treat organic contaminants within an area of concern. ISOTEC oxidants and catalysts generate hydroxyl radicals, which react with the organic contaminants within the subsurface producing innocuous by-products such as carbon dioxide and water (and chloride ions if chlorinated compounds are being treated).

3.0 ISOTEC REMEDIATION PROGRAM

The remediation program was comprised of one field injection event. The remediation program was completed over a seven-day period from December 1 through December 8, 2004.

3.1 ISOTEC PROCESS FIELD METHODS

ISOTEC technicians prepared stabilized 12% hydrogen peroxide from 35% hydrogen peroxide. The 35% hydrogen peroxide was delivered to the site and stored on-site in a Department of Transportation (DOT) approved chemical tanker. The 35% hydrogen peroxide was transferred into 300-gallon polyethylene tanks with an air operated diaphragm pump and diluted with on-site water to the desired concentration. The technicians wore proper personal protective equipment and used appropriate safety procedures during the transfer. Iron catalyst was also mixed in 300-gallon polyethylene tanks using on-site water, dry ISOTEC chemicals, and an electric mixing motor with attached mixing blade.

ISOTEC reagents were injected into the subsurface using 86 direct-push injection points at 43 injection locations across the treatment area. The direct-push rods were installed by American Environmental Drilling, Inc. At each location, two temporary injection points were advanced to predetermined depths to cover the entire 7-23 foot bgs treatment interval. The injection points designated "A" consisted of a 5-foot treatment interval. Specifically, American Environmental Drilling, Inc drove the direct-push injection rod to 13 feet bgs and then pulled back to 8 feet bgs to expose a 5-foot ISOTEC injection screen. Injection points designated "B" consisted of a 9-foot injection interval. At the "B" locations, direct-push rods with three attached 3-foot long ISOTEC injection screens were driven to a depth of 23 feet bgs to treat the 14-23 foot bgs interval. ISOTEC reagents were then injected through each rod into the subsurface.

The injections were accomplished using air-operated diaphragm pumps, flow meters, polyvinyl chloride (PVC) flexible tubing and steel wellhead assemblies. The wellheads, with pressure gauges and relief valves, were attached to the direct-push injection rods. The wellhead assemblies were attached with PVC tubing to an air-operated diaphragm pump and from the pump to either the peroxide, catalyst or water tanks with PVC tubing. The peroxide, catalyst and water were injected through the PVC tubing using the pump.

In general, the injection process was similar for each injection point. First, water was injected, followed by 12% stabilized hydrogen peroxide (oxidizer), a water flush, ISOTEC's patented chelated iron catalyst (catalyst), and a final water flush.

3.2 ISOTEC FIELD ACTIVITIES

Reagents were injected into the subsurface using 86 direct-push injection points at 43 injection locations from December 1 through December 8, 2004 (**Figure 2**).

Injection volumes, pressures, and rates varied on a point-by-point basis during the injection event. Reagent volumes were limited due to increased injection pressure and surfacing at several locations. Surfacing is described as the escape of ISOTEC reagents, groundwater, and/or gas to the ground surface. It is important to note that the surfacing that occurred during the injection event resulted in only minor amounts of liquid forming at the surfacing location and ceased immediately after the injection pumps were shut off. Additionally, the small amount of liquid that surfaced was easily contained on-site using absorbent materials.

During the injection event, ISOTEC setup on 86 injection points at 43 injection locations (**Figure 2**). The temporary injection locations were placed on a grid pattern with 24 feet between centers. ISOTEC setup on the A and B points at each location and injected reagents simultaneously into both points. The majority of injection points received 100 gallons of 12% hydrogen peroxide and 100 gallons of ISOTEC catalyst. Pressures at the wellheads of the injection points ranged from 0 to 40 pounds per square inch (psi), while the average injection rates ranged from 2 to 3 gallons per minute (gpm) during injections. The first two injection locations (E3 and E5) received limited reagent volume (160 gallons and 240 gallons, respectively) as injection pressures, flow rates and subsurface reactions were observed. Reagent volumes were increased as injections proceeded without incident. Two of the injection points (E1-B and B6-B) received less reagent due to increased pressures of 70 to 80 psi, and eight injection points (A7-A, A7-B, A8-A, A8-B, B7-A, B7-B, C5-A and C5-B) received less reagent due to surfacing (**Table 1**).

ISOTEC injected a total of 16,117 gallons of reagents through 86 injection points during the injection event. The injected reagent volumes are presented in **Table 1**.

4.0 ANALYTICAL RESULTS

AGVIQ/CH2MHILL collected groundwater samples from Site 13 ISCO treatment area monitoring wells prior to (baseline) and following injection activities (post-injection). Four treatment area monitoring wells were sampled in October 2004 during the baseline sampling event (LS13-MW03, LS13-MW14, LS13-MW21 and LS13-MW28). Post-injection groundwater samples were collected from monitoring wells LS13-MW03, LS13-MW14, LS13-MW26 and LS13-MW28 in December 2004. Monitoring well LS13-MW-21 was sampled only during baseline sampling event and LS13-MW-26 was sampled only during post-injection sampling event.

The groundwater analytical data is presented in **Section 4.1, Section 4.2, Section 4.3,** and **Section 4.4** and compares baseline PCP, TCE, PCE and cis-1,2-DCE analytical data to post-injection analytical data.

In the subsequent sections, when discussing analytical data, ISOTEC will refer to a groundwater sample collected from an individual monitoring well by the well name. The well/sample name will also be abbreviated. For example, monitoring well LS13-MW03 will be referred to as MW03.

4.1 PENTACHLOROPHENOL

Four monitoring wells were sampled during the baseline sampling event (MW03, MW14, MW21 and MW28). Baseline PCP concentrations ranged from 14 ug/L in MW28 to 630 ug/L in MW14 (**Table 2**).

Post-injection PCP concentrations in the four sampled wells (MW03, MW14, MW26, and MW28) ranged from non-detect (ND) in MW28 to 48 ug/L in MW26 (**Table 2**). Monitoring wells MW03, MW14 and MW28 reported PCP concentration reductions. The most significant concentration reduction was observed in monitoring well MW14, which was reduced from a baseline concentration of 630 ug/L to 5.1 ug/L, a 99% reduction. PCP concentrations were reduced from 77 ug/L to 4.4 ug/L in MW03, and from 14 ug/L to ND in MW28.

4.2 TRICHLOROETHENE

Four monitoring wells were sampled during the baseline sampling event (MW03, MW14, MW21 and MW28). Baseline TCE concentrations ranged from ND in MW21 to 8 ug/L in MW28 (**Table 3**).

Post-injection TCE concentrations in the four sampled wells (MW03, MW14, MW26, and MW28) ranged from ND in MW14 and MW26 to 4.1 ug/L in MW03 (**Table 3**). Monitoring wells MW03, MW14 and MW28 reported TCE concentration reductions. Monitoring well MW28 reported the largest TCE concentration reduction, decreasing from 8 ug/L to 1.6 ug/L, an 80% reduction. TCE concentrations in MW03 were reduced

from 5.1 ug/L to 4.1 ug/L, and MW14 concentrations were reduced from 0.26 ug/L to ND.

4.3 TETRACHLOROETHENE

Four monitoring wells were sampled during the baseline sampling event (MW03, MW14, MW21 and MW28). Baseline PCE concentrations ranged from ND in MW21 to 6.3 ug/L in MW28 (**Table 4**).

Post-injection PCE concentrations in the four sampled wells (MW03, MW14, MW26, and MW28) ranged from 0.56 in MW26 to 2.5 ug/L in MW03 (**Table 4**). PCE concentration reductions were observed in monitoring wells MW03 and MW28. The largest PCE concentration reduction was reported in monitoring well MW28 which decreased from 6.3 ug/L to 1.5 ug/L, a 76% reduction. Monitoring well MW03 PCE concentrations were reduced from 3.2 ug/L to 2.5 ug/L. A concentration increase was observed in monitoring well MW14, from a baseline concentration of 0.14 ug/L to 0.95 ug/L.

4.4 CIS-1,2- DICHLOROETHENE

Four monitoring wells were sampled during the baseline sampling event (MW03, MW14, MW21 and MW28). Baseline cis-1,2-DCE concentrations ranged from ND in MW21 to 9.8 ug/L in MW28 (**Table 5**).

Post-injection cis-1,2-DCE concentrations in the four sampled wells (MW03, MW14, MW26, and MW28) ranged from ND in MW14 and MW28 to 9 ug/L in MW03 (**Table 5**). Monitoring wells MW14 and MW28 reported cis-1,2-DCE concentration reductions. The largest concentration reduction was observed in monitoring well MW28, which was reduced from a baseline of 9.8 ug/L to 3.2 ug/L, a 67% reduction. Cis-1,2-DCE concentrations in MW14 were reduced from 0.72 ug/L to ND. A slight concentration increase was observed in monitoring well MW03 which increased from a baseline concentration of 8.6 ug/L to 9 ug/L.

5.0 CONCLUSIONS

The primary objective of the remediation program at Site 13 was to achieve contaminant mass reduction thereby reducing groundwater contaminant concentrations to below their respective MCLs through in-situ chemical oxidation. The MCLs for the COCs are 5 micrograms per liter (ug/L) for TCE, PCE and PCP and 70 ug/L for cis-1,2-DCE.

5.1 EFFECTIVENESS OF THE ISOTEC PROCESS

Review of the analytical data indicates that the ISOTEC process at Site 13 was successful in reducing dissolved contaminant concentrations in the treatment area monitoring wells. Groundwater TCE, PCE and cis-1,2-DCE concentrations in the treatment area monitoring wells were reduced to levels below their respective MCLs (**Tables 2** through **4)**.

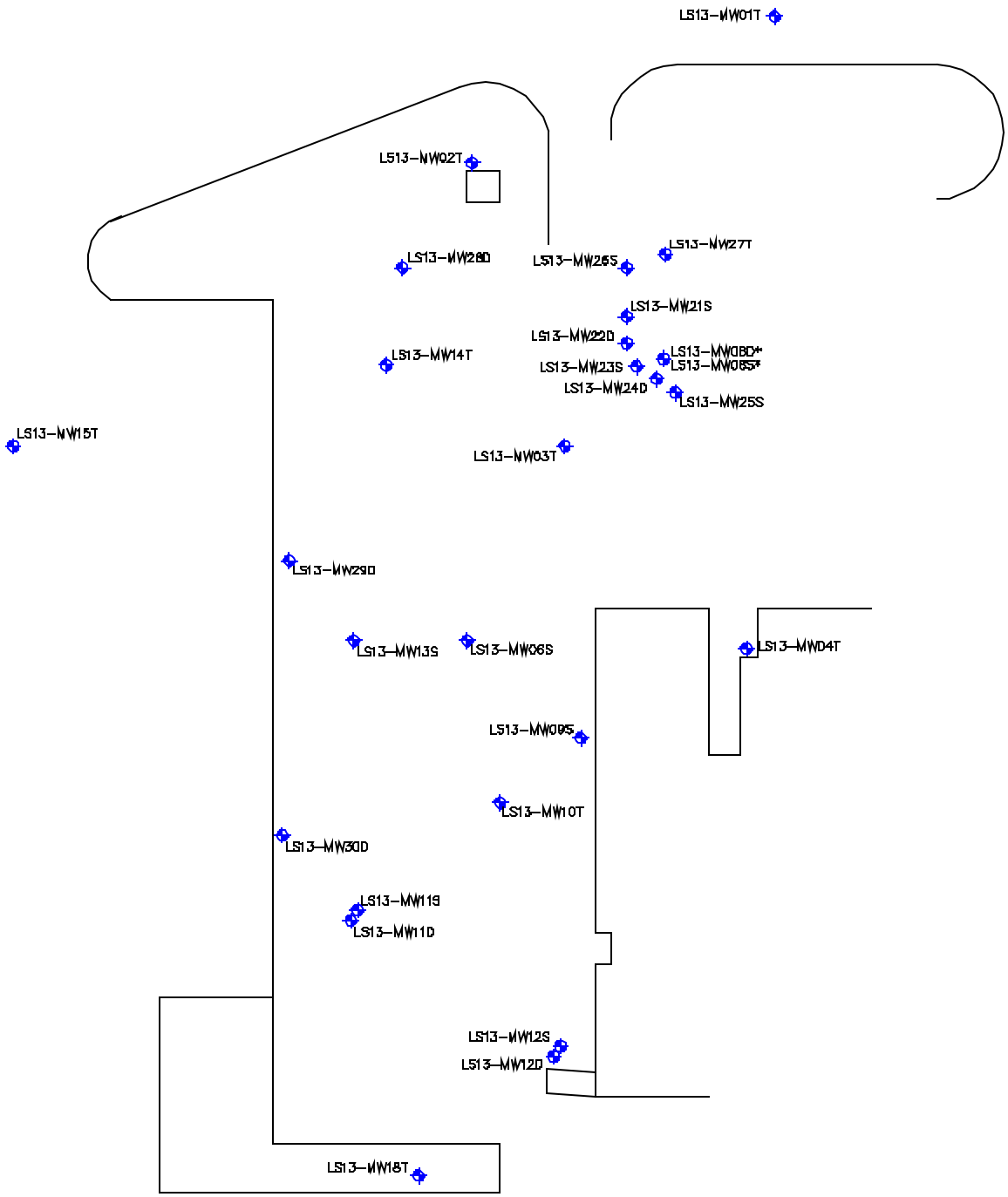
Groundwater PCP concentrations across the treatment area also showed significant reductions (**Figures 3** and **4**). The three monitoring wells with both baseline and post-injection data (MW03, MW14 and MW28) showed PCP concentration reductions ranging from 82% to 99% (**Table 5**).

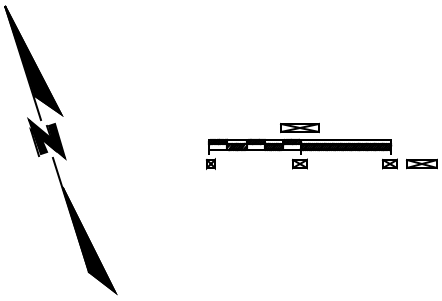
It should be noted that the highest post-injection PCP concentration was observed at treatment area monitoring well MW26. Monitoring well MW26 is located in the direct vicinity of injection locations A7, A8 and B7, all of which received a limited amount of reagents due to surfacing within the area of the tank excavation (**Figure 2, Table 1**).

5.2 RECOMMENDATIONS

Based on review of the baseline and post-injection analytical data, the remediation program has effectively reduced dissolved TCE, PCE and cis-1,2-DCE concentrations in the ISCO treatment area of Site 13. Dissolved PCP concentrations above the MCLs are still present at monitoring wells MW14 (5.1 ug/L) and MW26 (48 ug/L).

The chemical and physical effects of the injection disrupt the equilibrium between total mass and dissolved mass and may take months to re-equilibrate. Therefore, dissolved concentrations may fluctuate over time as equilibrium conditions return. ISOTEC recommends quarterly sampling of the treatment area monitoring wells to monitor any fluctuations.



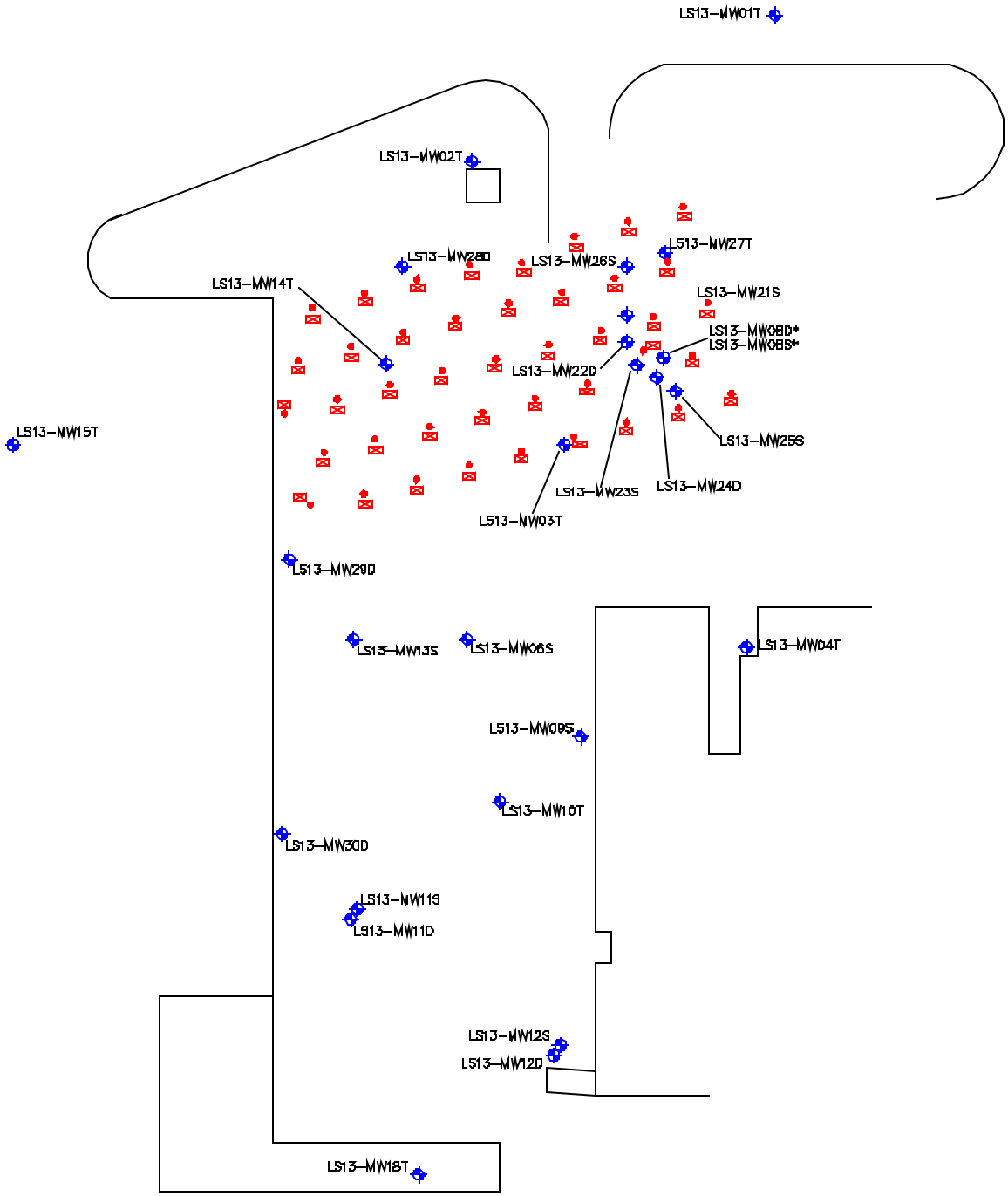


In-Situ Oxidative Technologies, Inc.
5600 S. Quebec St., Suite 320 D
Greenwood Village, CO 80111
www.insituoxidation.com
(303) 843-9079

Site Plan *Site 13* NAB Little Creek Virginia Beach, Virginia		FIGURE# 1
DATE: 2/1/05	SCALE: 1" = 70'	PROJECT# 900676
DRAWN BY: NMT	CHECKED BY: SH	

NOTE:
Site Map and Well Locations taken from maps provided by Agviq-CH2MHILL

...\Figure 1 - Site Plan.dwg 05/04/2005 05:03:58 PM



In-Situ Oxidative Technologies, Inc.
5600 S. Quebec St., Suite 320 D
Greenwood Village, CO 80111
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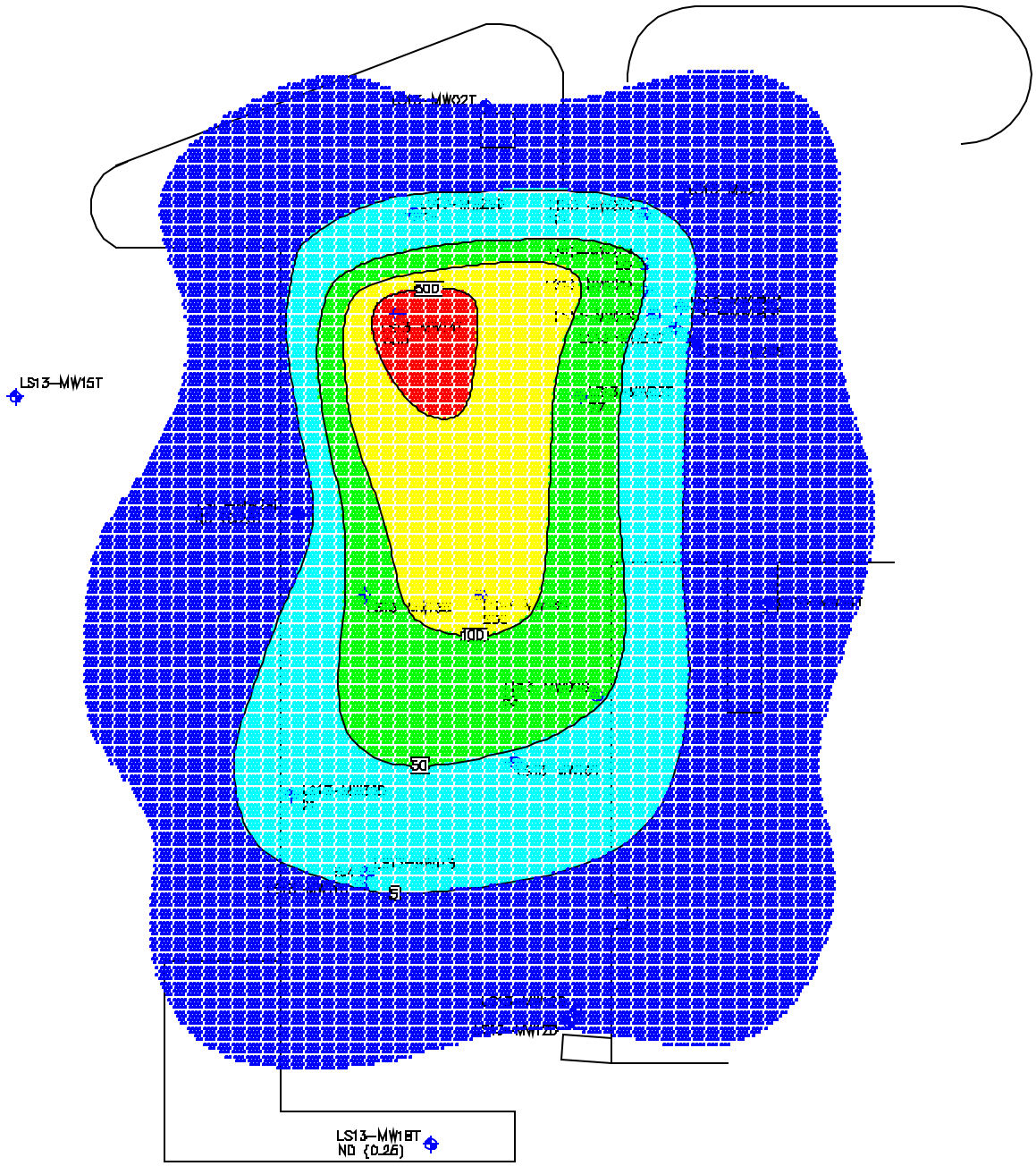
(303) 843-9079

Direct-Push Injection Location Map *Site 13* NAB Little Creek Virginia Beach, Virginia		FIGURE# 2
DATE: 2/1/05	SCALE: 1" = 70'	PROJECT# 900676
DRAWN BY: NMT	CHECKED BY: SH	

NOTE:
Site Map and Well Locations taken from maps provided by Agvlq-CH2MHILL



PCP Concentration Scale

- > 500 ug/L
- 100– 500 ug/L
- 50 – 100 ug/L
- 5 – 50 ug/L
- < 5 ug/L

NOTE:
Site Map and Well Locations taken from maps provided by AgMq-CH2MHILL

ISOTEC

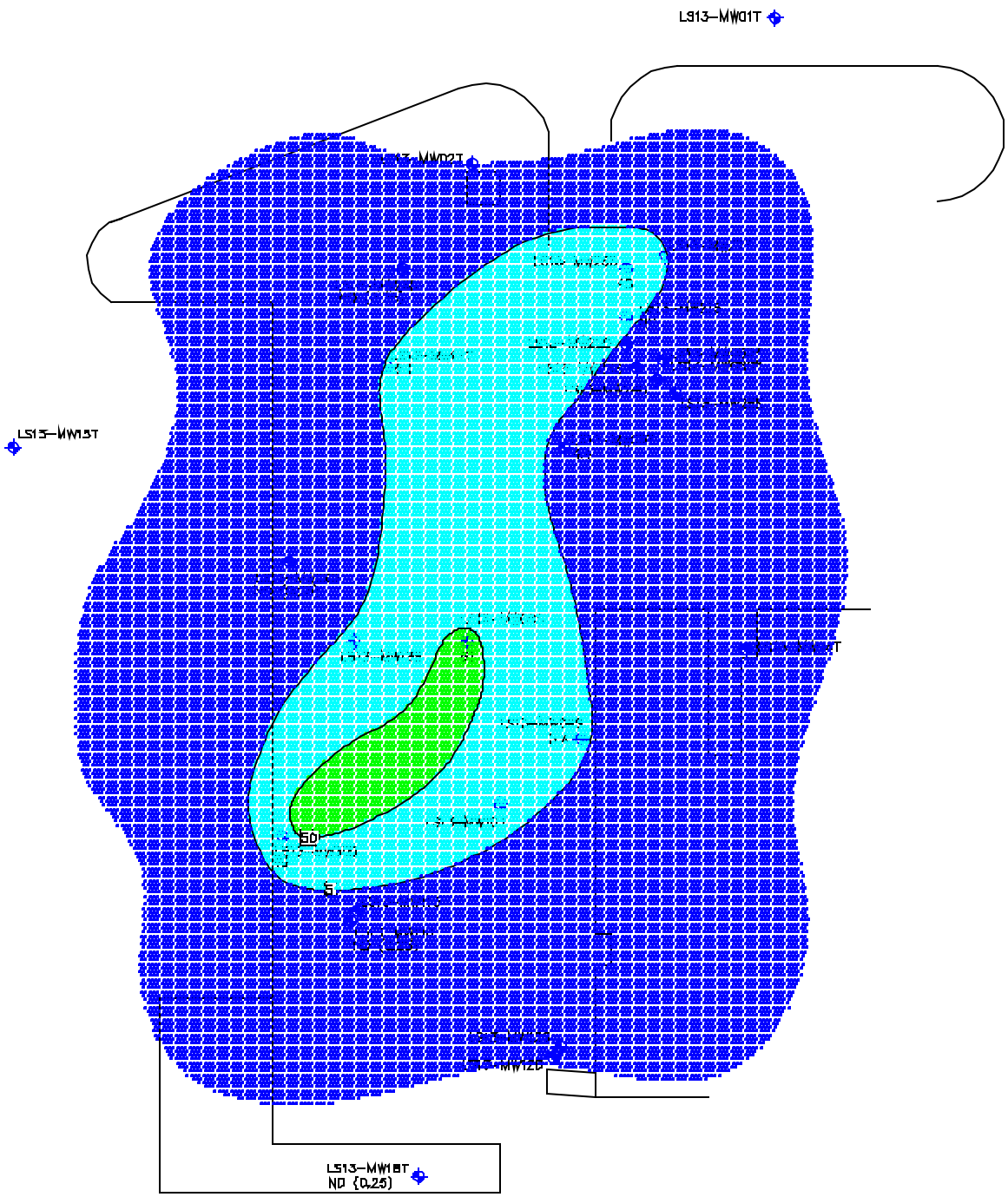
In-Situ Oxidative Technologies, Inc.
5600 S. Quebec St., Suite 320 D
Greenwood Village, CO 80111
www.insituoxidation.com
(303) 843-9079

Baseline PCP Isoconcentration Map
October 2004
Site 13 NAB Little Creek
Virginia Beach, Virginia

FIGURE# 3

DATE: 3/1/05 | SCALE: 1" = 70' | PROJECT# 900676

DRAWN BY: NMT | CHECKED BY: SH



PCP Concentration Scale

- > 500 ug/L
- 100– 500 ug/L
- 50 – 100 ug/L
- 5 – 50 ug/L
- < 5 ug/L

NOTE:
Site Map and Well Locations taken from maps provided by Agviq-CH2MHILL

ISOTEC

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Greenwood Village, CO 80111
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(303) 843-9079

Post-Injection PCP Isoconcentration Map
December 2004
Site 13 NAB Little Creek
Virginia Beach, Virginia

FIGURE# 4

DATE: 3/1/05 | SCALE: 1" = 70' | PROJECT# 900676

DRAWN BY: NMT | CHECKED BY: SH

Table 1

First Event Injection Log

Site 13
NAB Little Creek
Virginia Beach, Virginia

Temporary Injection Point	December 1, 2004		December 2, 2004		December 3, 2004		December 4, 2004		Reagent Totals
	ISOTEC Reagent		ISOTEC Reagent		ISOTEC Reagent		ISOTEC Reagent		
	H_2O_2 (gallons)	Catalyst (gallons)	H_2O_2 (gallons)	Catalyst (gallons)	H_2O_2 (gallons)	Catalyst (gallons)	H_2O_2 (gallons)	Catalyst (gallons)	
E3-A	50	40							90
E3-B	30	40							70
E5-A	60	60							120
E5-B	60	60							120
E7-A	100	100							200
E7-B	100	100							200
C2-A	100	100							200
C2-B	100	100							200
C4-A			100	100					200
C4-B			100	100					200
C6-A			100	100					200
C6-B			100	100					200
C8-A			100	100					200
C8-B			100	100					200
A3-A			100	100					200
A3-B			100	100					200
A5-A					100	100			200
A5-B					100	100			200
A7-A					100	100			200
A7-B					100	100			200
A9-A					100	100			200
A9-B					100	100			200
D2-A					100	100			200
D2-B					100	100			200
D4-A					100	100			200
D4-B					100	100			200
D6-A					100	100			200
D6-B					100	100			200
D8-A					100	100			200
D8-B					100	100			200
B1-A					100	100			200
B1-B					100	100			200
B3-A					100	100			200
B3-B					100	100			200
B5-A							100	100	0
B5-B							100	100	0
B7-A							100	100	0
B7-B							100	100	0
E2-A							100	100	0
E2-B							100	100	0
E4-A							100	100	0
E4-B							100	100	0
E6-A							100	100	0
E6-B							100	100	0
E8-A							100	100	0
E8-B							100	100	0
C3-A							100	100	0
C3-B							100	100	0
Totals	**600**	**600**	**800**	**800**	**1800**	**1800**	**1400**	**1400**	**6400**
Daily Totals	**1200**		**1600**		**3600**		**2800**		

Table 1

First Event Injection Log (continued)

Site 13
NAB Little Creek
Virginia Beach, Virginia

Temporary Injection Point	December 6, 2004 ISOTEC Reagent		December 7, 2004 ISOTEC Reagent		December 8, 2004 ISOTEC Reagent		Reagent Totals
	H_2O_2 (gallons)	Catalyst (gallons)	H_2O_2 (gallons)	Catalyst (gallons)	H_2O_2 (gallons)	Catalyst (gallons)	
C5-A	100	50					150
C5-B	100	50					150
C7-A	100	100					200
C7-B	100	100					200
C9-A	100	100					200
C9-B	100	100					200
A2-A	100	100					200
A2-B	100	100					200
A4-A	100	100					200
A4-B	100	100					200
E1-A	100	100					200
E1-B	2	0					2
F2-A	100	100					200
F2-B	100	100					200
A6-A	100	100					200
A6-B	100	100					200
A8-A	75	0					75
A8-B	75	0					75
B2-A			100	100			200
B2-B			100	100			200
B4-A			100	100			200
B4-B			100	100			200
B6-A			100	100			200
B6-B			30	35			65
B8-A			100	100			200
B8-B			100	100			200
D7-A			100	100			200
D7-B			100	100			200
D5-A			100	100			200
D5-B			100	100			200
F3-A			100	100			200
F3-B			100	100			200
F1-A			100	100			200
F1-B			100	100			200
D3-A					100	100	200
D3-B					100	100	200
D1-A					100	100	200
D1-B					100	100	200
Totals	**1652**	**1400**	**1530**	**1535**	**400**	**400**	**6917**
Daily Totals	**3052**		**3065**		**800**		

Total H2O2	**8182**
Total Catalyst	**7935**
Total Reagent	**16117**

Table 2

Dissolved Phase PCP Concentrations (ug/L)
with Percentage Reductions

Site 13
NAB Little Creek
Virginia Beach, Virginia

Monitoring Well	Baseline Groundwater Data (October 2004)	Post-Injection Groundwater Data (December 2004)	Baseline vs. Post-Injection (Percentage Reduction)
	PCP (ug/L)	PCP (ug/L)	
LS13-MW03	**77**	**4.4**	**94%**
LS13-MW14	**630**	**5.1**	**99%**
LS13-MW21	**50**	**NS**	**NA**
LS13-MW26	**NS**	**48**	**NA**
LS13-MW28	**14**	**2.5**	**82%**
LS13-MW06	200	51	75%
LS13-MW09	53	5.4	90%
LS13-MW11D	5.4	2.5	54%
LS13-MW18	2.5	2.5	0%
LS13-MW29	2.5	2.5	0%
LS13-MW30	21	49	-133%

NOTES

2.5	Non-detect (value shown in blue is 1/2 the detection limit)
Bold	ISCO Treatment Area Well
	Indicates concentration is above the State MCL of 5 ug/L

Table 3

Dissolved Phase TCE Concentrations (ug/L) with Percentage Reductions

Site 13
NAB Little Creek
Virginia Beach, Virginia

Monitoring Well	Baseline Groundwater Data (October 2004)	Post-Injection Groundwater Data (December 2004)	Baseline vs. Post-Injection (Percentage Reduction)
	TCE (ug/L)	TCE (ug/L)	
LS13-MW03	**5.1**	**4.1**	**20%**
LS13-MW14	**0.26**	**0.25**	**4%**
LS13-MW21	**0.25**	**NS**	**NA**
LS13-MW26	**NS**	**0.25**	**NA**
LS13-MW28	**8**	**1.6**	**80%**
LS13-MW06	12	24	-100%
LS13-MW09	63	9	86%
LS13-MW11D	10	2.4	76%
LS13-MW18	2.4	2.1	13%
LS13-MW29	0.59	0.51	14%
LS13-MW30	1.4	1.5	-7%

NOTES

2.5	Non-detect (value shown in blue is 1/2 the detection limit)
Bold	ISCO Treatment Area Well
	Indicates concentration is above the State MCL of 5 ug/L

Table 4

Dissolved Phase PCE Concentrations (ug/L)
with Percentage Reductions

Site 13
NAB Little Creek
Virginia Beach, Virginia

Monitoring Well	Baseline Groundwater Data (October 2004)	Post-Injection Groundwater Data (December 2004)	Baseline vs. Post-Injection (Percentage Reduction)
	PCE (ug/L)	PCE (ug/L)	
LS13-MW03	**3.2**	**2.5**	**22%**
LS13-MW14	**0.14**	**0.95**	**-579%**
LS13-MW21	**0.25**	**NS**	**NA**
LS13-MW26	**NS**	**0.56**	**NA**
LS13-MW28	**6.3**	**1.5**	**76%**
LS13-MW06	6.5	12	-85%
LS13-MW09	40	9.5	76%
LS13-MW11D	18	4.2	77%
LS13-MW18	9.8	8.7	11%
LS13-MW29	3.7	3.6	3%
LS13-MW30	4.3	6.7	-56%

NOTES

2.5	Non-detect (value shown in blue is 1/2 the detection limit)
Bold	ISCO Treatment Area Well
	Indicates concentration is above the State MCL of 5 ug/L

Table 5

Dissolved Phase cis-1,2- DCE Concentrations (ug/L)
with Percentage Reductions

Site 13
NAB Little Creek
Virginia Beach, Virginia

Monitoring Well	Baseline Groundwater Data (October 2004)	Post-Injection Groundwater Data (December 2004)	Baseline vs. Post-Injection (Percentage Reduction)
	cis-1,2 DCE (ug/L)	cis- 1,2 DCE (ug/L)	
LS13-MW03	**8.6**	**9**	**-5%**
LS13-MW14	**0.72**	**0.25**	**65%**
LS13-MW21	**0.25**	**NS**	**NA**
LS13-MW26	**NS**	**0.25**	**NA**
LS13-MW28	**9.8**	**3.2**	**67%**
LS13-MW06	8.9	24	-170%
LS13-MW09	93	6.3	93%
LS13-MW11D	4.3	1.3	70%
LS13-MW18	2.4	1.7	29%
LS13-MW29	0.28	0.31	-11%
LS13-MW30	1.6	1.9	-19%

NOTES

2.5 Non-detect (value shown in blue is 1/2 the detection limit)

Bold ISCO Treatment Area Well

Indicates concentration is above the State MCL of 70 ug/L

Attachment D

Solutions
Industrial & Environmental Services

3722 Benson Drive ■ Raleigh, NC 27609
(919) 873-1060 ■ Fax (919) 873-1074
www.solutions-ies.com

January 10, 2005

Ms. Terra Pascarosa
AGVIQ LLC
4663 Haygood Road
Suite 208
Virginia Beach, VA 23455

Re.: Report of Edible Oil Substrate (EOS®) Injection
NAB Little Creek, Site 13, Southern Plume Area
Virginia Beach, Virginia
AGVIQ Project No. 1148
Solutions -IES Project No. 2170.04A2.AGVI

Dear Ms. Pascarosa:

Solutions Industrial & Environmental Services, Inc. (Solutions-IES) completed the injection of Edible Oil Substrate (EOS®) at the Naval Amphibious Base (NAB) Little Creek, Virginia Beach, Virginia. The work was performed in accordance with the terms of your Purchase Order # AV04-0106, Mod 0001 executed by AGVIQ LLC on 24 June 2004 and Mod 002 signed on 10 December 2004. The purpose of the injection was to enhance the bioremediation of chlorinated volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) that are present in groundwater in the southern plume area of Site 13. The activities were performed as outlined in the purchase order, the 8 July 2004 Health and Safety Plan, and the 26 July 2004 Work Plan. Both guidance documents were prepared by Solutions-IES and submitted previously. This report describes the substrate injection activities that were conducted on site between 6 December and 15 December 2004.

Introduction

Attachment 1 contains five figures provided by AGVIQ-CH2MHill to Solutions-IES that illustrate where the remediation efforts were performed. For simplicity, the original or previously-used figure numbers have been retained. Figure 1-1 shows the location of NAB Little Creek near Virginia Beach, VA. Figure 1-2 shows the location of Site 13 on the base, and Figure 2-11 shows the extent of the trichloroethene (TCE) groundwater plume at Site 13. Figure 1-3 identifies the northern and southern portions of the

plume. Figure 4 from the Solutions-IES Work Plan shows the four single-row barriers where it was planned to inject EOS® in the southern two-thirds of the groundwater plume. Solutions-IES prepared Figure 6 to illustrate the actual locations of the injections across the site. The contaminants of concern at Site 13 are PCE, TCE, *cis*-1,2-DCE, and pentachlorophenol (PCP).

According to subsurface information provided to Solutions-IES by CH2MHill prior to mobilization, the water table was estimated at 7 feet below ground surface (bgs). The top of the Yorktown confining unit is located at a depth of approximately 23 feet bgs. The treatment zone was planned for the depth interval of 7.5 feet to 22.5 feet bgs. The start date and site logistics were discussed in a kickoff meeting conducted at the site on 25 October 2004.

Mobilization and Setup

Solutions-IES personnel mobilized a Geoprobe Model 5400 mounted on a 4-wheel drive pickup along with an equipment truck and trailer to NAB Little Creek on 6 December 2004. A laydown area for the equipment was established near the northwest corner of the southern plume area. The 40 injection well locations, identified as IW-1 through IW-40, were established on the ground surface on approximate 10-foot centers in the four barriers and were approved by Ms. Terra Pascarosa of AGVIQ. Hose was connected to a fire hydrant on F Street and extended to the laydown area. Two disposable plastic pools were set up within secondary containment to mix the emulsion.

On December 9, 2004, Mr. Paul Landin of CH2MHill identified four additional locations to install wells and inject additional EOS®. In accordance with an approved change order authorized on 10 December 2004, IW-41 and IW-42 were located approximately 5 feet upgradient of existing well MW-09S, and IW-43 and IW-44 were located approximately 5 feet upgradient of MW-30D. The injection wells and existing monitor wells in the south plume area are shown on Figure 6.

Injection Well Installation

The well construction was described in the project Work Plan. All of the injection wells were installed with a Geoprobe?. After assuring that utilities had been cleared in the area, Geoprobe? casing with an outside diameter of 2.125", outfitted with an expendable conical tip, was driven through the pavement at the marked location. Additional sections of casing were added and driven until the cone tip was located at approximately 22.5 feet below the ground surface (ft bgs). Appendix 2 provides several photographs

documenting the site work. Photograph 1 shows the injection well installation process. One 10-foot and one 5-foot section of 1-inch diameter machine slotted PVC screen (0.020-inch slot) were screwed together and inserted into the Geoprobe? casing. A 10-foot section of Schedule 40 1-inch diameter PVC casing was attached to the top of the screen. The Geoprobe? casing was then removed from the ground leaving the PVC well components behind. The formation materials were allowed to "cave" around the screen after the metal casing was removed. The annular space within the unsaturated zone was filled with granulated bentonite clay. Water was added to hydrate the clay and the clay was compacted to aid in sealing the top of the well. The PVC casing was cut off flush with the paving surface and covered with a PVC cap. The well construction data is shown in Table 1, which is included with other tables in Attachment 3.

Well Development

The injection wells were developed to improve their connection with the surrounding aquifer materials using a combination of pumping and surging. Because all water had to be containerized and treated, the quantity of water removed from each well was minimized to the extent practical. All recovered water was placed in 55-gallon drums for disposal by others.

A section of polyethylene tubing was installed in each injection well and attached to a portable peristaltic pump. The pump was initiated and allowed to run until the turbidity of the discharge stream was greatly reduced. The tubing was removed and a surge block constructed from ½ inch PVC pipe was pushed to the bottom of the well and then pulled up to the water surface in the well. This process was repeated several times and the surge block was removed from the well. The well was pumped with the peristaltic pump until the water was almost clear. If the water was still turbid, the surging process was repeated.

Dilution of EOS Concentrate

Twenty-three drums of EOS® concentrate were purchased from EOS Remediation of Raleigh, NC and were delivered to the site on 7 December 2004. An additional two drums for the four newly added wells were delivered on 13 December. The contents of each drum were pumped into a plastic pool and were diluted with four parts water obtained from the fire hydrant on F Street. Mixing volumes were gauged using flow meters (Photograph 2).

Injection of Dilute EOS

Manifolds were assembled from 1" pipe fittings to allow connection of the injection hose to the PVC injection well. The manifold included a valve that could be used to vary the delivery of EOS®, a pressure gage to evaluate injection pressures, a water meter to read volumes injected, and a bleed valve to remove air from the lines. The injection apparatus consisted of a 3 HP single-phase electrical centrifugal pump that was powered from a portable generator. The intake hose from the pump was placed in the tank of dilute EOS®. The pump discharge line was arranged in a loop configuration ending at the EOS® tank. Valved "tees" were placed in the loop so that multiple injection wells could be injected simultaneously. In order to reduce the potential for breakthrough of emulsion to the surface, the injection hose was connected to alternate injection manifolds (i.e., inject one well, skip one well, inject one well, etc.).

Start and finish times, initial and final water meter readings, and estimates of injection rates were kept in the project field book as the injection proceeded. The EOS® injection data compiled from the field notes is shown in Table 2. The prescribed amount of dilute EOS® (approximately 150 gallons) was injected under low pressure into each of the wells. Between four and eight wells, depending on location and injection sequence, were injected simultaneously during each stage (Photograph 3). After the EOS® was injected, a small volume (~285 ml) of pre-mixed Vitamin B-12 solution provided by EOS Remediation was added to each of injection well by pouring it into the top of the manifold.

Water Chase

Additional water (water chase) was injected after the emulsion to move the emulsion away from the injection well into the formation. The original Work Plan specified approximately 2,200 gallons of water to follow the emulsion at each location. After the October site meeting and further review of site conditions, Solutions-IES found this volume of chase water to be excessive and reduced the volume of chase water to 1,100 gallons per injection point.

In most cases, the water chase was initiated immediately or shortly after completion of the EOS® injection. The injection manifold was routed from the tank containing EOS® to a hose from the fire hydrant. Table 3 shows the times and injection volumes for the water chase.

Radius of Influence Monitoring

Water levels were measured periodically in selected adjacent and nearby injection wells to evaluate mounding of the water table during injection and the subsequent water chase phase. Some mounding of the water table was observed 10 feet from the injection points. The maximum mounding observed appeared to be on the order of 2 feet above static.

Samples of groundwater were collected periodically from selected monitor and nearby injection wells to evaluate breakthrough of the emulsion. Dilute EOS® was not observed in any adjacent permanent wells during the injection process with the exception of MW-09S. Groundwater collected from MW-09S approximately 2.5 hours after the water chase was complete contained a slight whitish tint which appeared to be related to the EOS® that was injected into IW-41 and IW-42.

Well Abandonment

After the water chase was completed on 15 December 2004, all of the injection wells were abandoned by filling the well with granular bentonite clay to within 12 inches of the top. The PVC casing cut off below grade and the remaining hole was filled with neat cement grout (Photograph 4).

Site Restoration and Demobilization

Final site cleanup and demobilization occurred on the morning of 16 December 2004. The injection process required three men for eight days. A total of 10,479 lbs of EOS® concentrate was injected. The total volume of fluid injected into the ground was 55, 502 gallons. Table 4 summarizes the injection volumes by well.

Closing

We appreciate the opportunity to provide these environmental services for AGVIQ. If you have any questions regarding this report or if we may be of further assistance, please call us at (919) 873-1060.

Yours truly,

Solutions -IES

M. Tony Lieberman
Project Manager

Walter J. Beckwith, P.G.
Director of Technical Services

Attachment 1 – Figures
Attachment 2 – Photographs
Attachment 3 - Tables

cc: Mr. Paul Landin, CH2MHill

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ATTACHMENT 1

FIGURES

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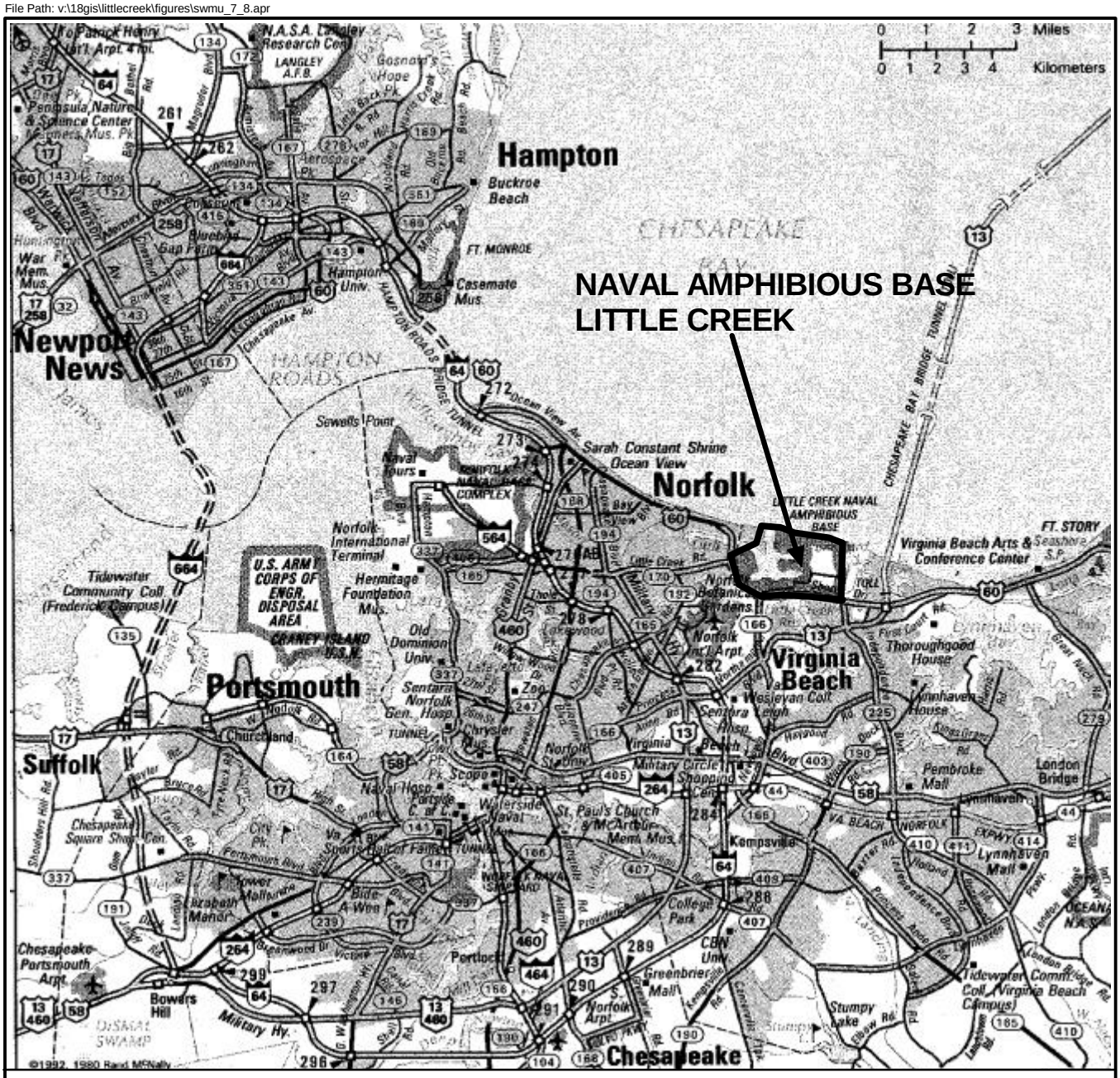

Source: Rand McNally

N

Figure 1-1
Regional Location Map
NAB Little Creek
Virginia Beach, Virginia

CH2MHILL

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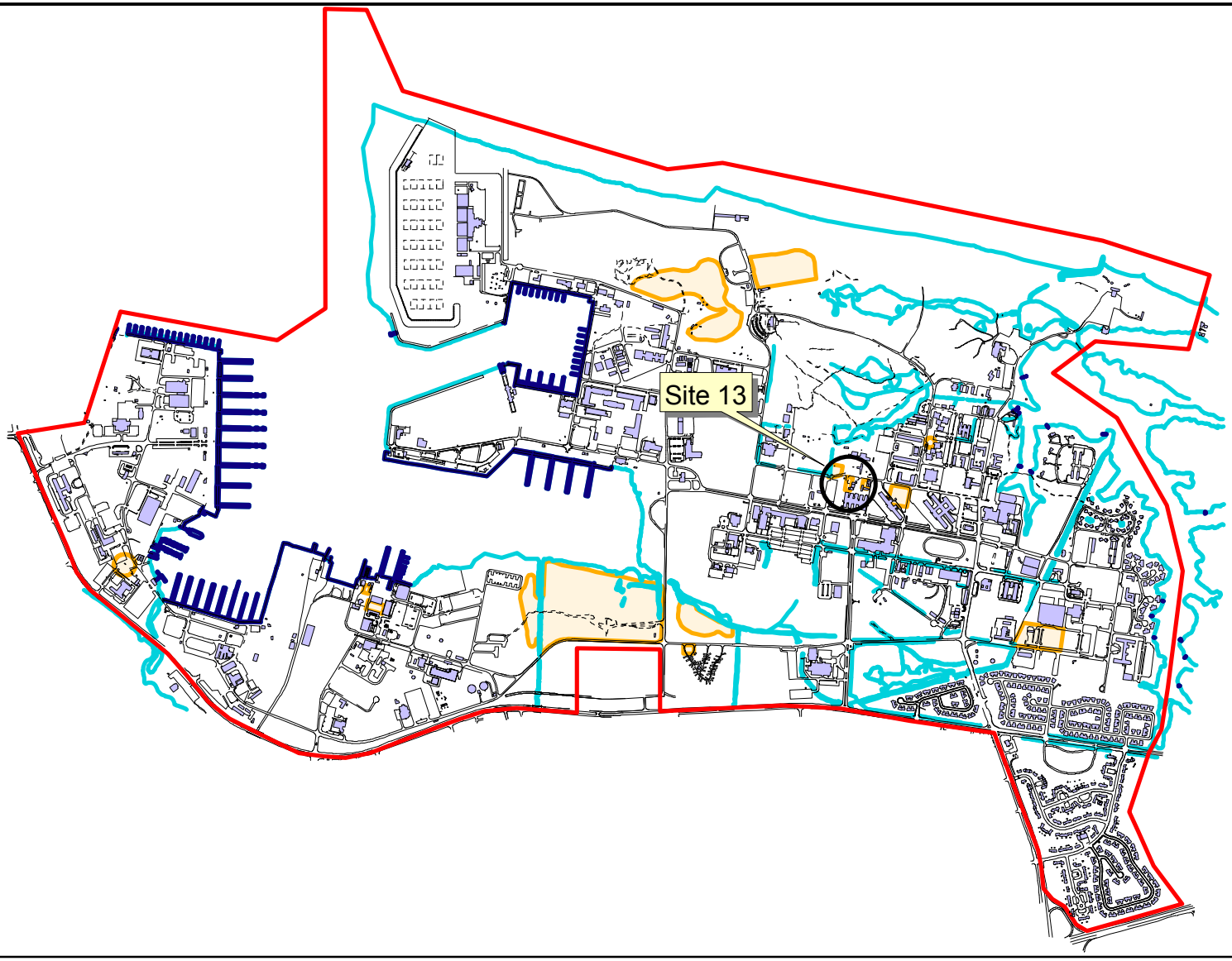

N

0 1000 2000 Feet

Figure 1-2
Site 13 Location Map
Treatability Study
NAB Little Creek

AGVIQ
CH2M HILL

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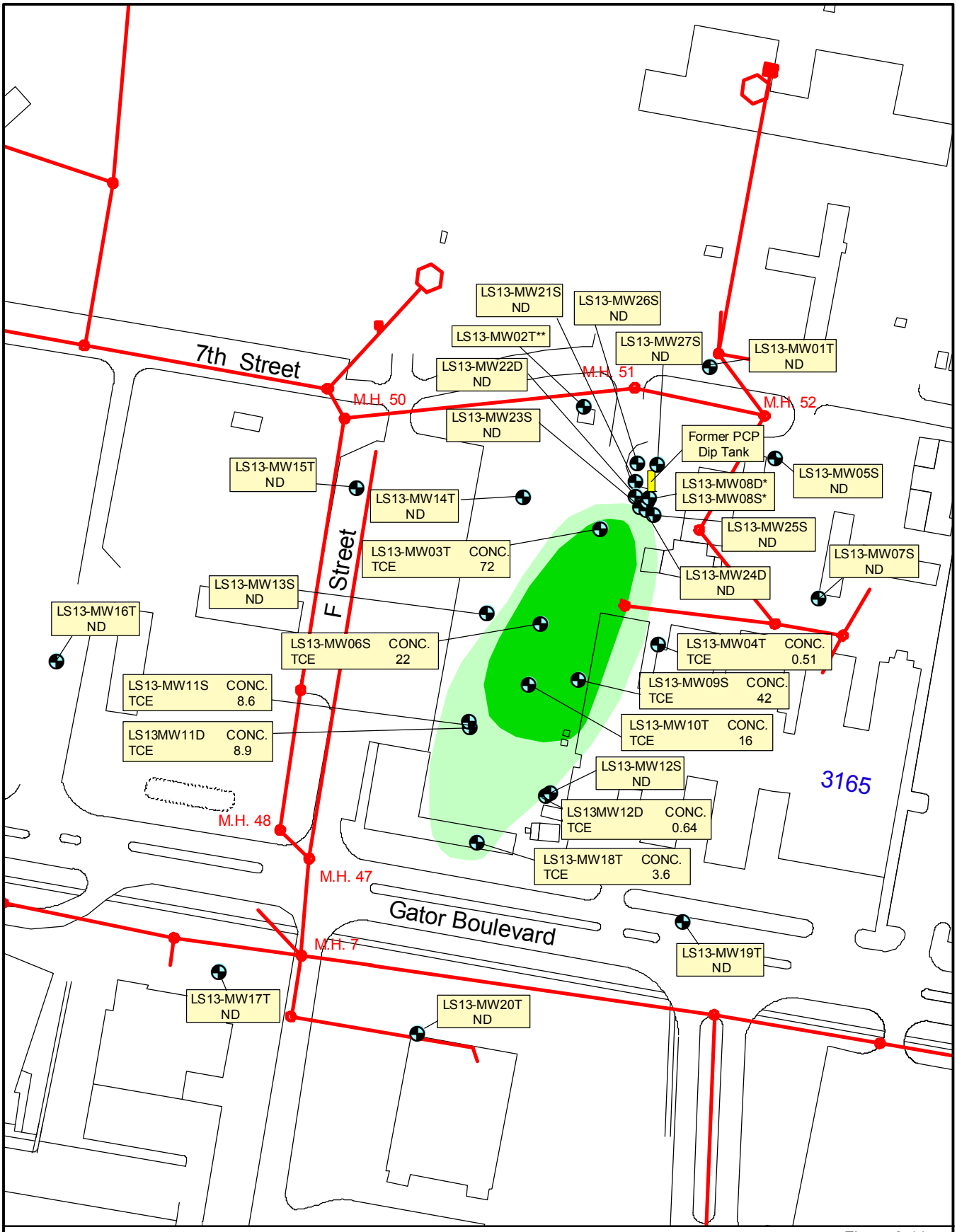


LEGEND

1-10 ug/L

10-100 ug/L

Sanitary Sewer Lines

ND - Not Detected
NA - Not Analyzed
* - Wells removed during 1999 removal action
** - Well not found

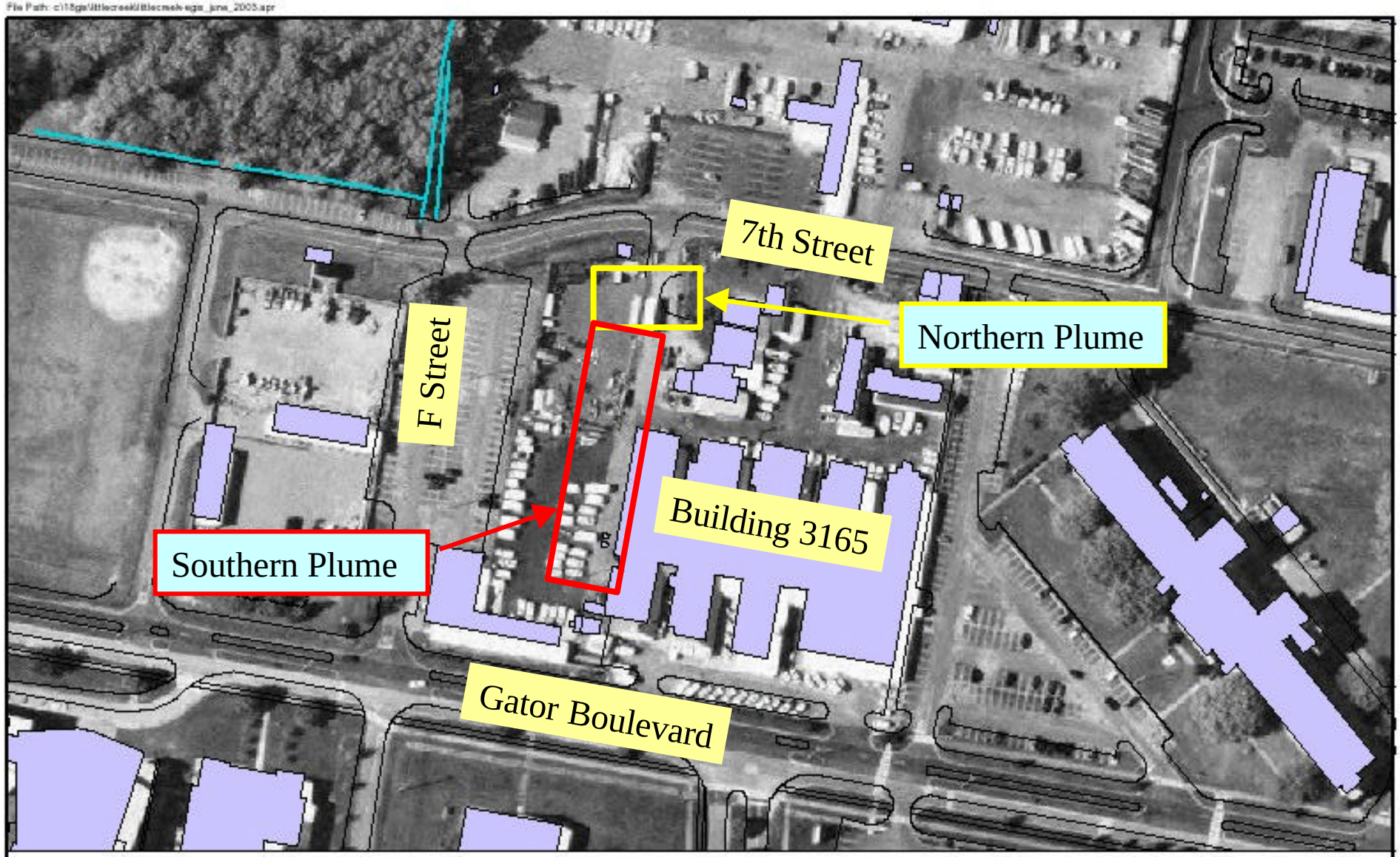
N

0 100 200 Feet

Figure 2-11
TCE Isoconcentration Map
For Columbia Aquifer, December 2003
Site 13 Feasibility Study
NAB Little Creek
Virginia Beach, Virginia

CH2MHILL

File Path: c:\18gis\littlecreek\littlecreek-egs_june_2003.apr



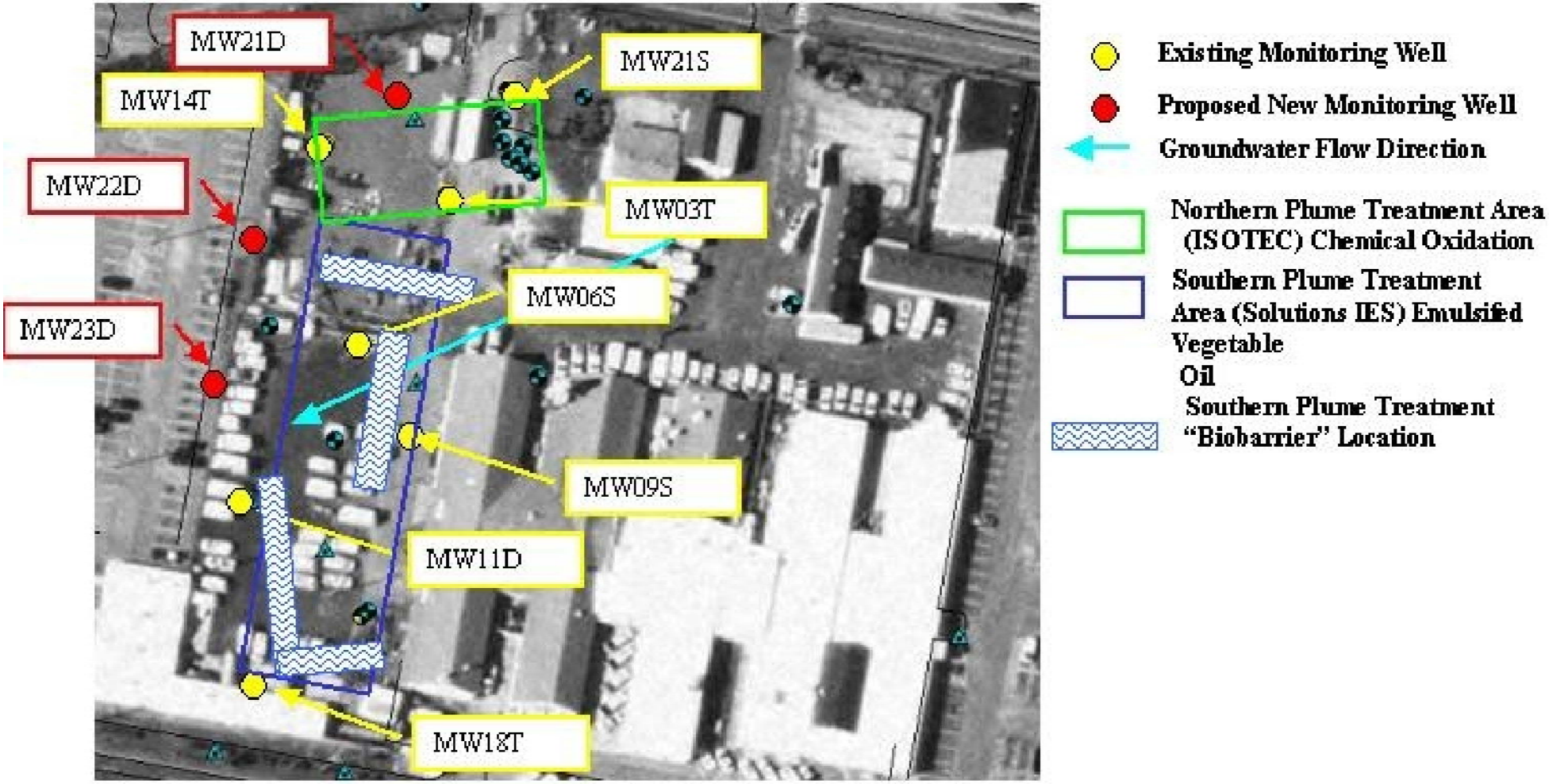
N

0 90 180 Feet

Figure 1-3
Site 13
Groundwater Plume Extent
NAB Little Creek
Virginia Beach, Virginia

AGVIQ-CH2MHILL JVI

FILE	DATE	PROJECT MANAGER	CHECKED BY	DRAFTER	PROJECT NUMBER
FIG4.DGN	07/26/04	MTL	MTL	GB	2170.04A2.AGVI



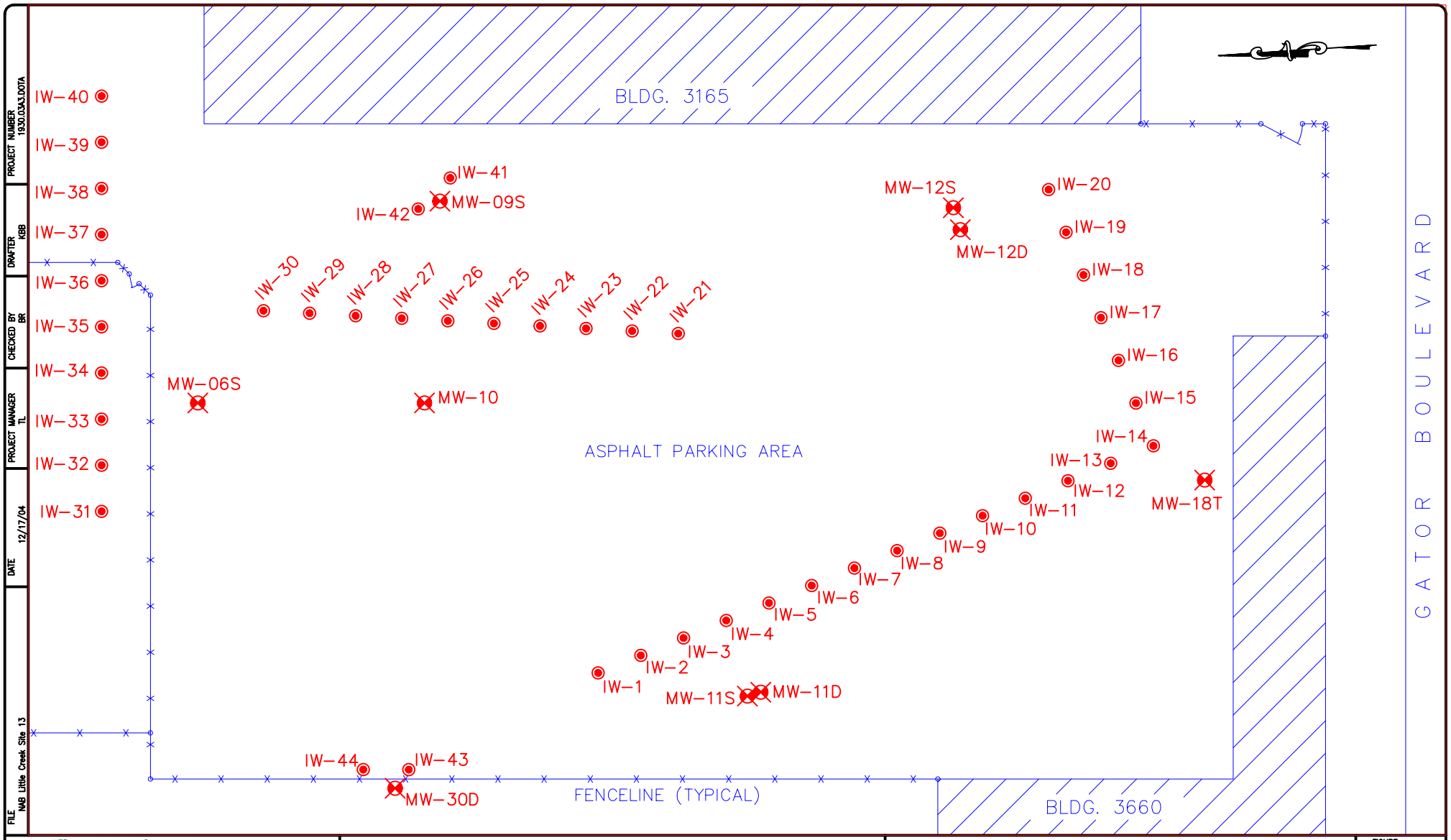
REFERENCE: AGVIQ-CH2MHILL, FIGURE 3-6, SITE 13, GROUNDWATER TREATMENT APPLICATIONS, GROUNDWATER MONITORING NETWORK, NAB LITTLE CREEK, VIRGINIA BEACH, VA

Solutions
Industrial & Environmental Services
3722 BENSON DRIVE
RALEIGH, NORTH CAROLINA 27609
TEL.: (919) 873-1060 FAX.: (919) 873-1074

SITE 13
PROPOSED EOS INJECTION LOCATIONS

NAB LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

FIGURE:
4



Solutions
Industrial & Environmental Services
3722 BENSON DRIVE
RALEIGH, NORTH CAROLINA 27609
TEL.: (919) 873-1060 FAX.: (919) 873-1074

0 20 40
SCALE IN FEET

LEGEND
IW-41 INJECTION WELL
MW-09S MONITORING WELL

INJECTION WELL LOCATIONS
NAVAL AMPHIBIOUS BASE
SITE # 13
LITTLE CREEK, VIRGINIA

FIGURE:
6

ATTACHMENT 2

PHOTOGRAPHS

ATTACHMENT 2 – SITE PHOTOGRAPHS

Photograph 1. Solutions-IES' Geoprobe 5400 installing casing preceding construction of an injection well.

ATTACHMENT 2 – SITE PHOTOGRAPHS

Photograph 2. Laydown area showing EOS® mixing pools and drums of EOS® concentrate staged for later use. Secondary containment is provided for spillage. Hoses carry potable water from a nearby fire hydrant and the dilute EOS to the injection points.

ATTACHMENT 2 – SITE PHOTOGRAPHS

Photograph 3. Injection system showing manifold setup for injecting four wells simultaneously. Flow meters measured the volumes injected and pressure gages monitored injection pressures.

ATTACHMENT 2 – SITE PHOTOGRAPHS

Photograph 4. View facing north. Injection wells (green circles) have been abandoned and holes in the pavement have been patched with cement grout.

ATTACHMENT 3

TABLES

TABLE 1
Injection Well Installation Data
NAB Little Creek - Site 13, Southern Plume Area

Well #	Date Installed	Total Depth (Ft bgs)	Screen Interval (Ft bgs)	Date Abandoned
Southwest Barrier				
IW-1	12/6/2004	22.5	7.5 - 22.5	12/15/2004
IW-2	12/6/2004	22.5	7.5 - 22.5	12/15/2004
IW-3	12/6/2004	22.5	7.5 - 22.5	12/15/2004
IW-4	12/7/2004	22.5	7.5 - 22.5	12/15/2004
IW-5	12/7/2004	22.5	7.5 - 22.5	12/15/2004
IW-6	12/7/2004	22.5	7.5 - 22.5	12/15/2004
IW-7	12/7/2004	22.5	7.5 - 22.5	12/15/2004
IW-8	12/7/2004	22.5	7.5 - 22.5	12/15/2004
IW-9	12/7/2004	22.5	7.5 - 22.5	12/15/2004
IW-10	12/7/2004	22.5	7.5 - 22.5	12/15/2004
IW-11	12/7/2004	22.5	7.5 - 22.5	12/15/2004
IW-12	12/7/2004	22.5	7.5 - 22.5	12/15/2004
IW-13	12/7/2004	22.5	7.5 - 22.5	12/15/2004
IW-14	12/8/2004	22.5	7.5 - 22.5	12/15/2004
South Barrier				
IW-15	12/8/2004	22.5	7.5 - 22.5	12/15/2004
IW-16	12/8/2004	22.5	7.5 - 22.5	12/15/2004
IW-17	12/8/2004	22.5	7.5 - 22.5	12/15/2004
IW-18	12/8/2004	22.5	7.5 - 22.5	12/15/2004
IW-19	12/8/2004	22.5	7.5 - 22.5	12/15/2004
IW-20	12/8/2004	22.5	7.5 - 22.5	12/15/2004
Central Barrier				
IW-21	12/9/2004	22.5	7.5 - 22.5	12/15/2004
IW-22	12/9/2004	22.5	7.5 - 22.5	12/15/2004
IW-23	12/9/2004	22.5	7.5 - 22.5	12/15/2004
IW-24	12/9/2004	22.5	7.5 - 22.5	12/15/2004
IW-25	12/9/2004	22.5	7.5 - 22.5	12/15/2004
IW-26	12/9/2004	22.5	7.5 - 22.5	12/15/2004
IW-27	12/9/2004	22.5	7.5 - 22.5	12/15/2004
IW-28	12/9/2004	22.5	7.5 - 22.5	12/15/2004
IW-29	12/9/2004	22.5	7.5 - 22.5	12/15/2004
IW-30	12/10/2004	22.5	7.5 - 22.5	12/15/2004
North Barrier				
IW-31	12/10/2004	22.5	7.5 - 22.5	12/15/2004
IW-32	12/10/2004	22.5	7.5 - 22.5	12/15/2004
IW-33	12/10/2004	22.5	7.5 - 22.5	12/15/2004
IW-34	12/10/2004	22.5	7.5 - 22.5	12/15/2004
IW-35	12/10/2004	22.5	7.5 - 22.5	12/15/2004
IW-36	12/13/2004	22.5	7.5 - 22.5	12/15/2004
IW-37	12/13/2004	22.5	7.5 - 22.5	12/15/2004
IW-38	12/13/2004	22.5	7.5 - 22.5	12/15/2004
IW-39	12/13/2004	22.5	7.5 - 22.5	12/15/2004
IW-40	12/13/2004	22.5	7.5 - 22.5	12/15/2004
MW-09S and MW-30D Area				
IW-41	12/13/2004	22.5	7.5 - 22.5	12/15/2004
IW-42	12/13/2004	22.5	7.5 - 22.5	12/15/2004
IW-43	12/14/2004	22.5	7.5 - 22.5	12/15/2004
IW-44	12/14/2004	22.5	7.5 - 22.5	12/15/2004

TABLE 2
Substrate Injection Data
NAB Little Creek - Site 13, Southern Plume Area

Well #	Begin Injection Date	Begin Injection Time	Stop Injection Date	Stop Injection Time	Flow Meter Reading Start	Flow Meter Reading Stop	Total Vol. (gals)	Injection Rate (gpm)	Pressure (psi)
Southwest Barrier									
IW-1	12/8/04	10:20	12/8/04	10:40	13,771	13,969	198	9.2	<2
IW-2	12/9/04	10:56	12/9/04	12:00	15,070	15,220	150	2.9	<2
IW-3	12/8/04	10:53	12/8/04	11:15	1,445	1,595	150	8.8	0
IW-4	12/9/04	10:57	12/9/04	12:04	2,742	2,893	151	2.6	0
IW-5	12/8/04	10:58	12/8/04	11:16	232	383	151	9.2	0
IW-6	12/9/04	10:58	12/9/04	11:44	1,515	1,665	150	4.8	0
IW-7	12/8/04	11:23	12/8/04	11:48	72	222	150	7.6	0
IW-8	12/9/04	10:58	12/9/04	12:11	1,390	1,544	154	2	0
IW-9	12/8/04	11:29	12/8/04	11:49	4,895	5,045	150	8	0
IW-10	12/9/04	10:59	12/9/04	11:54	6,145	6,295	150	4.1	
IW-11	12/8/04	11:40	12/8/04	12:25	38,704	38,854	150	8	0
IW-12	12/9/04	10:59	12/9/04	12:10	39,995	40,145	150	3.2	
IW-13	12/8/04	11:51	12/8/04	12:53	9,669	9,819	150	8	0
IW-14	12/9/04	11:00	12/9/04	12:07	10,919	11,070	151	4	
South Barrier									
IW-15	12/10/04	9:00	12/10/04	10:50	1,696	1,846	150	8	
IW-16	12/9/04	12:33	12/9/04	13:24	446	596	150	5	0
IW-17	12/10/04	9:00	12/10/04	10:50	1,322	1,472	150		
IW-18	12/9/04	12:34	12/9/04	13:27	72	222	150	5	0
IW-19	12/10/04	9:00	12/10/04	10:50	1,693	1,843	150		
IW-20	12/9/04	12:35	12/9/04	13:00	431	585	154	6	0
Central Barrier									
IW-21	12/10/04	14:25	12/10/04	15:00	2,692	2,842	150	6	0
IW-22	12/13/04	14:45	12/13/04	15:44	3,958	4,108	150	3.3	
IW-23	12/10/04	14:25	12/10/04	15:00	2,572	2,722	150	6	0
IW-24	12/13/04	14:45	12/13/04	15:27	4,073	4,223	150	5.8	
IW-25	12/10/04	14:25	12/10/04	15:00	2,943	3,093	150	6	0
IW-26	12/13/04	14:45	12/13/04	15:31	5,252	5,402	150	4.5	
IW-27	12/10/04	14:25	12/10/04	15:00	3,992	4,142	150	6	0
IW-28	12/13/04	14:45	12/13/04	15:33	3,943	4,093	150	3.6	
IW-29	12/14/04	10:22	12/14/04	10:42	5,194	5,344	150	9.5	2
IW-30	12/13/04	14:45	12/13/04	15:33	2,765	2,928	163	3.3	
North Barrier									
IW-31	12/14/04	13:17	12/14/04	13:52	6,574	6,724	150	7.4	0
IW-32	12/15/04	7:43	12/15/04	8:10	6,466	6,616	150	6.2	
IW-33	12/14/04	13:17	12/14/04	14:01	5,216	5,366	150	5.0 - 6.4	0
IW-34	12/15/04	7:43	12/15/04	9:14	6,540	6,690	150	4.6	
IW-35	12/14/04	13:17	12/14/04	14:03	5,290	5,440	150	4.8 - 5.4	0
IW-36	12/15/04	7:43	12/15/04	9:12	8,709	8,859	150	5.4	
IW-37	12/14/04	13:17	12/14/04	14:06	6,445	6,595	150	4.1 - 4.4	0
IW-38	12/15/04	7:43	12/15/04	9:24	7,695	7,845	150	4.4	
IW-39	12/14/04	13:17	12/14/04	14:10	7,395	7,545	150	1.2 - 4.0	
IW-40	12/15/04	7:43	12/15/04	9:20	7,824	7,974	150	7.6	0
MW-09S and MS-30D Areas									
IW-41	12/14/04	10:24	12/14/04	10:43	4,039	4,189	150	7.6	0
IW-42	12/14/04	10:23	12/14/04	10:44	5,324	5,474	150	6.5	0
IW-43	12/15/04	10:40	12/15/04	12:15	41,245	41,495	250	4.1 - 10	
IW-44	12/15/04	10:40	12/15/04	12:15	12,170	12,420	250	2.5 - 7	

TABLE 3
Chase Water Injection Data
NAB Little Creek - Site 13, Southern Plume Area

Well #	Begin Injection Date	Begin Injection Time	Stop Injection Date	Stop Injection Time	Flow Meter Reading Start	Flow Meter Reading Stop	Total Vol. (gals)	Injection Rate (gpm)	Pressure (psi)
Southwest Barrier									
IW-1	12/8/04	13:10	12/9/04	7:45	13,968	15,070	1,102	2	1-2
IW-2	12/9/04	13:45	12/10/04	8:22	15,220	16,180	960	4.4 - 11	
IW-3	12/8/04	13:10	12/9/04	7:45	1,595	2,742	1,147	5.0 - 9.0	1-2
IW-4	12/9/04	13:45	12/10/04	8:10	2,893	3,993	1,100	0.2 - 9.6	
IW-5	12/8/04	13:10	12/9/04	8:40	383	1,510	1,127	3.4 - 8.4	0-2
IW-6	12/9/04	13:45	12/10/04	7:50	1,665	2,765	1,100	0.9 - 15.8	
IW-7	12/8/04	13:10	12/9/04	8:40	222	1,390	1,168	0.6 - 10.4	0-2
IW-8	12/9/04	13:45	12/10/04	7:45	1,544	2,692	1,148	0.4 - 14.5	
IW-9	12/8/04	13:10	12/9/04	9:30	5,045	6,145	1,100	8.4	2
IW-10	12/9/04	13:45	12/9/04	16:35	6,295	7,395	1,100	6 - 9.5	
IW-11	12/8/04	13:10	12/9/04	9:30	38,854	39,954	1,100	3.1 - 12.4	2
IW-12	12/9/04	13:45	12/9/04	16:26	40,145	41,245	1,100	6.1 - 10.5	
IW-13	12/8/04	13:10	12/9/04	9:30	9,819	10,919	1,100	3.2 - 10	2
IW-14	12/9/04	13:45	12/9/04	16:04	11,070	12,170	1,100	8.1 - 8.4	
South Barrier									
IW-15	12/10/04	11:25	12/10/04	12:55	1,846	2,946	1,100	12	1-2
IW-16	12/9/04	13:45	12/9/04	15:28	596	1,696	1,100	12 - 12.8	
IW-17	12/10/04	11:26	12/10/04		1,472	2,572	1,100	10	1-2
IW-18	12/9/04	13:45	12/9/04	15:56	222	1,322	1,100	8.6	
IW-19	12/10/04	11:27	12/10/04		1,843	2,943	1,100	8	0-1
IW-20	12/9/04	13:45	12/9/04	16:07	585	1,692	1,107	9 - 11.5	
Central Barrier									
IW-21	12/13/04	9:50	12/10/04	13:02	2,767	3,949	1,182	6	
IW-22	12/13/04	16:10	12/14/04	9:15	4,108	5,208	1,100	8.4 - 10	2
IW-23	12/13/04	9:50	12/10/04	11:55	2,955	4,072	1,117	4.1 - 10	
IW-24	12/13/04	16:10	12/14/04	8:52	4,223	5,223	1,000	8.8 - 12	0
IW-25	12/13/04	9:50	12/10/04	12:11	4,151	5,251	1,100	4.4 - 10	
IW-26	12/13/04	16:10	12/13/04	9:12	5,402	6,502	1,100	6.3 - 10	1
IW-27	12/13/04	9:50	12/14/04	12:40	2,843	3,943	1,100	4.0 - 8.2	
IW-28	12/13/04	16:10	12/14/04	9:13	4,093	5,193	1,100	5.5 - 11	2
IW-29	12/14/04	11:02	12/14/04	12:55	5,344	6,444	1,100	10.2	2
IW-30	12/13/04	16:10	12/14/04	9:13	2,928	4,035	1,107	6.7 - 9	2
North Barrier									
IW-31	12/14/04	14:25	12/14/04	16:44	6,724	7,824	1,100	8	
IW-32	12/15/04	9:35	12/15/04	11:39	6,616	7,716	1,100	8.5	
IW-33	12/14/04	14:25	12/14/04	16:50	5,366	6,466	1,100	7	0
IW-34	12/15/04	9:35	12/15/04	11:40	6,690	7,790	1,100	8.2	
IW-35	12/14/04	14:25	12/14/04	16:43	5,440	6,540	1,100	8	0
IW-36	12/15/04	9:35	12/15/04	11:35	8,859	9,959	1,100	9.4	
IW-37	12/14/04	14:25	12/14/04	16:51	6,595	7,695	1,100	7	0
IW-38	12/15/04	9:35	12/15/04	11:56	7,845	8,945	1,100	7	
IW-39	12/14/04	14:25	12/14/04	16:27	7,545	8,708	1,163	10.2	0
IW-40	12/15/04	9:35	12/15/04	11:34	7,974	9,074	1,100	9.1	
MW-09S and MW-30D Areas									
IW-41	12/14/04	11:02	12/14/04	12:42	4,189	5,289	1,100	11.2 - 11.4	2.2
IW-42	12/14/04	11:02	12/14/04	12:13	5,474	6,574	1,100	17 - 18.2	1
IW-43	12/15/04	12:42	12/15/04	14:40	41,495	42,595	1,100	6 - 10	2
IW-44		12:42	12/15/04	14:43	12,420	13,521	1,101	7.2 - 9.5	2

TABLE 4
Injection Quantities
NAB Little Creek, Site 13, Southern Plume Area
December 8 -15, 2004

Well ID	IW-1	IW-2	IW-3	IW-4	IW-5	IW-6	IW-7	IW-8	IW-9	IW-10	IW-11
Dilute (4:1) EOS (gal.)	198	150	150	151	151	150	150	154	150	150	150
EOS Concentrate (lbs)	290	229	229	231	229	229	229	235	229	229	229
Water Chase (gal.)	1,102	960	1,147	1,100	1,127	1,100	1,168	1,148	1,100	1,100	1,100
Well ID	IW-12	IW-13	IW-14	IW-15	IW-16	IW-17	IW-18	IW-19	IW-20	IW-21	IW-22
Dilute (4:1) EOS (gal.)	150	150	151	150	151	150	150	150	154	150	150
EOS Concentrate (lbs)	229	229	229	229	231	229	229	229	235	229	229
Water Chase (gal.)	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,107	1,182	1,100
Well ID	IW-23	IW-24	IW-25	IW-26	IW-27	IW-28	IW-29	IW-30	IW-31	IW-32	IW-33
Dilute (4:1) EOS (gal.)	150	150	150	150	150	150	150	163	150	150	150
EOS Concentrate (lbs)	229	229	229	229	229	229	229	249	229	229	229
Water Chase (Gal.)	1,117	1,100	1,100	1,100	1,100	1,100	1,100	1,107	1,100	1,100	1,100
Well ID	IW-34	IW-35	IW-36	IW-37	IW-38	IW-39	IW-40	IW-41	IW-42	IW-43	IW-44
Dilute (4:1) EOS (gal.)	150	150	150	150	150	150	150	150	150	250	250
EOS Concentrate (lbs)	229	229	229	229	229	229	229	229	229	382	382
Water Chase (Gal.)	1,100	1,100	1,100	1,100	1,100	1,163	1,100	1,100	1,100	1,100	1,101

Totals	
Dilute (4:1) EOS	6,873 gallons
EOS Concentrate	10,479 lbs
Water Chase	48,629 gallons
Total Volume Injected	55,502 gallons

EOS Concentrate is weight of concentrated EOS emulsion injected.

Attachment E

DISTRIBUTION: WHITE AND YELLOW COPIES TO TANK FARM FOREMAN - BLUE COPY TO CUSTOMER - MANILA - DRIVERS BOOK

INDUSTRIAL MARINE SERVICES, INC. FORM #102 LIQUID
1301 MARSH STREET • P.O. BOX 1779
Norfolk, Virginia 23501 19352 L

EMERGENCY 24 HOUR telephone (757) 543-5718

DATE	TIME-IN	TIME OUT
1. 2-9-05		

NON-NEGOTIABLE TRUCK LOADING TICKET AND BILL OF LADING

This carrier certifies that the cargo tank supplied for this shipment is a proper container for the transportation of the commodity as described below.

The Shipper certifies the product is properly identified and labeled as indicated below in accordance with 49 CFR 172.101 and is not a hazardous waste according to 40 CFR 261 and VR672.10.1 (If cargo is HAZARDOUS WASTE contact HAZMAT Mgr. for Proper Manifest.)

2. JOB NUMBER	JOB NAME	JOB SUPERVISOR	TANK NO.
351.3734	CTO-026 Little Creek	D. Marsh	

3. CONSIGNED TO:

4. CONSIGNEE	ADDRESS	STATE
IMS Environmental	1301 Marsh St.	Norfolk, VA

5. CARRIER NAME: IMS Environmental

(*) Provide Technical Name for n.o.s. Materials

6 PRODUCT	HM	GALLONS	PRODUCT	HM	GALLONS
[redacted] DEM			[redacted] DEM		
[redacted]			[redacted]		
Non-Haz Water		6000 G	[redacted]		

7. RECEIVED BY	DATE	TIME	A.M. P.M.
Beaver	2-9-05		

8. THIS SALE NUMBER	GALLON READING FINISH	10Ths
12 drums		
THIS SALE NUMBER	GALLON READING FINISH	10Ths

9. METERED GALLONS

10. SHIPPER REPRESENTATIVE	DRIVER
Larry Fly (Print Name)	James Kinsler (Print Name)
Per (Signature)	Per (Signature)

DISTRIBUTION: WHITE AND YELLOW COPIES TO TANK FARM FOREMAN - BLUE COPY TO CUSTOMER - MANILA - DRIVERS BOOK

INDUSTRIAL MARINE SERVICES, INC.

FORM #102 LIQUID

1301 MARSH STREET • P.O. BOX 1779
Norfolk, Virginia 23501

19380 L

EMERGENCY 24 HOUR telephone (757) 543-5718

	DATE	TIME-IN	TIME OUT
1.	11/30/04		

NON-NEGOTIABLE TRUCK LOADING TICKET AND BILL OF LADING

This carrier certifies that the cargo tank supplied for this shipment is a proper container for the transportation of the commodity as described below.

The Shipper certifies the product is properly identified and labeled as indicated below in accordance with 49 CFR 172.101 and is not a hazardous waste according to 40 CFR 261 and VR672.10.1 (if cargo is HAZARDOUS WASTE contact HAZMAT Mgr. for Proper Manifest.)

2. JOB NUMBER	JOB NAME	JOB SUPERVISOR	TANK NO.
351.3709	CHEM HILL CTO 158	D. Moore	

3. CONSIGNED TO:

IMS-E 1301 Marsh St Norfolk VA

4. CONSIGNEE ADDRESS STATE

NAB Little Creek

5. CARRIER NAME: IMS

(*) Provide Technical Name for n.o.s. Materials

6. PRODUCT	HM	GALLONS	PRODUCT	HM	GALLONS
Petroleum oil, n.o.s. 3 NA 1270 PG III (Flammable Liquid)(*) DEA			Gasoline 3 UN 1203 PG II		
Petroleum oil, n.o.s. 3 NA 1270 PG III (Combustible Liquid)			Fuel oil (or) Flammable liq. n.o.s. 3 UN 1993 PG III (Flammable Liquid) (*)		
Non-haz water		250 G	Fuel oil (or) Combustible liq. n.o.s. 3 NA 1993 PG III (Combustible Liquid)		

7. RECEIVED BY	DATE	TIME	A.M. P.M.

8. THIS SALE NUMBER	GALLON READING FINISH	10Ths
V 5 Drums	V	
^	^	
THIS SALE NUMBER	GALLON READING FINISH	10Ths

9. METERED GALLONS

10. SHIPPER REPRESENTATIVE	DRIVER
Jon Fry	T. Duke
(Print Name)	(Print Name)
Per (Signature)	Per (Signature)

FORM # 102 LIQUID

Soilex Corporation
Post Office Box 1444
Chesapeake, VA 23327
(757) 549-8448
FAX: (757) 549-6668

NON-HAZARDOUS SHIPPING MANIFEST

MANIFEST NO. 3711-01

GENERATOR

NAME NAB Little Creek

TELEPHONE 887-4933

ADDRESS 1450 Gator Blvd / Bldg 3165

CITY Norfolk ~~Va Beach~~

STATE VA

SHIPMENT ORIGIN TO-0026

CITY Norfolk ~~Va Beach~~

STATE VA

AUTHORIZED AGENT

FIRM

ADDRESS

OTHER

MATERIAL CHARACTERIZATION

ACTIVITY GENERATING THIS MATERIAL: UST/AST REMOVAL _____ OTHER Drum Waste

PETROLEUM TYPE (S): VIRGIN PRODUCT X NON-VIRGIN PRODUCT _____

PHYSICAL STATE: STOCKPILED _____ EXCAVATING _____ DRUMS 5 OTHER _____

HANDLING INSTRUCTIONS: **Transport To Facility Designated Below**

FIRE OR SPILL INSTRUCTIONS: **Non-Flammable / Non-Hazardous**

DESTINATION:

I hereby certify, to the best of my knowledge, the material characterized above is non-hazardous as defined by the Virginia Hazardous Waste Management Regulations, Federal Regulations under Subtitle C – RCRA, U.S. Department of Transportation, or local/state of origin regulations.

[illegible] / NAVY
Signature of Generator / Agent

Luca Bhy / 11-30-04
Printed Name / Date

TRANSPORTER

TRANSPORTER NAME IMS Environmental

TELEPHONE 512-5717

TRUCK NO. 50

I certify that the materials described above were received by me for shipment and delivered to the designated facility.

[illegible] 11-30-04
Transporter Signature / Date

FACILITY

I certify that the materials described above were delivered to the facility and received by me.

ACCEPTED BY _____ DATE _____

REASONS FOR REJECTION _____

Gross Weight	
Tare Weight	
Net Weight	
Tons	

CUSTOMER

Appendix B
Analytical Results

Appendix B
Treatability Study Analytical Data and Field Parameters
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

Station ID	LS13-MW03T							LS13-MW06S							LS13-MW09S							LS13-MW11D						
Sample Date	10/26/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/27/04	01/05/05	02/28/05	05/10/05	07/07/05	09/07/05	01/11/06	10/28/04	01/05/05	02/28/05	05/10/05	07/07/05	09/07/05	01/11/06	10/27/04	01/05/05	03/01/05	05/10/05	07/07/05	09/07/05	01/11/06
Chemical Name																												
Volatile Organic Compounds (UG/L)																												
1,1,1-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.18 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.24 J	0.5 U	0.2 J	0.25 J	0.5 U	0.5 U	0.34 J	0.44 J	0.5 U	0.51 J	0.88	25 U	5	84 U	0.23 J	0.5 U	0.15 J	0.13 J	0.11 J	0.5 U	0.5 U
1,2,3-Trichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.11 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.19 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dibromo-3-chloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dibromoethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,3-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,4-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.14 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	16	5 U	5 U	5 U	13 U	5 U	4.2 J	21 U	2.4 J	250 U	5 U	240 J	5 U	2.4 J	5 U	5 U	5 U	5 U	5 U
2-Hexanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	13 U	5 U	5 U	21 U	5 U	250 U	5 U	840 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	13 U	5 U	5 U	21 U	5 U	250 U	5 U	840 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	5 U	2.5 B	3.2 B	2.7 B	5 U	5 U	5 U	5 U	5 U	12 B	7.3 B	4.6 J	2.4 J	13 B	5 U	19 B	21 U	11 B	250 U	9.3	1,200 B	2.4 B	5 U	3.6 B	4.8 B	4.7 J	5 U	5 U
Benzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.14 J	0.13 J	0.13 J	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.16 J	25 U	0.36 J	84 U	0.5 U	0.5 U	0.15 J	0.11 J	0.13 J	0.5 U	0.5 U
Bromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.52	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromodichloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	0.5 U	0.37 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	38 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon disulfide	0.39 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.21 J	0.5 U	0.75	0.36 J	0.5 U	0.5 U	1.3 U	0.5 U	1.6 J	2 J	0.26 J	25 U	0.17 J	84 U	0.81	0.15 J	0.29 J	0.22 J	0.5 U	0.5 U	0.5 U
Carbon tetrachloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.39 J	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.81	25 U	0.5 U	84 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.69	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	6.5	2.6	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cumene	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.11 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (Freon-12)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.36 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.45 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.4 J	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.19 J	0.5 U	0.5 U
Methyl acetate	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	1.1	3.9	0.5 U	1.6	1.3 U	0.5 U	7.4 J	5	0.5 U	25 U	1.2	84 U	0.5 U	0.5 UJ	1.2	0.5 U	4.6	0.5 U	0.5 U
Methyl-tert-butyl ether (MTBE)	0.78	1.9 J	0.14 J	0.8	0.94	1.2	0.39 J	2.3	6.8 J	2.6	1.3	3.3	1.5	0.63 J	1.9	0.29 J	0.88 J	7.5	25 U	1.9	84 U	0.49 J	1.5 J	9	5.3	8.5	5	8.8
Methylcyclohexane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylene chloride	0.14 B	0.5 U	0.11 B	2.3	0.48 B	0.5 U	0.5 U	0.13 B	0.5 U	2.9	0.17 B	0.54 B	0.5 U	1.3 U	0.29 B	7.4 J	1.1 B	0.1 B	25 U	0.26 J	84 U	0.2 B	0.5 U	0.5 U	0.19 B	0.6 B	0.5 U	0.5 U
Styrene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Tetrachloroethene	3.2	2.5 J	0.51	0.93	0.72	1.2	0.25 J	6.5	12	4.1	0.96	0.55	0.33 J	1.3 U	40	9.5	2 J	0.37 J	6.3 J	0.15 J	84 U	18	4.2	1.6	0.5 U	0.34 J	0.61	5.2
Toluene	0.11 B	0.5 U	0.24 B	0.19 B	0.14 J	0.5 U	0.5 U	0.5 U	0.11 B	0.29 B	0.11 J	0.13 J	0.5 U	0.31 J	0.14 B	0.25 B	0.67 B	0.16 J	25 U	0.15 J	84 U	0.16 B	0.16 B	0.33 B	0.11 J	0.19 J	0.5 U	0.5 U
Trichloroethene	5.1	4.1	0.2 B	1.7	1.1	2.9	0.43 J	12	24	8.6	15	0.95	1.3	1.3 U	63	9	2.4	10	38	3.1	84 U	10	2.4	0.76	0.17 J	0.24 J	0.25 J	8.9
Trichlorofluoromethane(Freon-11)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.11 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl chloride	2.2 J	0.28 J	0.5 U	0.66	0.29 J	1.8	0.5 U	0.99 J	1.8	1.2	2.5	1.1	5.8	10	12 J	2.4 J	15	25 R	65	160	61 J	1.3 J	0.21 J	0.61	0.5 U	0.5 U	0.47 J	0.69
Xylene, total	0.5 U	0.5 U	0.5 U	0.5 U	1.3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.1	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.55	0.5 U	0.5 U
cis-1,2-Dichloroethene	8.6	9	0.1 J	4.5	2.4	11	0.92 J	8.9	24	11	13	18	31	110	93	6.3	58	150	470	1,300	1,900	4.3	1.3	22	18	10	7.2	10
cis-1,3-Dichloropropene	0.5 U	0.15 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.11 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,2-Dichloroethene	0.13 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.36 J	2.5	0.76	0.99	0.52	1.2	0.66 J	2.1	0.26 J	0.62 J	1.6	25 U	11	84 U	0.16 J	0.5 U	0.12 J	0.11 J	0.5 U	0.5 U	0.16 J
trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U	0.5 U	2.1 U	0.5 U	25 U	0.5 U	84 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Notes:
U- Analyte not detected
J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is imprecise
UL- Analyte not detected. Quantitation limit is higher
R- Unreliable result
NA- Not analyzed

Appendix B
Treatability Study Analytical Data and Field Parameters
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

Station ID	LS13-MW14T							LS13-MW18T							LS13-MW21S	LS13-MW26S						LS13-MW28D						
Sample Date	10/26/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/27/04	01/05/05	03/01/05	05/10/05	07/07/05	09/07/05	01/11/06	10/28/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/26/04	12/21/04	03/01/05	05/09/05	07/07/05	09/06/05	01/10/06
Chemical Name																												
Volatile Organic Compounds (UG/L)																												
1,1,1-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.15 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.24 J	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.18 J	0.5 U	0.21 J	0.73 J	0.5 U	0.5 U	0.5 UJ
1,2,3-Trichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,2-Dibromo-3-chloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,2-Dibromoethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,3-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
1,4-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 J	0.49 J	1.1 J	0.51	1.4	2.3
2-Butanone	5 U	8.6	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1.3 J	20	5 U	21 U	5 U	5 U	5 U
2-Hexanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	21 U	5 U	5 U	5 U
4-Methyl-2-pentanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	21 U	5 U	5 U	5 U
Acetone	5 U	220	14 B	3.5 B	7.8	5 U	5 U	5 U	5 U	3 B	2.6 B	5 U	3.2 J	5 U	3.3 B	8.4 B	4.4 B	4.6 B	7.9	5 U	2.3 B	4.3 B	390	2.3 B	14 B	5 U	2.5 J	5 U
Benzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J	0.5 U	0.13 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.18 J	0.45 J	0.2 J	0.22 J	0.5 U
Bromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Bromodichloromethane	0.5 U	0.64	0.14 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.36 J	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Bromoform	0.5 U	0.23 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.25 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.37 J	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Carbon disulfide	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.76	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.13 J	0.15 J	0.34 J	0.5 U	0.5 U	0.5 U	0.39 J	0.93 J	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Carbon tetrachloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.72	0.64	0.89	0.53	0.61	0.57	0.31 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J	0.26 J	0.53	1.5	3.3	2	3.4	7.5
Chloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Chloroform	0.5 U	2.5	0.47 J	0.18 J	0.5 U	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.62	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.74	1.9	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Chloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U	0.14 J	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Cumene	0.11 J	0.5 UJ	0.5 U	0.5 U	0.29 J	0.5 U	0.13 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.11 J	0.05 UJ	0.5 U	0.5 U	0.5 U	0.5 U	5.7	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.32 J
Cyclohexane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (Freon-12)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.46 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.13 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.25 J	0.5 U	2	0.5 U	0.5 U	0.12 J	2.1 U	0.36 J	0.5 U	0.2 J
Methyl acetate	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.5	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Methyl-tert-butyl ether (MTBE)	3.6	0.5 UJ	1	1.4	0.97	0.57	0.61	0.5 U	0.5 U	0.5 U	0.5 U	0.21 J	0.31 J	0.5 U	0.27 J	0.15 J	0.5 U	0.11 J	0.5 U	0.5 U	0.19 J	0.4 J	0.5 U	0.16 J	2.1 U	0.21 J	0.17 J	0.12 J
Methylcyclohexane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Methylene chloride	0.13 B	0.15 B	0.1 B	0.22 B	0.54 B	0.5 U	0.5 U	0.21 B	0.5 U	0.27 B	0.22 B	0.49 B	0.5 U	0.5 U	0.27 B	0.5 U	0.11 B	2 B	0.51 B	0.5 U	0.5 U	0.28 B	0.15 B	0.5 U	1.5 B	0.56 B	0.5 U	0.5 U
Styrene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Tetrachloroethene	0.14 J	0.95 J	0.81	0.11 J	0.5 U	0.5 U	0.16 J	9.8	8.7	7.9	4.5	4.5	4.5	4.2	0.5 U	0.56 J	0.66	0.5 U	0.5 U	0.5 U	0.5 U	6.3	1.5	1.9	18	1.1	0.31 J	0.5 U
Toluene	0.5 U	0.17 B	0.1 B	0.5 U	0.11 J	0.5 U	0.5 U	0.11 B	0.2 B	0.25 B	0.5 U	0.13 J	0.5 U	0.5 U	0.13 B	0.5 U	0.18 B	0.21 B	0.12 J	0.5 U	0.12 J	0.14 B	0.12 B	0.19 B	2.1 U	0.16 J	0.5 U	0.5 U
Trichloroethene	0.26 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.4	2.1	1.7	1.2	1.2	1.1	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	8	1.6	2.7	15	1.5	0.49 J	0.34 J
Trichlorofluoromethane(Freon-11)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U
Vinyl chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.47 J	0.5 U	0.22 J	0.5 U	0.24 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	4.2 J	2.7	17	49	9	5.3	1.3
Xylene, total	0.11 J	0.5 U	0.5 U	0.5 U	1.6	0.5 U	0.23 J	0.5 U	0.5 U	0.5 U	0.5 U	0.27 J	0.5 U	0.5 U	0.14 J	0.5 U	0.5 U	0.5 U	0.76	0.5 U	27	0.5 U	0.5 U	0.5 U	2.1 U	1	0.5 U	0.5 U
cis-1,2-Dichloroethene	0.72	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U	0.81 J	2.4	1.7	1.5	1.2	1.3	1.2	0.96	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	9.8	3.2	5.3	18	4.2	1.3	0.77 J
cis-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 B	0.5 U	0.44 J	0.5 U	0.5 U	0.5 U
trans-1,2-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.14 J	0.5 U	0.1 J	2.1 U	0.13 J	0.5 U	0.5 UJ
trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.1 U	0.5 U	0.5 U	0.5 U

Notes:
U- Analyte not detected
J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is impreci
UL- Analyte not detected. Quantitation limit is higher
R- Unreliable result
NA- Not analyzed

Appendix B
Treatability Study Analytical Data and Field Parameters
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

Station ID	LS13-MW29D							LS13-MW30D							
Sample Date	10/27/04	12/21/04	03/01/05	05/09/05	07/07/05	09/07/05	01/10/06	10/27/04	01/05/05	03/01/05	05/09/05	07/07/05	09/07/05	01/10/06	01/10/06
Chemical Name															
Volatile Organic Compounds (UG/L)															
1,1,1-Trichloroethane	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.26 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.11 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	0.5 U	0.5 U	0.2 J	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ
1,2,3-Trichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dibromo-3-chloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dibromoethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.16 J	0.13 J
1,2-Dichloroethane	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,3-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,4-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	5 U	5 U	9.4	5 U	5 U	5 U	5 U	5 U	51	1.1 J	5 U	5 U	5 U	5 U	5 U
2-Hexanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	7.3 B	2.2 B	9 B	3.7 B	5 U	3.2 J	5 U	4.3 B	13 B	5 U	3.2 B	5 U	3.4 J	2.2 B	2.2 B
Benzene	0.5 U	0.5 U	0.15 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromodichloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	0.5 U	0.31 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon disulfide	0.5 U	0.5 U	0.26 J	0.5 U	0.5 U	0.5 U	0.5 U	0.27 J	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon tetrachloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	5.3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	9.1	2.4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	0.5 U	0.5 U	0.18 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cumene	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (Freon-12)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.25 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methyl acetate	0.5 U	0.5 UJ	3.4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.27 J	0.5 U	0.5 U	3.2	1.8	0.5 U	0.5 U
Methyl-tert-butyl ether (MTBE)	1	1.4 J	2.4	1.3	1.6	0.81	0.99	2.1	1.3	1.1	1.6	0.98	0.7	0.65	0.64
Methylcyclohexane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylene chloride	0.47 B	0.5 U	0.22 B	2.1 B	0.29 B	0.5 U	0.5 U	0.3 B	0.24 B	0.15 B	0.28 B	0.5 U	0.5 U	0.5 U	0.5 U
Styrene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Tetrachloroethene	3.7	3.6 J	1.2	3.3	2.4	1.8	3	4.3	6.7	5	0.5 U	0.25 J	0.39 J	0.25 J	0.61
Toluene	0.14 B	0.5 U	0.16 B	0.21 B	0.11 J	0.5 U	0.5 U	0.13 B	0.21 B	0.11 B	0.5 U	0.19 J	0.12 J	0.11 J	0.12 J
Trichloroethene	0.59	0.51	0.22 B	0.52	0.4 J	0.28 J	0.41 J	1.4	1.5	0.64 B	0.5 U	0.1 J	0.13 J	0.45 J	0.66
Trichlorofluoromethane(Freon-11)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl chloride	0.5 UJ	0.5 U	0.18 J	0.5 U	0.5 U	0.5 U	0.5 U	0.23 J	0.5 U	0.5 U	0.15 J	0.11 J	0.5 U	0.5 U	0.5 U
Xylene, total	0.5 U	0.5 U	0.5 U	0.5 U	0.71	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	0.28 J	0.31 J	11	0.24 J	0.29 J	0.28 J	0.23 J	1.6	1.9	0.36 J	6.8	3.3	3.2	4 J	5.2 J
cis-1,3-Dichloropropene	0.5 U	0.14 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.11 B	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,2-Dichloroethene	0.5 U	0.5 U	0.11 J	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ
trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Notes:
U- Analyte not detected
J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is impreci
UL- Analyte not detected. Quantitation limit is higher
R- Unreliable result
NA- Not analyzed

Appendix B
Treatability Study Analytical Data and Field Parameters
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

Station ID	LS13-MW03T							LS13-MW06S							LS13-MW09S							LS13-MW11D						
Sample Date	10/26/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/27/04	01/05/05	02/28/05	05/10/05	07/07/05	09/07/05	01/11/06	10/28/04	01/05/05	02/28/05	05/10/05	07/07/05	09/07/05	01/11/06	10/27/04	01/05/05	03/01/05	05/10/05	07/07/05	09/07/05	01/11/06
Chemical Name																												
Semi-volatile Organic Compounds (UG/L)																												
1,1-Biphenyl	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
1,2,4,5-Tetrachlorobenzene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
2,4,5-Trichlorophenol	21 U	20 U	20 U	22 U	20 U	20 U	22 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	21 U	20 U	20 U	20 U	80 U	20 U	22 U
2,4,6-Trichlorophenol	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
2,4-Dichlorophenol	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
2,4-Dimethylphenol	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
2,4-Dinitrophenol	21 U	20 UJ	20 U	22 U	20 U	20 U	22 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	21 U	20 U	20 U	20 U	80 U	20 U	22 U
2,4-Dinitrotoluene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
2,6-Dinitrotoluene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	3.6 J	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
2-Chloronaphthalene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
2-Chlorophenol	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
2-Methylnaphthalene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
2-Methylphenol	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6.1	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
2-Nitroaniline	21 U	20 U	20 U	22 U	20 U	20 U	22 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	21 U	20 U	20 U	20 U	80 U	20 U	22 U
2-Nitrophenol	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
3,3'-Dichlorobenzidine	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	47 R	5 U	5 U	5 R	5 U	5 R	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
3-Nitroaniline	21 U	20 U	20 U	22 U	20 U	20 U	22 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	21 U	20 U	20 U	20 U	80 U	20 U	22 U
4,6-Dinitro-2-methylphenol	21 U	20 U	20 U	22 U	20 U	20 U	22 U	20 U	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U	20 UJ	20 U	20 U	20 U	20 U	20 U	21 U	20 UJ	20 U	20 U	80 U	20 U	22 UJ
4-Bromophenyl-phenylether	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
4-Chloro-3-methylphenol	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
4-Chloroaniline	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	47 R	5 U	5 U	5 R	5 U	5 R	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
4-Chlorophenyl-phenylether	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
4-Methylphenol	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	420	120 J	57	4.1 J	5 U	5 U	470	290	46 J	58	88	21	5.3 U	5 U	76	110	120	3.8 J	5.4 U
4-Nitroaniline	21 U	20 U	20 U	22 U	20 U	20 U	22 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	21 U	20 U	20 U	20 U	80 U	20 U	22 U
4-Nitrophenol	21 U	20 U	20 U	22 U	20 U	20 U	22 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	21 U	20 U	20 U	20 U	80 U	20 U	22 U
Acenaphthene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5.3 U	5 UJ	5 U	5 U	20 U	5 U	5.4 U
Acenaphthylene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Acetophenone	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Anthracene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Atrazine	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Benzaldehyde	5.1 U	5 UJ	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Benzo(a)anthracene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Benzo(a)pyrene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Benzo(b)fluoranthene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Benzo(g,h,i)perylene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Benzo(k)fluoranthene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Butylbenzylphthalate	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Caprolactam	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Chrysene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Di-n-butylphthalate	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Di-n-octylphthalate	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Dibenz(a,h)anthracene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Dibenzofuran	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Diethylphthalate	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Dimethyl phthalate	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Fluoranthene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Fluorene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Hexachlorobenzene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Hexachlorobutadiene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Hexachlorocyclopentadiene	5.1 U	5 UJ	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	47 R	5 U	5 U	5 R	5 U	5 R	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Hexachloroethane	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Indeno(1,2,3-cd)pyrene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Isophorone	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Naphthalene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Nitrobenzene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Pentachlorophenol	77 J	4.4 J	5 U	5.6 U	5 U	5 U	5.6 U	200 J	51 J	20	5 U	11 J	5 U	5 U	53 J	5.4 J	5 U	5 U	5 U	5 U	5 U	5.4 J	5 U	5 U	5 U	20 U	5 U	5.4 U
Phenanthrene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
Phenol	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2.4 J	10	4.6 J	5 U	5.3 U	5 U	5 U	5 U	8.5 J	2.1 J	5.4 U
Pyrene	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
bis(2-Chloro-1-methylethyl) ether	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
bis(2-Chloroethoxy)methane	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
bis(2-Chloroethyl)ether	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
bis(2-Ethylhexyl)phthalate	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	6.7	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	32	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
n-Nitroso-di-n-propylamine	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U
n-Nitrosodiphenylamine	5.1 U	5 U	5 U	5.6 U	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	20 U	5 U	5.4 U

Notes:
U- Analyte not detected
J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is imprecise
UL- Analyte not detected. Quantitation limit is higher
R- Unreliable result
NA- Not analyzed

Appendix B
Treatability Study Analytical Data and Field Parameters
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

Station ID	LS13-MW14T							LS13-MW18T							LS13-MW21S	LS13-MW26S						LS13-MW28D						
Sample Date	10/26/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/27/04	01/05/05	03/01/05	05/10/05	07/07/05	09/07/05	01/11/06	10/28/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/26/04	12/21/04	03/01/05	05/09/05	07/07/05	09/06/05	01/10/06
Chemical Name																												
Semi-volatile Organic Compounds (UG/L)																												
1,1-Biphenyl	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1.4 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4,5-Tetrachlorobenzene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,4,5-Trichlorophenol	20 U	20 U	20 U	57 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
2,4,6-Trichlorophenol	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,4-Dichlorophenol	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,4-Dimethylphenol	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,4-Dinitrophenol	20 U	20 UJ	20 U	57 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U	20 UJ	20 U	20 U	20 U	20 U	20 U
2,4-Dinitrotoluene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,6-Dinitrotoluene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Chloronaphthalene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Chlorophenol	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Methylnaphthalene	10	5 U	5 U	14 U	3.7 J	5 U	1.7 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	35	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Methylphenol	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Nitroaniline	20 U	20 U	20 U	57 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
2-Nitrophenol	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
3,3'-Dichlorobenzidine	5 U	5 R	5 U	14 U	23 R	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 R	5 U	5 U	5 U	5 U	5 U	5 U	5 R	5 U	5 U	5 U	5 U	5 U
3-Nitroaniline	20 U	20 U	20 U	57 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
4,6-Dinitro-2-methylphenol	20 U	20 U	20 U	57 U	20 U	20 U	20 U	20 U	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
4-Bromophenyl-phenylether	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Chloro-3-methylphenol	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Chloroaniline	5 U	5 R	5 U	14 U	23 R	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 R	5 U	5 U	5 U	5 U	5 U	5 U	5 R	5 U	5 U	5 U	5 U	5 U
4-Chlorophenyl-phenylether	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methylphenol	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Nitroaniline	20 U	20 U	20 U	57 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
4-Nitrophenol	20 U	20 U	20 U	57 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Acenaphthene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acenaphthylene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetophenone	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Anthracene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U
Atrazine	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzaldehyde	5 U	5 UJ	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U
Benzo(a)anthracene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzo(a)pyrene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U
Benzo(b)fluoranthene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U
Benzo(g,h,i)perylene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U
Benzo(k)fluoranthene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U
Butylbenzylphthalate	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Caprolactam	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	19	13	2.7 J	5 U	5 U	5 U	5 U
Chrysene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Di-n-butylphthalate	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Di-n-octylphthalate	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibenz(a,h)anthracene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U
Dibenzofuran	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U
Diethylphthalate	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dimethyl phthalate	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Fluoranthene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Fluorene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Hexachlorobenzene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Hexachlorobutadiene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Hexachlorocyclopentadiene	5 U	5 R	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 R	5 U	5 U	5 U	5 U	5 U	5 U	5 R	5 U	5 U	5 U	5 U	5 U
Hexachloroethane	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Indeno(1,2,3-cd)pyrene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U
Isophorone	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	13	5 U	5 U	14 U	3.4 J	5 U	1.7 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	68	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Nitrobenzene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Pentachlorophenol	630 J	5.1	210	99	210 J	160	64	5 U	5 U	5 U	5 U	5 U	5 U	5 U	50 J	48	34	60	57 J	110	1,500	14 J	5 U	5 U	2.7 J	10 J	7.1	5 U
Phenanthrene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U
Phenol	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Pyrene	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
bis(2-Chloro-1-methylethyl) ether	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
bis(2-Chloroethoxy)methane	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
bis(2-Chloroethyl)ether	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
bis(2-Ethylhexyl)phthalate	5 U	5 U	5 U	14 U	5 U	4.8 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
n-Nitroso-di-n-propylamine	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
n-Nitrosodiphenylamine	5 U	5 U	5 U	14 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U

Notes:
U- Analyte not detected
J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is impreci
UL- Analyte not detected. Quantitation limit is higher
R- Unreliable result
NA- Not analyzed

Appendix B
Treatability Study Analytical Data and Field Parameters
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

Station ID	LS13-MW29D							LS13-MW30D							
Sample Date	10/27/04	12/21/04	03/01/05	05/09/05	07/07/05	09/07/05	01/10/06	10/27/04	01/05/05	03/01/05	05/09/05	07/07/05	09/07/05	01/10/06	01/10/06
Chemical Name															
Semi-volatile Organic Compounds (UG/L)															
1,1-Biphenyl	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4,5-Tetrachlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,4,5-Trichlorophenol	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
2,4,6-Trichlorophenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,4-Dichlorophenol	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,4-Dimethylphenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,4-Dinitrophenol	20 U	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
2,4-Dinitrotoluene	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,6-Dinitrotoluene	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Chloronaphthalene	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Chlorophenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Methylnaphthalene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Methylphenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	7.1	5 U	5 U	5 U	5 U	5 U	5 U
2-Nitroaniline	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
2-Nitrophenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
3,3'-Dichlorobenzidine	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	60 R	5 U	5 U	5 U	5 U	5 U	5 U
3-Nitroaniline	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
4,6-Dinitro-2-methylphenol	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U
4-Bromophenyl-phenylether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Chloro-3-methylphenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Chloroaniline	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	60 R	5 U	5 U	5 U	5 U	5 U	5 U
4-Chlorophenyl-phenylether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methylphenol	5 U	5 U	5 U	5 U	5 U	38	5 U	5 U	470	300	5 U	22	5 U	6.3	4.4 J
4-Nitroaniline	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
4-Nitrophenol	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Acenaphthene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U
Acenaphthylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetophenone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	3.6 J	5 U	5 U	5 U	5 U	5 U	5 U
Anthracene	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Atrazine	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzaldehyde	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzo(a)anthracene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzo(a)pyrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzo(b)fluoranthene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzo(g,h,i)perylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzo(k)fluoranthene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Butylbenzylphthalate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Caprolactam	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	18	22
Chrysene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Di-n-butylphthalate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Di-n-octylphthalate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibenz(a,h)anthracene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibenzofuran	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Diethylphthalate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dimethyl phthalate	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Fluoranthene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Fluorene	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Hexachlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Hexachlorobutadiene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Hexachlorocyclopentadiene	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	60 R	5 U	5 U	5 U	5 U	5 U	5 U
Hexachloroethane	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Indeno(1,2,3-cd)pyrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Isophorone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Nitrobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Pentachlorophenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	21 J	49 J	5 U	5 U	5 U	5 U	5 U	5 U
Phenanthrene	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Phenol	5 U	5 U	5 U	5 U	5 U	2.3 J	5 U	5 U	5 U	5 U	5 U	1.7 J	5 U	5 U	5 U
Pyrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
bis(2-Chloro-1-methylethyl) ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
bis(2-Chloroethoxy)methane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
bis(2-Chloroethyl)ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
bis(2-Ethylhexyl)phthalate	5 U	5 U	5 U	4.4 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4.4 J	5 U	5 U
n-Nitroso-di-n-propylamine	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
n-Nitrosodiphenylamine	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

Notes:
U- Analyte not detected
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UJ- Analyte not detected. Quantitation limit is impreci
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Appendix B
Treatability Study Analytical Data and Field Parameters
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

Station ID	LS13-MW03T							LS13-MW06S							LS13-MW09S							LS13-MW11D						
Sample Date	10/26/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/27/04	01/05/05	02/28/05	05/10/05	07/07/05	09/07/05	01/11/06	10/28/04	01/05/05	02/28/05	05/10/05	07/07/05	09/07/05	01/11/06	10/27/04	01/05/05	03/01/05	05/10/05	07/07/05	09/07/05	01/11/06
Chemical Name																												
Pesticide/Polychlorinated Biphenyls (UG/L)																												
4,4'-DDD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aldrin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin ketone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
alpha-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
gamma-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)																												
Aluminum	824	495	762	35 B	32.9 B	45 B	55.7 B	217	376	157 B	19.1 B	39.3 B	10,300	43.3 B	613	204	225	85.7 B	102 J	199 J	142 B	131 J	169 B	162 B	26.1 B	101 J	127 B	35.1 B
Antimony	2 U	2 U	3.5 B	1.3 U	3.7 U	1.7 U	2.5 U	2 U	2.8 U	4.6 B	3.3 J	3.7 U	1.7 U	4 J	2 U	2.8 U	5.1 B	2.9 J	4.3 B	1.7 U	6.8 J	2 U	2.8 U	3.6 B	1.3 U	3.7 U	1.7 U	2.5 U
Arsenic	1.8 U	1.8 U	2.1 U	1.6 U	3.7 U	1.9 U	3.6 U	1.8 U	2.9 U	4.9 B	6.3 J	9.8 J	14.6	13.8	1.8 U	3.7 B	20.3	23.6	26.7	34.4	33.1	1.8 U	2.9 U	14.3	13.9	22.3	6.9 J	9.9 J
Barium	33.5 J	46.7 B	3.1 B	49.7 J	40.5 J	55.2 J	27 J	11.9 J	13.1 B	10.3 B	22.8 J	13.1 J	81.7 J	18.1 J	10.7 J	33.1 B	29.1 B	13.5 J	14 J	17.7 J	16.9 J	21.7 J	25 B	36 B	40.3 J	75.9 J	52.4 J	36.4 J
Beryllium	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.59 J	0.55 B	0.1 U	0.3 U	0.1 U	0.1 U	0.1 U	1.2 J	0.49 B	0.1 U	0.38 B	0.1 U	0.1 U	0.1 U	0.79 B	0.71 B	0.1 U	0.3 U	0.1 U	0.1 U	0.1 U	0.81 B	0.48 B
Cadmium	1.3 J	3 B	2.3 B	1.3 J	1 J	2.2 J	0.73 B	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	0.2 U	0.3 U	0.2 J	0.46 B	1.2 B	0.2 U	0.5 U	0.2 U	0.3 U	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	2.6 J	0.3 U
Calcium	21,400	24,800	9,870	25,600	23,200	21,400	13,800	9,520	10,600	34,600	44,300	24,300	27,300	39,100	7,360	13,900	22,300	18,000	16,300	15,400	12,700	15,700	23,600	33,500	46,200	76,100	36,300	30,000
Chromium	1.7 J	1.4 B	3.5 B	0.84 J	1.1 U	0.62 J	0.9 U	0.5 U	0.91 B	0.6 U	0.8 U	1.1 U	10.5	0.9 U	0.97 J	1.2 B	0.6 U	0.8 U	1.1 U	0.6 U	0.9 U	0.54 J	0.7 U	0.6 U	0.8 U	1.1 U	0.6 U	0.9 U
Cobalt	2.1 J	7.5 B	1.1 B	1.1 J	1.1 U	4.7 J	5.5 J	7.3 J	8.8 B	15.5 B	18 J	8.1 J	21.7 J	22.9 J	3.1 J	18.8 B	16.9 B	7.9 J	8.2 J	11.2 J	22 J	2.8 J	0.85 B	12.6 B	14.9 J	23 J	9.6 J	6.7 J
Copper	12.8 J	48.2	21.6 B	4.2 J	8.1 J	18 J	8.2 J	1.7 B	1.1 B	3.4 B	3.1 J	1.7 J	21.3 J	0.81 J	0.5 U	2 B	2.8 B	4.1 J	1.7 J	1.6 J	2 J	0.5 U	3.5 B	4.4 B	3.9 J	1.4 J	0.5 U	0.5 U
Cyanide	1.6 U	1.6 U	0.8 U	0.8 U	0.8 U	2.8 U	0.7 U	1.6 U	1.6 U	0.8 U	0.8 U	0.8 U	2.8 U	0.7 U	1.6 U	1.6 U	0.8 U	0.8 U	0.8 U	2.8 U	2.4 B	1.6 U	1.7 B	0.8 U	0.8 U	1.8 J	2.8 U	0.7 U
Iron	4,870	3,890	3,860	154 B	256	1,450	992	20,500	8,320	89,600	130,000	58,300	146,000	123,000	4,070	19,900	150,000	114,000	128,000	140,000	201,000	1,010	226	16,300	32,200	58,800	809	12,600
Lead	12.5	9.2	13.3	1.2 U	1.6 U	2.1 J	1.7 U	1.9 J	1.7 U	1.8 B	1.2 U	2.3 J	12.7	1.7 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1.7 J	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1.7 J
Magnesium	4,050 J	3,330 B	516 B	3,210 J	3,460 J	2,850 J	2,080 J	4,030 J	4,590 B	20,000	18,500	11,800	12,600	16,600	5,380	10,800	17,700	14,900	12,000	10,200	10,900	4,140 J	2,830 B	11,000	19,200	35,100	4,710 J	12,400
Manganese	283	203	55.5	89.6	93.6	138	59.9	546	583	2,650	3,750	3,890	3,420	3,040	1,000	2,440	2,090	1,050	1,100	1,560	1,760	506	134	2,780	5,610	8,660	355	2,540
Mercury	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	6.5 J	9.4 B	4.7 B	2.7 J	1.7 J	4.8 J	3.8 J	0.54 J	0.7 U	0.8 U	0.8 U	1.3 U	4.9 J	1 U	0.64 J	3 B	0.8 U	1.4 J	1.3 U	4.3 J	1.3 J	3 J	2.7 B	3.9 B	2.1 J	4.8 J	8.5 J	3.2 J
Potassium	1,060 J	1,230 B	332 B	1,340 J	1,500 J	1,190 J	924 J	1,120 J	1,130 B	996 B	1,640 J	1,020 J	1,820 J	999 J	736 J	7,600	3,510 B	1,890 J	1,740 J	1,890 J	963 J	1,750 J	1,940 B	1,800 B	2,130 J	2,800 J	2,050 J	1,790 J
Selenium	2.6 U	2.6 U	2.7 U	2.2 U	4.5 U	3 U	3.9 U	2.6 U	3.5 U	7.9	2.2 U	4.5 U	4.1 J	3.9 U	2.6 U	3.5 U	7.7	2.2 U	4.5 U	3 U	3.9 U	2.6 U	3.5 U	2.7 U	2.2 U	4.5 U	3 U	3.9 U
Silver	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U	0.7 U	0.7 U	0.8 U	0.75 J	1.3 U	0.7 U	0.7 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U
Sodium	19,200	20,900	4,020 B	19,500	24,200	18,200	18,900	20,200	20,500	25,700	19,100	22,200	19,200	13,400	20,900	23,300	18,800	19,700	22,000	20,200	22,600	26,700	19,900	30,500	34,500	30,800	9,860	22,700
Thallium	1.9 U	1.9 U	3 U	2.8 U	4 U	2.8 U	6.2 U	1.9 U	4.9 U	3 U	6.8 J	4 U	2.8 U	6.2 U	1.9 U	4.9 U	6.9 B	2.8 J	4 U	2.8 U	6.2 U	1.9 U	4.9 U	3 U	5.2 J	4 U	2.8 U	6.2 U
Vanadium	2.2 J	1.6 B	2.6 B	0.3 U	0.8 U	0.56 J	0.4 U	0.4 U	0.57 B	0.5 U	1.2 J	1.5 J	22.2 J	1.1 J	1.4 J	0.97 B	0.62 B	1.1 J	3.5 J	2.2 J	2.3 J	0.68 J	3.5 B	0.83 B	0.55 J	1.5 J	1.8 J	0.4 U
Zinc	4,180	4,220	2,180	2,080	1,190	2,800	1,470	8.2 J	6.5 B	5 B	1.2 B	2.4 J	37.9	3.6 U	5.2 B	10.9 B	14.3 B	5.8 B	1.3 U	8.8 J	3.6 U	14.6 J	37.2	37.2	32.3	1.3 U	148	15.8 J

Notes:
U- Analyte not detected
J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is imprecise
UL- Analyte not detected. Quantitation limit is higher
R- Unreliable result
NA- Not analyzed

Appendix B
Treatability Study Analytical Data and Field Parameters
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

Station ID	LS13-MW14T							LS13-MW18T							LS13-MW21S	LS13-MW26S						LS13-MW28D						
Sample Date	10/26/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/27/04	01/05/05	03/01/05	05/10/05	07/07/05	09/07/05	01/11/06	10/28/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/26/04	12/21/04	03/01/05	05/09/05	07/07/05	09/06/05	01/10/06
Chemical Name																												
Pesticide/Polychlorinated Biphenyls (UG/L)																												
4,4'-DDD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aldrin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin ketone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
alpha-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
gamma-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)																												
Aluminum	145 J	9,980	216	30.2 B	18.3 B	75.1 B	60.6 B	302	400	397	30.9 B	25.3 B	85.1 B	98 B	733	2,200	1,540	110 B	41.5 B	86 B	101 B	1,720	6,890	289	32.8 B	57 B	79.1 B	142 B
Antimony	2 U	2 U	2.1 U	1.3 U	3.7 U	1.7 U	2.5 U	2 U	4 B	3.1 B	1.3 U	3.7 U	1.7 U	2.5 U	2 U	2 U	2.1 U	1.3 U	3.7 U	1.7 U	2.5 U	2.7 B	2 U	3.2 B	1.3 U	3.7 U	1.7 U	2.5 U
Arsenic	1.8 U	2.1 B	2.1 U	1.6 U	3.7 U	1.9 U	3.6 U	1.8 U	2.9 U	2.1 U	1.6 U	3.7 U	3.8 J	3.6 U	1.8 U	5.6 B	2.1 U	1.6 U	3.7 U	1.9 U	3.6 U	1.8 U	1.8 U	2.1 U	1.6 U	3.7 U	1.9 U	3.6 U
Barium	25.1 J	33.8 B	21 B	29.5 J	30.2 J	30.3 J	29 J	11.8 J	15.6 B	5.3 B	11.6 J	13.9 J	19.5 J	11.2 J	12.4 J	21.1 B	9.2 B	13.1 J	12.4 J	14.7 J	11.7 J	18.8 J	57.3 B	5 B	11.4 J	13.2 J	14.2 J	13.7 J
Beryllium	0.1 U	4.4 B	0.1 U	0.1 U	0.1 U	0.69 B	0.56 B	0.1 U	0.3 U	0.1 U	0.1 U	0.1 U	0.88 B	0.49 B	0.1 U	0.1 U	0.11 B	0.1 U	0.1 U	0.73 B	0.67 B	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.67 B	0.66 B
Cadmium	0.2 U	3.9 B	0.3 U	0.2 U	0.5 U	0.22 B	0.3 U	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	0.2 U	0.3 U	0.2 U	0.26 B	0.67 B	0.2 U	0.5 U	0.2 U	11.9	0.2 U	3.1 B	0.42 B	0.2 U	0.5 U	0.2 U	0.3 U
Calcium	19,600	30,800	12,400	15,300	17,000	17,500	14,700	7,240	8,440	7,890	7,820	11,200	16,800	7,250	10,000	3,400 B	3,390 B	3,750 J	3,910 J	4,710 J	7,630	9,590	23,700	4,790 B	8,160	7,500	8,510	11,500
Chromium	0.5 U	30.2	0.75 B	0.8 U	1.1 U	0.6 U	0.9 U	0.56 J	0.7 U	0.6 U	1.3 J	1.1 U	0.86 B	0.9 U	1.4 J	3 B	1.7 B	1.8 J	1.1 U	0.6 U	0.9 U	2 J	33.8	0.6 U	0.8 U	1.1 U	0.6 U	0.9 U
Cobalt	3.4 J	158	44.4 B	21.6 J	18.6 J	20.4 J	25.1 J	2.3 J	1.2 B	1.1 B	0.79 J	1.1 U	3.4 J	1.2 B	1.7 J	2 B	2.2 B	2.8 J	2.4 J	3.4 J	3.9 B	3.3 J	51.2	8 B	7.3 J	9.4 J	11.3 J	5.9 J
Copper	0.5 U	98.1	12.9 B	7.2 J	6.8 J	4.7 J	5.7 J	0.5 U	0.52 B	0.66 B	0.63 J	0.87 J	0.5 U	0.5 U	0.6 B	1 B	1.3 B	2 J	1.1 J	0.5 U	0.5 U	0.71 B	134	10.9 B	3.9 J	3.9 J	0.5 U	0.5 U
Cyanide	1.6 U	6.1 B	0.8 U	0.8 U	2.6 J	2.8 U	0.7 U	1.6 U	1.6 U	0.8 U	0.8 U	0.8 U	2.8 U	0.7 U	1.6 U	1.6 U	0.8 U	0.8 U	0.8 U	2.8 U	0.7 U	1.6 U	6.8 B	0.8 U	0.8 U	0.8 U	2.8 U	0.7 U
Iron	1,270	69,000	2,380	1,380	978	1,530	1,050	631	383	651	537	996	6,830	2,000	11,800	7,810	4,190	2,000	2,300	4,460	14,400	6,350	71,100	5,300	10,400	12,400	15,700	18,500
Lead	0.9 U	1.4 B	1.3 U	1.2 U	1.6 U	1.4 U	1.7 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1.7 U	0.9 U	1.4 B	1.3 U	1.2 U	1.6 U	1.4 U	1.7 U	1.2 J	1.8 B	1.3 U	1.3 J	2.6 J	1.5 J	1.7 J
Magnesium	7,550	18,200	5,680	6,340	6,710	7,030	6,700	3,570 J	4,150 B	4,040 B	4,030 J	6,490	8,450	3,620 J	3,350 J	1,540 B	1,920 B	2,150 J	2,360 J	2,830 J	4,460 J	3,920 J	10,900	2,210 B	3,210 J	2,860 J	3,350 J	4,100 J
Manganese	231	3,140	780	593	568	493	415	130	63.6	114	101	179	655	177	460	247	256	287	315	362	772	571	2,740	578	968	909	932	1,170
Mercury	0.1 U	1.1	0.1 U	0.12 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.17 J	0.1 U	0.1 U	0.1 U	0.1 U	0.15 B	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	1.4 J	85.3	25.6 B	8.5 J	9.6 J	11.5 J	5.7 J	1.3 J	1.5 B	1.7 B	2.1 J	1.3 J	2.7 J	1 U	0.5 U	2.7 B	2.8 B	4.1 J	1.5 J	2.1 J	1.6 J	1.7 J	67.2	4.2 B	2 J	2.9 J	3.2 J	1.2 J
Potassium	1,520 J	4,840 B	1,280 B	1,430 J	1,640 J	1,720 J	1,480 J	965 J	1,150 B	917 B	1,010 J	1,090 J	1,130 J	879 J	1,340 J	1,800 B	953 B	908 J	902 J	1,150 J	903 J	1,100 J	4,010 B	665 B	882 J	979 J	1,090 J	944 J
Selenium	2.6 U	9.5	2.7 U	2.2 U	4.5 U	3 U	3.9 U	2.6 U	3.5 U	2.7 U	2.2 U	4.5 U	3 U	3.9 U	2.6 U	2.6 U	2.7 U	2.2 U	4.5 U	3 U	3.9 U	2.6 U	21	2.7 U	2.2 U	4.5 U	3 U	3.9 U
Silver	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U
Sodium	35,000	286,000	42,300	34,900	35,700	33,600	36,700	20,300	21,900	20,900	20,500	22,000	19,400	19,400	9,250	10,800	11,400	10,400	12,100	13,100	11,000	19,300	277,000	15,600	13,400	18,600	17,800	13,400
Thallium	1.9 U	10.8	3 U	2.8 U	4 U	3 B	6.2 U	1.9 U	5 B	3 U	2.8 U	4 U	2.8 U	6.2 U	1.9 U	1.9 U	3 U	2.8 U	4 U	3.2 B	6.2 U	1.9 U	11.5	3 U	2.8 U	4 U	2.8 U	6.2 U
Vanadium	0.52 J	4.6 B	1.1 B	0.91 J	0.8 U	0.82 J	0.4 U	1.1 J	1.3 B	1 B	0.3 U	0.8 U	2.4 J	0.4 U	1.3 J	3.9 B	2.5 B	0.48 J	0.8 U	0.5 U	0.4 U	2.9 J	10.4 B	8.4 B	6.4 J	8.6 J	9.8 J	4.5 J
Zinc	6.5 B	926	62.9	34.2	44.3	57.2	16.6 J	5.6 B	5.1 B	5.1 B	3.5 B	3.2 J	6.3 J	3.6 U	6.4 B	16.8 B	21.5	23.3	16.9 J	19.8 J	26.6	7.7 J	484	45.2	47.1	48	50.1	18.9 J

Notes:
U- Analyte not detected
J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is impreci
UL- Analyte not detected. Quantitation limit is higher
R- Unreliable result
NA- Not analyzed

Appendix B
Treatability Study Analytical Data and Field Parameters
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

Station ID	LS13-MW29D							LS13-MW30D							
Sample Date	10/27/04	12/21/04	03/01/05	05/09/05	07/07/05	09/07/05	01/10/06	10/27/04	01/05/05	03/01/05	05/09/05	07/07/05	09/07/05	01/10/06	01/10/06
Chemical Name															
Pesticide/Polychlorinated Biphenyls (UG/L)															
4,4'-DDD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aldrin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin ketone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
alpha-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
gamma-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)															
Aluminum	439	199 B	407	259	51.3 B	84.3 B	161 B	144 J	968	112 B	11.4 U	35.8 B	89.4 B	63.6 B	50.3 B
Antimony	2 U	2 U	3.3 B	1.3 U	3.7 U	1.7 U	2.5 U	2 U	2.8 U	2.7 B	1.3 U	3.7 U	1.7 U	2.5 U	2.5 U
Arsenic	2 J	3 B	3.1 B	1.6 U	3.7 U	23.4	3.6 U	1.8 U	3.4 B	23.7	20.7	19	1.9 U	23.6	22.7
Barium	20.6 J	20.6 B	13.8 B	22.6 J	21.7 J	27.9 J	21.2 J	24.7 J	124 B	24.2 B	24.4 J	24.4 J	18.1 J	25.6 J	25.6 J
Beryllium	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.97 B	0.55 B	0.1 U	0.5 B	0.1 U	0.1 U	0.1 U	0.8 B	0.63 B	0.51 B
Cadmium	0.2 U	0.26 B	0.31 B	0.2 U	0.5 U	0.2 U	0.76 B	0.2 U	0.3 U	0.34 B	0.2 U	0.5 U	0.2 U	0.3 U	0.3 U
Calcium	16,000	15,300	16,000	17,000	16,200	21,200	14,600	12,700	59,400	41,700	32,300	21,700	14,300	21,900	21,500
Chromium	0.89 J	0.52 B	0.6 U	1.3 J	1.1 U	0.6 U	0.9 U	0.5 U	3.1 B	0.67 B	0.8 U	1.1 U	0.6 U	0.9 U	0.9 U
Cobalt	2.9 J	3.6 B	2.5 B	2.3 J	2.2 J	7.1 J	1.9 B	7.5 J	52.9	7.6 B	2.2 J	5.7 J	2.7 J	3.3 B	3.2 B
Copper	0.5 U	0.5 U	0.73 B	0.85 J	0.8 U	0.5 U	0.5 U	0.5 U	0.94 B	0.4 U	0.99 J	0.8 U	0.5 U	0.5 U	0.5 U
Cyanide	1.6 U	1.6 U	0.8 U	0.8 U	0.8 U	2.8 U	0.7 U	1.6 U	4.5 B	0.8 U	0.8 U	0.8 U	2.8 U	0.7 U	NA
Iron	1,720	2,820	2,060	1,070	1,620	67,300	1,500	1,510	57,200	66,700	47,500	49,000	1,240	55,900	56,000
Lead	0.9 U	0.9 U	1.3 U	1.2 U	1.6 U	1.4 U	1.7 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1.7 U	1.7 U
Magnesium	4,170 J	3,860 B	4,300 B	4,630 J	4,310 J	9,250	4,260 J	4,980 J	36,600	17,800	12,600	8,940	3,890 J	9,500	9,410
Manganese	138	188	113	114	112	3,480	110	932	8,430	6,190	4,830	3,600	124	3,510	3,460
Mercury	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	3.1 J	2.5 B	2.5 B	3.4 J	2 J	0.9 U	1.8 J	4.5 J	6.5 B	0.8 U	0.81 J	1.3 U	2.1 J	1 U	1 U
Potassium	1,500 J	1,610 B	1,390 B	1,710 J	1,690 J	1,240 J	1,400 J	1,430 J	2,760 B	1,170 B	1,380 J	1,170 J	1,550 J	962 J	952 J
Selenium	2.6 U	2.6 U	2.7 U	2.2 U	4.5 U	3 U	3.9 U	2.6 U	4.7 B	5.1	2.2 U	4.5 U	3 U	3.9 U	3.9 U
Silver	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.7 U	0.7 U	0.7 U	0.84 B	0.6 U	1.3 U	0.7 U	0.7 U	0.7 U
Sodium	32,300	29,200	31,000	33,300	34,400	18,600	25,100	22,100	58,700	30,900	27,200	22,100	21,700	17,600	17,800
Thallium	1.9 U	1.9 U	3 U	2.8 U	4 U	2.8 U	6.2 U	1.9 U	4.9 U	3 U	6.2 J	4 U	2.8 U	6.2 U	6.2 U
Vanadium	1.5 J	0.85 B	1.2 B	0.66 J	0.8 U	1.1 J	1.4 J	0.51 J	7.1 B	0.5 U	0.57 J	1.2 J	0.6 J	0.83 J	0.55 J
Zinc	7.9 J	7.8 B	6.4 B	7.7 B	4.9 J	0.5 U	6 J	14.9 J	13.5 B	2.8 B	1.3 B	1.3 U	6.9 J	3.6 U	3.6 U

Notes:
U- Analyte not detected
J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is impreci
UL- Analyte not detected. Quantitation limit is higher
R- Unreliable result
NA- Not analyzed

Appendix B
Treatability Study Analytical Data and Field Parameters
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

Station ID	LS13-MW03T							LS13-MW06S							LS13-MW09S							LS13-MW11D						
Sample Date	10/26/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/27/04	01/05/05	02/28/05	05/10/05	07/07/05	09/07/05	01/11/06	10/28/04	01/05/05	02/28/05	05/10/05	07/07/05	09/07/05	01/11/06	10/27/04	01/05/05	03/01/05	05/10/05	07/07/05	09/07/05	01/11/06
Chemical Name																												
Dissolved Metals (UG/L)																												
Aluminum	4.4 U	132 U	51 B	11.4 U	13 U	50.5 B	37.7 B	4.4 U	824	13.5 U	11.4 U	13 U	58.1 B	56.5 B	4.4 U	154 B	13.5 U	11.4 U	13 U	59.9 B	25.2 B	4.4 U	132 U	13.5 U	11.4 U	13 U	67.2 B	40.4 B
Antimony	2 U	2.8 U	2.1 B	1.4 J	3.7 U	1.7 U	1.2 U	2 U	2.8 U	4.2 B	2.7 B	3.7 U	1.7 U	3.5 B	2 U	2.8 U	5 B	2.2 J	3.7 U	1.7 U	5.8 B	2 U	2.9 B	4.2 B	1.5 J	3.7 U	1.7 U	1.2 U
Arsenic	1.8 U	2.9 U	2.1 U	1.6 U	3.7 U	1.9 U	1.4 U	1.8 U	2.9 U	4.6 B	6.7 B	10.6	9.2 J	16.4	1.8 U	2.9 U	16.7	21.2	25.6	33.8	34.7	1.8 U	2.9 U	18.1	18.5	3.7 U	7.7 J	15.4
Barium	28.6 J	43 B	0.1 U	53.2 J	39.1 J	56.4 J	32.9 J	11.5 J	14.1 B	9.6 B	22.1 J	13.3 J	19 J	17.7 J	9.4 J	33.8 B	29.1 B	13.5 J	12.8 J	18.4 J	16.2 J	16.4 J	33 B	46.7 B	43.8 J	21.1 J	55.9 J	33.1 J
Beryllium	0.1 U	0.3 U	0.1 U	0.1 U	0.1 U	0.82 B	0.36 B	0.1 U	0.3 U	0.1 U	0.1 U	0.1 U	0.82 B	0.54 B	0.1 U	0.43 B	0.1 U	0.1 U	0.1 U	0.81 B	0.28 B	0.1 U	0.33 B	0.1 U	0.1 U	0.1 U	0.91 B	0.52 B
Cadmium	0.43 J	2.1 B	0.47 B	1.3 J	0.77 J	2.2 J	1 B	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	2.7 J	0.2 U
Calcium	19,000	24,200	10,100	26,300	22,000	20,000	15,100	9,760	10,700	34,200	43,200	25,900	25,100	40,800	7,000	13,700	23,100	17,900	14,900	15,000	12,900	12,300	30,500	47,700	55,600	16,000	41,900	29,500
Chromium	0.5 U	0.7 U	0.6 U	0.8 U	1.1 U	1.2 B	0.4 U	0.5 U	0.99 B	0.6 U	0.8 U	1.1 U	0.6 U	0.4 U	0.5 U	1.4 B	0.6 U	0.8 U	1.1 U	0.6 U	0.4 U	0.5 U	0.7 U	0.6 U	0.84 J	1.1 U	0.6 U	0.4 U
Cobalt	2 J	7 B	0.6 U	0.53 J	1.1 U	4.5 J	2.7 B	7.7 J	7.8 B	15.6 B	17.8 J	8 J	9.2 J	20.4 J	2.8 J	18.1 B	18.7 B	8 J	8.9 J	11 J	22.6 J	2 J	0.87 B	33.8 B	21.9 J	2 J	9.4 J	6.1 J
Copper	0.5 U	42.3	3 B	2.9 J	6.2 J	14.7 J	3.3 J	0.5 U	2.4 B	0.4 U	1.5 J	0.8 U	0.5 U	0.3 U	0.6 B	1.6 B	0.4 U	2.2 J	0.8 U	0.5 U	0.54 J	0.5 U	0.52 B	0.4 U	1.2 J	0.8 U	0.5 U	0.3 U
Iron	771	295	39.1 B	10 U	116	1,230	279	5,610	16,800	84,100	127,000	59,100	67,000	123,000	110	19,200	154,000	115,000	115,000	143,000	201,000	789	13.6 U	25,200	41,600	1,130	832	11,900
Lead	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	2.6 J	1 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U
Magnesium	3,930 J	3,530 B	485 B	3,260 J	3,080 J	2,700 J	1,590 J	4,140 J	4,460 B	19,600	18,500	12,900	11,500	16,900	5,140	10,500	18,500	14,800	10,800	10,400	10,900	3,560 J	5,560	20,200	25,500	4,220 J	7,210	12,600
Manganese	246	171	7.8 B	90.7	86.3	138	73.5	532	537	2,600	3,940	4,300	2,550	2,880	956	2,350	2,490	1,130	1,310	1,510	1,780	253	141	5,840	7,870	116	620	2,480
Mercury	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.12 B	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	2.1 B	6.5 B	0.8 B	1.6 J	1.4 J	4.7 J	2.9 J	0.5 U	0.89 B	0.8 U	0.8 U	1.3 U	0.9 U	0.9 U	0.5 U	2.2 B	0.8 U	0.8 U	1.3 U	2.1 J	0.9 U	1.2 B	2 B	4.8 B	1.7 J	1.9 J	8.6 J	2.9 J
Potassium	982 J	1,240 B	317 B	1,390 J	1,440 J	1,190 J	683 J	1,150 J	1,200 B	954 B	1,550 J	1,020 J	1,180 J	978 J	711 J	7,800	3,750 B	1,840 J	1,620 J	1,900 J	925 J	1,520 J	2,060 B	1,920 B	2,040 J	1,650 J	2,120 J	1,590 J
Selenium	2.6 U	3.5 U	2.7 U	2.2 U	4.5 U	3 U	3.3 U	2.6 U	3.5 U	5.9	2.2 U	4.5 U	4 J	6.2 B	2.6 U	3.5 U	8.2	2.2 U	4.5 U	5.7	7.7 B	2.6 U	3.5 U	4 B	2.2 J	4.5 U	3 U	3.3 U
Silver	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.5 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.5 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.5 U	0.7 U	0.7 U	0.8 U	0.63 J	1.3 U	0.7 U	0.5 U
Sodium	18,600	20,500	5,400	19,900	22,100	17,500	9,870	20,700	20,000	25,900	18,600	23,600	18,900	13,200	20,800	23,300	19,700	18,900	20,300	21,000	21,700	25,700	25,600	38,800	36,400	33,300	12,300	22,300
Thallium	1.9 U	4.9 U	3 U	2.8 U	4 U	2.8 U	3.9 U	1.9 U	4.9 U	3.5 B	5.5 J	4 U	2.8 U	3.9 U	1.9 U	6.2 B	5.9 B	2.8 U	4 U	2.8 U	6.4 B	1.9 U	5.3 B	3 U	6 J	4 U	2.8 U	5.3 B
Vanadium	0.4 U	0.5 U	0.5 U	0.3 U	0.8 U	0.5 U	0.3 U	0.4 U	1.6 B	0.5 U	0.85 J	1.1 J	0.69 B	0.77 B	0.4 U	1.1 B	0.5 U	1.4 J	3.2 J	2.1 B	1.9 B	0.47 J	3 B	0.5 U	0.3 U	0.8 U	0.72 B	0.3 U
Zinc	1,710	3,070	76.7	2,260	1,030	2,920	2,640	3.8 B	11.5 B	3 B	2.4 B	1.3 U	0.5 U	0.3 U	3.3 B	7.9 B	4.4 B	2.4 B	1.3 U	5.3 B	0.38 B	2.9 B	29.7	1.2 U	3.5 B	4.1 B	140	10.8 B
Wet Chemistry (MG/L)																												
Acetate	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	16	0.5 U	2.12	4.72 L	0.2	1 U	84	200	0.5 U	4.84	46.3 L	60.9	1 U	1 U	6.8	0.934	39.3	0.336 L	0.096 J
Alkalinity	55.2	53	12.5	63.6	47.4	38.6	28	30.4	30.7 B	190	218	106	100	173	36.3	135	267	178	170	101	166 J	69.1	79.3	228	265	411	95.6	111
Butyrate	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	4.7	3.04	0.25	0.2 UL	0.15 J	1 U	38	57	3.18	1.08	0.374 L	0.2 U	1 U	1 U	1 U	0.5 U	2	0.2 UL	0.2 U
Chloride	32.9	24.1	6.24	24.2	25.5	13	13.6	26.2	22.5	17.6	10.2	26.6	18.9	8.75	20.7	9.79	15.4	10.9	11.9	17	12.7 J	29	20.2	22.1	21.8	18.5	14.9	24.7
Ethane	NA	NA	NA	NA	NA	NA	NA	5.00E-05 J	7.00E-05 B	3.00E-04 J	1.00E-04 B	9.00E-05 B	1.00E-04 B	0.002 U	2.00E-04 J	0.002 B	5.00E-04 J	5.00E-04 J	5.00E-04 B	3.00E-04 B	1.00E-04 B	0.002 U	7.00E-05 B	0.002 U	1.00E-04 B	3.00E-04 B	4.00E-05 B	4.00E-05 B
Ethene	NA	NA	NA	NA	NA	NA	NA	0.002 U	6.00E-05 B	9.00E-05 J	1.00E-04 J	4.00E-05 B	1.00E-04 B	1.00E-04 J	1.00E-04 B	5.00E-04 B	6.00E-04 J	7.00E-04 J	0.002 B	0.002 B	6.00E-04 J	0.002 U	5.00E-05 B	7.00E-05 J	9.00E-05 J	1.00E-04 B	7.00E-05 B	0.002 U
Lactate	NA	NA	NA	NA	NA	NA	NA	25 U	25 U	25 U	0.5 U	1.72	3.22 L	0.59	25 U	25 U	100	0.5 U	33.8	27.8 L	49.3	25 U	25 U	25 U	0.969	23.4	0.448 L	0.13 J
Methane	NA	NA	NA	NA	NA	NA	NA	0.006 L	0.014 B	0.005	0.022	0.056	0.21 J	1.4	0.007 L	0.003 B	0.027	0.45	0.78	1.1	0.87	0.006 L	0.007 B	0.009	0.54	0.61	0.21	0.048
Nitrate	0.285	0.89	0.76	0.635	0.395	0.32	0.575	1.25	0.07	0.05 U	0.155	0.05 U	0.05 U	0.05 U	0.865	0.04 J	0.05 U	0.05 U	0.675	0.05 U	0.205	0.05 U	0.16	0.3	0.05 U	0.05 U	0.05 U	0.05 U
Nitrite	0.05 U	0.014 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.16	0.05 U	0.05 U	0.075	0.05 U	0.05 U	0.05 U	0.105	0.05 U	0.05 U	1.05	0.05 U	0.05 U	0.05 U	0.055	0.05 U	0.05 U	2.98	0.05 U	0.05 U
Propionate	NA	NA	NA	NA	NA	NA	NA	0.81 J	1 U	15	3.93	0.469	0.2 UL	NA	0.8 J	30	91	2.04	1.35	0.2 UL	NA	0.73 J	1 U	1 J	2.9	31.6	0.2 UL	NA
Propionic Acid	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	NA	NA	NA	NA	NA	0.2 U	NA	NA	NA	NA	NA	NA	0.2 U
Pyruvate	NA	NA	NA	NA	NA	NA	NA	10 U	10 U	10 U	56.4	142	118 L	28.3	10 U	10 U	10 U	56.6	70.2	49 L	72.5	10 U	10 U	10 U	85.2	74.2	45.4 L	84.6
Sulfate	16.4	19.4	4.33 J	15.1	19.2	25.3	16.5	18.3	20.2	11.1	5.22	3.21 J	7.59	4.71	30.4	5.28	0.595 J	2.2 J	1.08 J	1.03 J	2.53	11.8	6.53	2.29 J	5 U	1.97 J	5.88	8.59
Total dissolved solids (TDS)	139	148	11	160	154	140	105	117	106	265	355	184	169	287	96	235	482	292	273	201	374	137	142	218	305	20,400	148	209
Total organic carbon (TOC)	3.88 J	5.27 B	5 U	3.39 J	3.03 J	8.95	4.32	6.37	5 U	58.4	126	7.54	13.3	27.2	2.87 J	137	216	98.8	79.4	45.8	84.8 J	3.21 J	4.83 B	11.5	14.6	129	7.69	3.48
Field Parameters																												
Dissolved Oxygen (mg/L)	3.1	NA	12.56	3.85	3.39	0.8	4.24	1.99	0	0	0	0	0	0	1.97	0	0	0	0	0	1.29	1.88	0	0	0	0	0	0
Depth to Water (ft)	4.3	4.56	3.54	3.87	4.84	4.98	3.35	4.64	4.78	3.87	4.31	4.99	5.28	3.69	5.11	5.2	4.39	4.76	5.41	5.65	4.12	6.24	7.14	5.69	6.2	6.91	7.04	4.96
Oxidation Reduction Potential (mV)	52	185	72	150	16.8	120	124	31	49	-126	-144	-188	-172	-158	167	-159	-118	-126	-131	-140	-168	16	79	-111	-155	-153	18	-112
Flow Rate (GPM)	0.06	0.079	0.072	0.05	0.066	0.079	0.092	0.072	0.079	0.066	0.05	0.079	0.092	0.079	0.044	0.079	0.079	0.046	0.079	0.079	350	0.055	0.079	0.066	0.046	0.052	0.079	0.085
Gallons Purged (GAL)	4	3	2.5	4	3.5	NA	4	3	2	3	2.5	2.5	5	4	3	2.5	3.5	2	2	3	5	3	3	2	2	2.75	5	4
pH	6.09	7.28	9.99	6.11	6.84	6.77	5.81	5.86	5.8	6.67	6.6	7.78	7.7	7.09	5.74	5.53	6.22	6.42	7.16	6.75	6.6	6.29	6.48	6.58	6.6	7.02	6.75	6.86
Specific Conductance (ms/cm)	0.26	0.175	0.057	0.198	0.2	0.158	0.168	0.241	0.162	0.482	0.579	0.373	0.358	0.801	0.217	0.246	0.548	0.429	0.429	0.446	0.697	0.289	0.137	0.293	0.421	0.293	0.111	0.487
Temperature (C)	24.01	19.8	15.21	19.47	24.6	26.84	18.67	24.3	18.3	15.94	18.2	22.69	25.58	18.4	23.1	17.04	15.59	17.96	24.2	26.17	17.5	23.56	20.82	17.64	18.49	23.1	23.85	21.5
Turbidity (NTU)	3.9	20.9	32.7	0	0	-10	0	46.5	107	37.3	0.2	8.4	4.16	9.3	0	5.7	15.2	12.2	62.1	0	135	1.9	2.1	0	26.7	19.6	-1.1	0

Notes:
U- Analyte not detected
J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is imprecise
UL- Analyte not detected. Quantitation limit is higher
R- Unreliable result
NA- Not analyzed

Appendix B
Treatability Study Analytical Data and Field Parameters
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

Station ID	LS13-MW14T							LS13-MW18T							LS13-MW21S	LS13-MW26S						LS13-MW28D						
Sample Date	10/26/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/27/04	01/05/05	03/01/05	05/10/05	07/07/05	09/07/05	01/11/06	10/28/04	12/21/04	02/28/05	05/09/05	07/07/05	09/06/05	01/10/06	10/26/04	12/21/04	03/01/05	05/09/05	07/07/05	09/06/05	01/10/06
Chemical Name																												
Dissolved Metals (UG/L)																												
Aluminum	4.4 U	10,700	66.1 B	11.4 U	13 U	70.7 B	44.4 B	4.4 U	132 U	13.5 U	11.4 U	13 U	63.7 B	54.8 B	4.4 U	132 U	24.6 B	20.2 J	17.7 B	86.3 B	42.8 B	432	8,920	14.8 B	11.4 U	28.8 B	73.4 B	47.6 B
Antimony	2 U	2.8 U	3.5 B	1.3 U	3.7 U	1.7 U	1.2 U	2 U	3 B	2.8 B	1.3 U	3.7 U	1.7 U	1.2 U	2 U	2.8 U	2.5 B	1.3 U	3.7 U	1.7 U	1.2 U	2.5 B	2.8 U	2.1 U	1.3 U	3.7 U	1.7 U	1.2 U
Arsenic	1.8 U	3.7 B	2.1 U	1.6 U	3.7 U	1.9 U	2.2 B	1.8 U	2.9 U	2.1 U	1.6 U	3.7 U	3.5 J	3.1 B	1.8 U	2.9 U	2.1 U	1.6 U	3.7 U	1.9 U	1.5 B	1.8 U	3.4 B	2.1 U	1.6 U	3.7 U	1.9 U	2.7 B
Barium	17.4 J	33.5 B	18.2 B	27.8 J	28.5 J	29 J	28.2 J	10.8 J	12.8 B	4.1 B	12 J	13.8 J	14.7 J	10.8 J	10.6 J	11.8 B	3.6 B	12.1 J	11.3 J	14.5 J	12 J	15.1 J	61 B	4.6 B	11.3 J	17.4 J	15 J	13 J
Beryllium	0.1 U	5.2	0.1 U	0.1 U	0.1 U	0.98 B	0.5 B	0.1 U	0.3 B	0.1 U	0.1 U	0.1 U	0.9 B	0.67 B	0.1 U	0.3 U	0.1 U	0.1 U	0.1 U	0.96 B	0.44 B	0.1 U	0.86 B	0.1 U	0.1 U	0.1 U	0.9 B	0.54 B
Cadmium	0.2 U	1.9 B	0.3 U	0.2 U	0.5 U	0.2 U	0.2 B	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U	0.3 U	0.54 B	0.2 U	0.5 U	0.2 U	16.6	0.2 U	0.7 B	0.3 U	0.2 U	0.5 U	0.2 U	0.2 U
Calcium	13,200	34,800	11,300	14,900	15,900	16,300	14,900	7,350	8,030	8,250	8,260	11,400	16,600	7,930	9,130	2,730 B	3,230 B	3,750 J	3,670 J	4,650 J	7,950	9,420	25,200	4,780 B	7,940	7,560	8,820	11,600
Chromium	0.5 U	31.2	0.6 U	0.8 U	1.1 U	0.6 U	0.4 U	0.5 U	0.7 U	0.6 U	0.8 U	1.1 U	0.6 U	0.4 U	0.5 U	0.7 U	0.6 U	0.8 U	1.1 U	0.6 U	0.4 U	0.59 B	38.3	0.6 U	0.8 U	2.9 J	0.6 U	0.4 U
Cobalt	3 J	186	41.3 B	21.1 J	18.2 J	19.4 J	24.2 J	0.52 B	0.3 U	0.85 B	0.52 J	1.4 J	1.5 J	0.92 B	1.6 J	1.8 B	1.9 B	2.8 J	1.9 J	3.5 J	3.9 B	3.5 J	59.2	8.1 B	7.4 J	9 J	11.7 J	5.7 J
Copper	0.5 U	114	12.5 B	6.7 J	6.8 J	5.4 J	5.5 J	0.5 U	0.4 U	0.4 U	0.83 J	0.8 U	0.5 U	0.3 U	0.5 U	0.4 U	0.59 B	1.4 J	0.8 U	0.5 U	0.3 U	0.5 U	146	10.4 B	3 J	4.4 J	0.5 U	0.3 U
Iron	863	70,100	1,410	941	856	1,200	1,020	58.5 B	13.6 U	172	279	960	7,070	2,320	2,990	55 B	465	1,140	2,020	4,120	13,800	4,700	66,800	2,480	9,520	11,500	16,900	16,800
Lead	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U	0.9 U	1.7 U	1.3 U	1.2 U	3.2	1.4 U	1 U
Magnesium	5,380	21,600	5,230	6,220	6,240	6,650	6,630	3,590 J	3,920 B	4,180 B	4,290 J	6,400	8,550	3,950 J	3,180 J	1,270 B	1,760 B	2,200 J	2,280 J	2,930 J	4,510 J	3,780 J	13,000	2,210 B	3,110 J	2,860 J	3,520 J	4,090 J
Manganese	205	3,430	715	581	534	464	403	54.9	27.6	89.4	105	190	670	227	394	187	242	293	301	369	747	552	2,690	576	923	922	1,000	1,130
Mercury	0.1 U	0.78	0.1 U	0.11 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	0.92 B	101	22.7 B	8.1 J	9.4 J	11.5 J	6.2 J	0.82 B	0.73 B	1.4 B	1 J	1.3 U	1.1 J	0.9 U	0.5 U	0.98 B	1.2 B	1.9 J	1.4 J	2.2 J	1.3 J	1.3 B	76.1	3.8 B	2.4 J	4.3 J	3.5 J	0.9 U
Potassium	1,150 J	5,260	1,210 B	1,420 J	1,570 J	1,690 J	1,440 J	937 J	1,080 B	897 B	1,050 J	1,110 J	1,130 J	839 J	1,190 J	1,330 B	793 B	886 J	850 J	1,130 J	994 J	988 J	4,300 B	654 B	908 J	1,040 J	1,140 J	914 J
Selenium	2.6 U	15.1	2.7 U	2.2 U	4.5 U	3 U	3.3 U	2.6 U	3.5 U	2.7 U	2.2 U	4.5 U	3 U	3.3 U	2.6 U	3.5 U	2.7 U	2.2 U	4.5 U	3 U	3.3 B	2.6 U	28.5	2.7 U	2.2 U	4.5 U	3 U	3.3 U
Silver	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.5 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.5 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.5 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.5 U
Sodium	25,500	289,000	39,900	34,700	34,000	31,800	35,300	20,400	20,900	21,700	21,600	22,800	19,500	18,700	9,170	9,610	11,000	10,300	9,760	13,100	11,200	19,300	297,000	16,100	14,300	18,400	17,700	13,200
Thallium	1.9 U	5.7 B	3 U	2.8 U	4 U	4 J	3.9 U	1.9 U	4.9 U	3 U	2.8 U	4 U	2.8 U	3.9 U	1.9 U	4.9 U	3 U	2.8 U	4 U	2.8 U	3.9 U	1.9 U	4.9 U	3 U	4.6 J	4 U	2.8 U	4.3 B
Vanadium	0.4 U	3.4 B	0.5 U	0.3 U	0.8 U	0.5 U	0.3 U	0.4 U	0.5 U	0.5 U	0.3 U	0.8 U	0.5 U	0.3 U	0.4 U	0.5 U	0.5 U	0.34 J	0.8 U	0.5 U	0.3 U	0.99 J	4.8 B	1.7 B	5.6 J	6.9 J	11 J	3.9 J
Zinc	3.9 B	1,060	57.4	32.4 B	41.6	62.5	15.8 B	3 B	3.5 B	4.1 B	4.4 B	2.5 B	1.8 B	2.4 B	4.6 B	13.2 B	18.1 B	24.7 B	17.5 J	18.9 J	27.4	6.7 B	542	43.6	47.4 B	48	50.8	17 B
Wet Chemistry (MG/L)																												
Acetate	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	1 U	0.5 U	0.434	1.01 L	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	2.9	1 U	0.12 J	0.214	NA	NA
Alkalinity	35.9	35.2	25.7	24.7	21.4	14.7	13.5	30	21.5 B	24.7	24.6	47.7	60.7	20	31	5.43 B	6.61 J	293	7.09 B	6.64 J	22.5	21.1	62.7	23.2	25.3	33.6	25.7	40.4
Butyrate	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	1 U	0.5 U	0.29	0.2 UL	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	0.5 U	0.307	NA	NA
Chloride	45.9	22.2	40.8	43.9	46.3	55.1	48	25.1	0.01	21.6	22.3	22.3	25.8	20.6	11.4	9.65	11.8	10	12.3	15.7	10.9	29.8	8.67	11.2	10.6	14.8	15.7	8.78
Ethane	NA	NA	NA	NA	NA	NA	NA	4.00E-05 J	0.002 U	0.002 U	4.00E-05 B	1.00E-04 B	3.00E-05 B	3.00E-05 B	NA	NA	NA	NA	NA	NA	NA	NA	5.00E-04 B	8.00E-05 B	6.00E-04 J	9.00E-05 B	NA	NA
Ethene	NA	NA	NA	NA	NA	NA	NA	4.00E-05 B	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	NA	NA	NA	NA	NA	NA	NA	NA	7.00E-04 J	4.00E-04 J	0.003	3.00E-04 B	NA	NA
Lactate	NA	NA	NA	NA	NA	NA	NA	25 U	25 U	25 U	0.5 U	0.503	1.01 L	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	25 U	25 U	0.5 U	0.294	NA	NA
Methane	NA	NA	NA	NA	NA	NA	NA	0.003 L	0.006 B	0.011	0.009	0.01	0.011	0.041	NA	NA	NA	NA	NA	NA	NA	NA	0.003 B	0.027	0.16	0.043	NA	NA
Nitrate	0.085	1.3	0.415	0.17	1.02	1.62	2.41	0.05 U	0.13	0.405	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.007 U	0.37	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.695	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Nitrite	0.05 U	0.014 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.014 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.014 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Propionate	NA	NA	NA	NA	NA	NA	NA	0.73 J	1 U	1 U	0.5 U	1.09	0.2 UL	NA	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	0.5 U	0.2 U	NA	NA
Propionic Acid	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyruvate	NA	NA	NA	NA	NA	NA	NA	10 U	10 U	10 U	95.5	91.5	96.9 L	97.6	NA	NA	NA	NA	NA	NA	NA	NA	10 U	10 U	45.7	54.7	NA	NA
Sulfate	21	783	56.4	29.9	29.5	33.5	30.4	15.5	17.6	14.7	13	12.1	7.88	11.3	14.4	9.74	12.1	13.4	15.1	16	15.7	21	575	13.8	14.9	17.7	18.5	18.5
Total dissolved solids (TDS)	140	1,560	167	185	194	215	204	118	105	111	118	129	141	66	123	68	49	2,580	65	83	113	120	1,450	73	106	109	117	98
Total organic carbon (TOC)	5.6	192	8.36	12.1	5.93	5.31	8.29	6.28	5 U	4.67 J	2.77 J	10.4	4.55 J	5 U	2.93 J	5.87 B	3.3 J	4.37 J	4.15 J	6.57	6.36	4.56 J	218	11.8	11.8	13	8.33	6.13
Field Parameters																												
Dissolved Oxygen (mg/L)	2.71	NA	19.99	NA*	12.51	6.22	4.83	2.61	0	0	0	0	0	1.34	2	NA	0.12	6.74	4.2	0	2.59	NA	NA	8.52	0.17	0.61	0	1.83
Depth to Water (ft)	4.79	5.2	3.94	4.31	5.24	5.52	3.85	4.51	5.73	5.02	5.27	5.86	6.09	4.55	4.62	4.65	3.59	3.81	4.8	5.02	3.3	4.21	4.63	3.31	3.69	4.69	4.96	3.43
Oxidation Reduction Potential (mV)	105	318	188	173	16.5	237	195	172	172	128	141	-47	-69	44	79	299	183	191	148	150	33	56	170	175	-57	-62	-89	-23
Flow Rate (GPM)	0.032	0.059	0.079	0.046	0.079	0.072	0.085	0.066	0.066	0.052	0.05	0.066	0.066	0.079	0.044	0.053	0.079	0.052	0.079	0.085	0.085	0.049	0.099	0.052	0.059	0.079	0.092	0.092
Gallons Purged (GAL)	4	2	3	3.5	4	3	4.5	NA	2.5	3	2	3	3.5	4	3	2.5	4	2.5	4.5	3.5	4	3	3	3	2.5	4.2	5.2	5
pH	5.58	4.28	5.4	5.5	5.58	5.21	5.39	5.4	5.63	5.69	5.82	6.47	6.38	5.87	5.89	5.39	5.03	4.96	5.17	4.9	5.83	5.65	6.2	5.47	5.79	6.35	5.91	5.8
Specific Conductance (ms/cm)	0.23	1.72	0.289	0.243	0.243	0.264	0.412	0.2	0.147	0.15	0.143	0.175	0.187	0.168	0.149	0.059	0.086	0.074	0.091	0.104	0.219	0.21	1.2	0.114	0.133	0.143	0.147	0.182
Temperature (C)	23.42	20.6	17.18	19.2	22.21	25.52	19.5	21.9	19.46	17.51	17.21	20.01	21.96	19.22	23.19	19.6	14.97	19	23.74	26.57	18.2	23.49	19.4	16.22	18.74	22.78	24.92	18.93
Turbidity (NTU)	78.8	67.7	22	221	0.5	11.2	0.427	10.1	5.5	1.8	0.7	11.8	16.6	12.1	17.9	58.6	18	23.5	-0.1	0	0	30.1	145	6.7	2	10.7	-10	54.4

Notes:
U- Analyte not detected
J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is impreci
UL- Analyte not detected. Quantitation limit is higher
R- Unreliable result
NA- Not analyzed

Appendix B
Treatability Study Analytical Data and Field Parameters
Site 13 Treatability Study Report
NAB Little Creek
Virginia Beach, Virginia

Station ID	LS13-MW29D							LS13-MW30D							
Sample Date	10/27/04	12/21/04	03/01/05	05/09/05	07/07/05	09/07/05	01/10/06	10/27/04	01/05/05	03/01/05	05/09/05	07/07/05	09/07/05	01/10/06	01/10/06
Chemical Name															
Dissolved Metals (UG/L)															
Aluminum	4.4 U	132 U	13.5 U	11.4 U	13 U	52.8 B	39.1 B	4.4 U	409	13.5 U	11.4 U	13 U	55.7 B	28.1 B	38.4 B
Antimony	2 U	2.8 U	2.1 U	1.5 J	3.7 U	1.7 U	1.2 U	2 U	2.8 U	3 B	1.3 U	3.7 U	1.7 U	1.2 U	2.5 B
Arsenic	1.8 U	3.2 B	2.1 U	1.6 U	3.7 U	1.9 U	1.4 U	1.8 U	5 B	18.6	20.3	22.1	22.5	24.6	27.1
Barium	18.8 J	20.2 B	12.4 B	19.9 J	20.6 J	17 J	20 J	23.9 J	144 B	19.8 B	22.7 J	25.5 J	29.8 J	24.6 J	24.9 J
Beryllium	0.1 U	0.3 U	0.1 U	0.1 U	0.1 U	0.73 B	0.48 B	0.1 U	0.44 B	0.1 U	0.1 U	0.1 U	0.77 B	0.34 B	0.5 B
Cadmium	0.2 U	0.3 U	0.3 U	0.25 J	0.5 U	0.2 U	0.73 B	0.2 U	0.3 U	0.3 U	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U
Calcium	15,500	15,800	16,200	15,700	15,700	13,000	14,800	12,500	66,200	39,800	31,900	25,600	21,900	21,300	21,700
Chromium	0.5 U	0.7 U	0.6 U	0.8 U	1.1 U	0.6 U	0.4 U	0.5 U	3.4 B	0.6 U	0.8 U	1.1 U	0.6 U	0.4 U	0.4 U
Cobalt	2.8 J	3.5 B	2.2 B	2.4 J	2.1 J	2.6 J	2.3 B	7 J	64.5	4 B	1.7 J	5.3 J	8.3 J	4.3 J	4.1 J
Copper	0.5 U	0.4 B	0.4 U	1 J	0.86 J	0.5 U	0.3 U	0.5 U	0.63 B	0.4 U	1.1 J	0.8 U	0.5 U	0.3 U	0.3 U
Iron	747	1,020	391	264	1,110	1,060	92.1 J	1,110	64,000	65,100	46,000	51,400	75,600	62,700	62,800
Lead	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U	0.9 U	1.7 U	1.3 U	1.2 U	1.6 U	1.4 U	1 U	1 U
Magnesium	4,000 J	4,260 B	4,330 B	4,270 J	4,150 J	3,620 J	4,210 J	4,760 J	40,800	17,400	12,400	10,100	9,780	9,370	9,490
Manganese	132	191	119	112	112	121	123	880	9,500	6,070	4,790	4,130	3,690	3,330	3,380
Mercury	0.1 U	0.1 U	0.1 U	0.12 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	1.9 B	2.1 B	1.9 B	2.1 J	2 J	2.3 J	1.5 J	4.2 B	6.6 B	0.8 U	0.8 U	1.3 U	0.9 U	0.9 U	0.9 U
Potassium	1,420 J	1,680 B	1,430 B	1,570 J	1,600 J	1,480 J	1,340 J	1,370 J	2,970 B	1,160 B	1,290 J	1,270 J	1,290 J	899 J	913 J
Selenium	2.6 U	3.5 U	2.7 U	2.2 U	4.5 U	3 U	3.3 U	2.6 U	8.3	5.8	2.2 U	4.5 U	4.6 J	3.9 B	3.3 U
Silver	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.5 U	0.7 U	0.7 U	0.8 U	0.6 U	1.3 U	0.7 U	0.5 U	0.5 U
Sodium	31,100	28,600	31,200	27,700	32,500	19,700	23,200	21,200	65,800	31,400	26,500	24,600	19,900	17,200	17,200
Thallium	1.9 U	4.9 U	3 U	2.8 U	4 U	2.8 U	3.9 U	1.9 U	13.5	3 U	4.5 J	4 U	2.8 U	3.9 U	5 B
Vanadium	0.4 U	0.54 B	0.5 U	0.3 U	0.8 U	0.5 U	0.3 U	0.4 U	9.4 B	0.5 U	0.3 U	1 J	0.83 B	0.3 U	0.43 B
Zinc	7.8 B	8.1 B	5.4 B	11 B	6.5 B	6.7 B	6.3 B	13.5 B	8.5 B	1.8 B	3.6 B	1.3 U	0.5 U	0.3 U	0.3 U
Wet Chemistry (MG/L)															
Acetate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	40.9 L	0.32	NA
Alkalinity	37.9	33.9	33.2	28.5	32.6	97.9	27.1	26.7	403	192	136	104	24.4	83.1	NA
Butyrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 UL	0.2 U	NA
Chloride	58.4	41	45.7	40.1	51.7	17.1	37.1	26.8	11.7	25.9	24.3	20.8	33.7	16.4	NA
Ethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.00E-05 B	3.00E-05 B	NA
Ethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.00E-04 B	8.00E-05 J	NA
Lactate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	25.7 L	0.49	NA
Methane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.52	0.52	NA
Nitrate	0.05 U	0.007 U	0.05 U	0.05 U	0.05 U	0.05 U	0.125	0.05 U	0.02 J	0.05 U	0.135	0.05 U	0.05 U	0.05 U	NA
Nitrite	0.05 U	0.16	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.475	0.05 U	0.05 U	0.225	0.05 U	0.05 U	NA
Propionate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 UL	NA	NA
Propionic Acid	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA
Pyruvate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	30.5 L	54.9	NA
Sulfate	11.3	12.4	13.3	12.9	11.3	7.68	14.8	32.5	11.7	10.6	11.5	10	13.9	8.63	NA
Total dissolved solids (TDS)	174	162	160	196	111	214	164	136	766	341	214	196	130	187	NA
Total organic carbon (TOC)	8.61	2.96 B	5 U	5 U	2.79 J	5 U	2.56	6.47	199	69.9	11.4	22.2	48	5.63	NA
Field Parameters															
Dissolved Oxygen (mg/L)	2.06	NA	0	0.87	0	0	1.79	2.89	3.89	0	1.09	0	0	0	NA
Depth to Water (ft)	4.92	5.18	4	4.43	5.31	5.59	3.86	5.85	6.19	5.39	5.47	5.82	6.48	4.95	NA
Oxidation Reduction Potential (mV)	6.8	100	126	117	59	98	144	89	-169	-153	-176	-150	-133	-152	NA
Flow Rate (GPM)	0.044	0.079	0.079	0.046	0.079	0.066	0.092	0.038	0.066	0.105	0.046	0.079	0.079	0.079	NA
Gallons Purged (GAL)	2	3	2.5	3.5	2	4.8	4.5	2.5	2.5	2.5	2.5	3.9	3	3.5	NA
pH	5.76	6.3	5.8	5.29	6.12	6.21	5.58	5.75	5.93	6.65	6.67	7.37	6.75	6.87	NA
Specific Conductance (ms/cm)	0.321	0.175	0.243	0.218	0.239	0.169	0.229	0.262	0.448	0.525	0.398	0.3	0.305	0.499	NA
Temperature (C)	21.24	19.2	17.17	17.06	20.12	23.32	18.51	23.2	19.39	17.8	18.38	21.09	25.23	19.1	NA
Turbidity (NTU)	8.9	74.7	30.1	0.5	7.2	8	0	7	18.9	65.7	0	70	0	5.8	NA

Notes:
U- Analyte not detected
J- Reported value is estimated
B- Possible blank contamination
UJ- Analyte not detected. Quantitation limit is impreci
UL- Analyte not detected. Quantitation limit is higher
R- Unreliable result
NA- Not analyzed