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INTERIM REMEDIAL ACTION FOCUSED FIELD INVESTIGATION REPORT OPERABLE UNIT
4 (OU4) NTC ORLANDO FL
8/1/1996
ABB ENVIRONMENTAL SERVICES, INC

**INTERIM REMEDIAL ACTION
FOCUSED FIELD INVESTIGATION REPORT
OPERABLE UNIT 4**

**NAVAL TRAINING CENTER
ORLANDO, FLORIDA**

Contract Task Order No. 107

Contract No. N62467-89-D-0317

Prepared by:

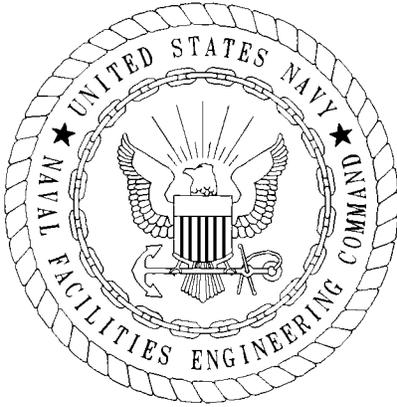
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August 1996



CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

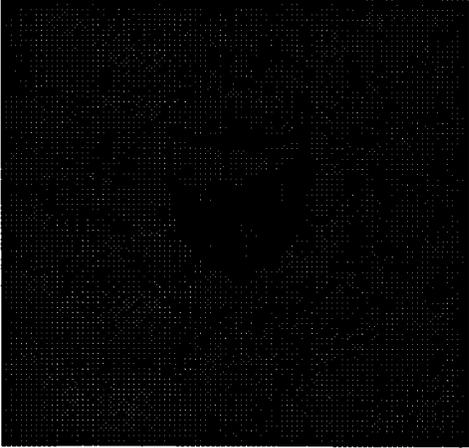
The Contractor, ABB Environmental Services, Inc., hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/107 are complete and accurate and comply with all requirements of this contract.

DATE: August 30, 1996

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(DFAR 252.227-7036)



FOREWORD

To meet its mission objectives, the U.S. Navy performs a variety of operations, some requiring the use, handling, storage, or disposal of hazardous materials. Through accidental spills and leaks and conventional methods of past disposal, hazardous materials may have entered the environment in ways unacceptable by today's standards. With growing knowledge of the long-term effects of hazardous materials on the environment, the Department of Defense (DOD) initiated various programs to investigate and remediate conditions related to suspected past releases of hazardous materials at their facilities.

One of these programs is the Base Realignment and Closure (BRAC) Cleanup Program. This program complies with the Base Closure and Realignment Act of 1988 (Public Law (P.L.) 100-526, 102 Statute 2623) and the Defense Base Closure and Realignment Act of 1990 (P.L. 101-510, 104 Statute 1808), which require the DOD to observe pertinent environmental legal provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); the 1992 Community Environmental Response Facilitation Act (CERFA); Executive Order 12580; and the statutory provisions of the Defense Environmental Restoration Program (DERP), the National Environmental Policy Act (NEPA), and any other applicable statutes that protect natural and cultural resources.

CERCLA requirements, in conjunction with corrective action requirements under Subtitle C of the Resource Conservation and Recovery Act (RCRA), govern most environmental restoration activities. Requirements under Subtitles C, D, and I, of RCRA, as well as the Toxic Substances Control Act (TSCA), the Clean Water Act (CWA), the Clean Air Act (CAA), the Safe Drinking Water Act (SDWA), and other statutes, govern most environmental mission or operational-related and closure-related compliance activities. These compliance laws may also be applicable or relevant and appropriate requirements (ARARs) for selecting and implementing remedial actions under CERCLA. NEPA requirements govern the Environmental Impact Analysis and Environmental Impact Statement preparation for the disposal and reuse of BRAC installations.

The BRAC program centers on a single goal: expediting and improving environmental response actions to facilitate the disposal and reuse of a BRAC installation, while protecting human health and the environment.

The Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM); the USEPA; and the Florida Department of Environmental Protection (FDEP) collectively coordinate the cleanup activities through the BRAC Cleanup Team, called the Orlando Partnering Team (OPT) in Orlando. This team approach is intended to foster partnering, accelerate the environmental cleanup process, and expedite timely, cost-effective, and environmentally responsible disposal and reuse decisions.

Questions regarding the BRAC program at NTC, Orlando should be addressed to the SOUTHNAVFACENGCOM BRAC Environmental Coordinator, Mr. Wayne Hansel, Code 18B7, at (407) 646-5294 or SOUTHNAVFACENGCOM Engineer-in-Charge (EIC), Ms. Barbara Nwokike, Code 1873, at (803) 820-5566.

EXECUTIVE SUMMARY

ABB Environmental Services, Inc. (ABB-ES), under contract to the Southern Division Naval Facilities Engineering Command, has prepared this Focused field Investigation Report for the Interim Remedial Action (IRA) located at OU4 (Area "C"), Naval Training Center (NTC), Orlando, Florida. This report was prepared under the Comprehensive Long-Term Environmental Action, Navy (CLEAN) Contract No. N62467-89-D0317 as Contract Task Order No. 107.

The objectives of the focused field investigation were to support the project logic diagram established in the IRA Focused Field Investigation Work Plan which included: 1) defining the extent of contamination in Lake Druid's surface water and sediment; 2) evaluate the source of volatile organics in lake druid; 3) delineate the horizontal and vertical extent of volatile organic compounds (VOC) contaminants in the groundwater along the lakeshore; 4) collect physical characteristics of the lake; and 5) support a focused IRA to mitigate VOC's in Lake Druid. In order to meet the proposed objectives a field program was initiated and included: surface water and sediment sampling; collection of groundwater samples within the surficial aquifer using direct push technology (DPT); monitoring and drive point well installation and sampling; and a site hydrogeologic characterization study.

The analytical program for the investigation included on-site laboratory analyses for 10 target VOCs using a gas chromatograph. A minimum of 10 percent of the groundwater, and sediment and surface water samples, were submitted to an off-site laboratory for confirmatory analysis of VOCs using Contract Laboratory Program (CLP) methods.

Results of the DPT groundwater investigation indicate that the width of the contaminant groundwater plume extends approximately 500 feet from the just south of the north fence line down the shore line of Lake Druid. VOCs were detected in groundwater at depths ranging from 4 to 68 feet below ground surface, and include chlorinated solvents, such as vinyl chloride (VC), dichloroethene (DCE), trichloroethene (TCE), and tetrachloroethene (PCE).

Chlorinated VOC contaminants (VC, DCE, TCE, PCE) were also identified in the drive point well samples, as well as, the sediment and surface water samples. Sediment and surface water samples were collected and VOC's delineated from within the creek, along the shoreline, and out into Lake Druid at approximately 25-foot intervals. The "hottest" areas of contamination were concentrated in the area around the creek's mouth. The six drive point wells, installed near the shore-line, in the creek and out in the lake, were screened into the subsurface just below the sediment bottom of the lake. The drive point wells indicated groundwater contaminated with the target chlorinated compounds just below the lakes sediment bottom.

The sampling results together with some of the hydrogeologic results such as, the drive point wells measuring an up-ward vertical potential around the lake, indicate that a source for Lake Druid's VOC contamination is groundwater. Based on these results the recommendation for this IRA is to submit a Focused Feasibility Study. The study will target controlling the highly contaminated portion of the groundwater plume from entering Lake Druid.

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1.0 INTRODUCTION

1.1 PURPOSE OF TECHNICAL MEMORANDUM. ABB Environmental Services, Inc. (ABB-ES), under contract to Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), has prepared this Focused Field Investigation Report for Operable Unit 4, Former Dry Cleaning and Laundry Facility, at the Naval Training Center (NTC), Area C, in Orlando, Florida. The development of this document is to report the results of the focused field investigation supporting the project logic diagram in the work plan and recommendations for an interim remedial action.

1.2 SITE DESCRIPTION.

1.2.1 Site Location and Description. Operable Unit (OU) 4 is composed of Study Areas 12, 13, and 14 as referred to in the Draft Group I and II Site Screening Reports (ABB Environmental Services, Inc. [ABB-ES], 1995). Area C (Figures 1-1 and 1-2) occupies 46 acres and is located approximately 1 mile west of the Main Base off Maguire Boulevard. Area C serves as a supply center for NTC, Orlando and includes a laundry and dry cleaning facility, which is now closed, and the Defense Reutilization and Marketing Office (DRMO). It is surrounded by urban development, including single- and multifamily residential developments to the north and south, Lake Druid to the west, and an office park to the east. There are no industrial facilities adjacent to Area C. This field investigation focused on approximately 6 acres of Area C property west of SA 13, including the eastern shore area of Lake Druid. Four of these acres were densely vegetated with large trees and heavy undergrowth. The remaining 2 acres are classified as Palustrine wetland by the U.S. Department of the Interior, Fish and Wildlife Service. This included a buffer strip along Lake Druid approximately 150 feet wide, which was defined by a March 1996 walkover of the area by the St. Johns River Water Management District. This buffer strip was also heavily vegetated. Greater detail can be found in Chapter 1.0 of the Area C Preliminary Risk Evaluation (PRE) (Appendix A).

1.2.2 Site History. Building 1100 was included as part of SA 13 during the environmental baseline survey (EBS) (ABB-ES, 1994b), and placed into Group II for screening. The screening investigation at SA 13 was performed in the spring of 1995. SA 13 includes the NTC Laundry and Dry cleaning Facility (Building 1100) and the former location of a Boiler House (Building 1101). SA 13 is located in the northwest corner of Area C at Port Hueneme Avenue and Davisville Street. Building 1101 was located east of Building 1100 and was demolished some time after 1962.

Building 1100 was constructed in 1943 and is a single-story wood-framed structure that has always been used as an industrial laundry and dry cleaning facility, serving the entire military base. The surrounding property is paved asphalt, except for small areas east and west of the building that are landscaped and grass covered. The paved areas around the perimeter of the building include roads and parking lots. Prior to construction of the facility in 1943, the land was undeveloped. The laundry was closed in the fall of 1994.

Reportedly, hazardous wastes materials generated and used in the dry cleaning process have been poorly managed. At the time of the baseline survey, there were reportedly many containers in the building, ranging in volume from ½ to 55 gallons that were open and not labeled. The facility received a Notice of Violation and a citation from Florida Department of Environmental Protection

Figure 1-1 Site Location Map

Figure 1-2 Map of Area C

(FDEP) for unlabeled and unmanifested waste. Wastewater from the laundry machines discharged to the sanitary sewer through badly deteriorated drainage trenches in the floor. The floor trenches discharge to a single pipe connected to a settling and surge tank. Due to the volume of water discharged in this area, a 30,000-gallon surge tank was installed in the mid-1960s. Sludge was removed from this tank annually and disposed of by the DRMO. Waste filters from the dry cleaning machines were also generated at the facility. PCE was separated from the water and filters by heating the assemblies in a pressure cooker. The filters were disposed of through the DRMO and the solvent recycled. In the past, the filters were allegedly disposed of in the North Grinder Landfill (ABB-ES, 1994b).

Reportedly, discharges of water contaminated with chlorinated solvents occurred on the property. Discharges of water from the washing machines to Lake Druid have also been reported.

The site screening investigation conducted at Area C included a soil gas survey, surface and subsurface soil sampling, and the installation of 16 monitoring wells to evaluate groundwater. Twelve wells were placed to evaluate the shallow surficial aquifer and were installed to a depth of approximately 15 to 20 feet bls. Four wells in the immediate vicinity of the laundry were screened at the base of the surficial aquifer, approximately 60 feet bls. Saturated soil samples were collected approximately every 6 feet from the interval between the shallow and deep wells and analyzed on a field gas chromatograph (GC). Combined with the groundwater samples collected from the monitoring wells, these data contributed to the evaluation of the surficial aquifer. The results of the site screening investigation are provided in detail in the Draft Site Screening Report for Groups I and II (ABB-ES, 1995).

Lake Druid was not included in the original site screening investigation. After reviewing the site screening data, the Orlando Partnering Team (OPT) requested that surface water and sediment samples be collected from the lake.

On November 29, 1995, surface water and sediment samples were collected along the shoreline of Lake Druid. These samples were analyzed by an offsite laboratory using U.S. Environmental Protection Agency (USEPA) Method 8010. PCE, TCE, cis-1,2-dichloroethene (cis-DCE), 1,1-DCE, and vinyl chloride were detected at these locations. At some locations, TCE and cis-DCE were detected in surface water at concentrations greater than had been detected in groundwater collected from the monitoring wells during site screening.

On December 11, 1995, additional surface water and sediment samples were collected in Lake Druid approximately 50 feet west of the November locations. The water depth was approximately 4 feet. Cis-DCE was detected in surface water collected from each location further out in the lake. TCE was also detected in surface water from sample location 13D/W00801. TCE and PCE were detected in sediment from this location and from location 13W/D00901. Chlorinated solvent concentrations from the locations further out in the lake were generally lower than at the shoreline.

During the week of December 18, 1995, groundwater samples were collected from the area between Lake Druid and Building 1100 for further screening. Samples were collected from temporary wells installed by hand auger in the heavily vegetated areas and from TerraProbeSM borings placed in open areas. Sample points were placed along north-south lines adjacent to Building 1100 as well as along the northern fence line.

Samples collected from the temporary wells were limited to the water table, and were screened with a portable GC and sent off site for laboratory analysis. Samples were collected from three depth intervals at each TerraProbeSM boring; at the water table, at approximately 18 bls, and at 30 feet bls. Analysis of the TerraProbeSM samples included the field GC and off-site laboratory. The results of this most recent phase of screening show that PCE and TCE are present at elevated concentrations down to 30 feet in depth, below which, samples were not taken. Figure 1-3 is a map showing the locations of all the November 1995, and December 1995 site screening locations, Tables 1-1 and 1-2 summarizes the data from these screening investigations.

Based on the results of the site screening exercises and in conjunction with the OPT, this IRA focused on the chlorinated contamination within Lake Druid was initiated.

Figure 1-3 Site Screening Sampling Locations

Table 1-1. Site Screening: Surface Water / Sediment Sample Results

SAMPLE ID	PCE (ppb)	TCE (ppb)	1,1-DCE (ppb)	CIS 1,2 DCE (ppb)	TRANS 1,2 DCE (ppb)	VINYL CHLORIDE (ppb)
SURFACE WATER						
13W00101				7.7		
13W00201	5.9	340		1100	12	2.2
13W00201D	4.7	370		1100	11	1.8
13W00301	6.6	33	1.5	180	2.5	15
13W00401		3				
13W00501						
13W00601				4.7		
13W00701				4.3		
13W00801		1.2		5.8		
13W00901				4.9		
13W01001				5.3		
13W01101				4.6		
SEDIMENT						
13D00101		2.3		5.7		
13D00201		38		890	18	
13D00201D	28		21	3200	24	69
13D00301	190	4200	10	23000	260	13
13D00401	7.3	19		19		
13D00501						
13D00601						
13D00701						
13D00801	18	11				
13D00901	10	44		37		
13D01001						
13D01101						

Note: The suffix "D" denotes a duplicate sample

Table 1-2. Site Screening: Temporary Well / Terraprobe Sampling Results

SAMPLE ID	PCE (ppb)	TCE (ppb)	1,1-DCE (ppb)	(TOTAL) 1,2-DCE (ppb)	VINYL CHLORIDE (ppb)
TERRAPROBE SAMPLES					
13Q00101FGC	1.5				
13Q00102FGC		59.3			
13Q00103FGC	109.6	8.3			
13Q00201FGC					
13Q00202FGC		45.8			
13Q00203FGC	24.1	23.4			
13Q00301FGC					
13Q00302FGC	11.2				
13Q00303FGC	12.0	18.0			
13Q00401FGC	1.7				
13Q00402FGC	8.8				
13Q00403FGC	167.9	277.6			
13Q00501FGC	0.3				
13Q00502FGC	50.6				
13Q00503FGC	21.9	1059.7			
13Q00601FGC	3.0				
13Q00602FGC	17.0	29.0			
13Q00603FGC	821.1	852.5			
13Q00603	760	2100		51	
13Q00701FGC	250.8	129.9			
13Q00701	1600	240		770	16
13Q00702FGC	4325.8	391.1			
13Q00702	270	18		7	
13Q00703FGC	272.0	41.1			
13Q00801FGC	136.3	5.1			
13Q00802FGC	468.8	54.2			
13Q00803FGC	23.4	7.6			
13Q00901FGC	16.1	1.9			

SAMPLE ID	PCE (ppb)	TCE (ppb)	1,1-DCE (ppb)	(TOTAL) 1,2-DCE (ppb)	VINYL CHLORIDE (ppb)
13Q00902FGC	0.8				
13Q00903FGC	3.0				
13Q01001FGC	.3				
13Q01002FGC	1346.4	51.0			
13Q01002	2500	84		25	
13Q01003FGC	1333.4	604.5			
13Q01003	2000	2200		39	
13Q01101FGC					
13Q01102FGC	863.5	8.6			
13Q01103FGC	952.0	98.7			
13Q01103	6400	400		270	
13Q01201FGC	4.3				
13Q01202FGC	3.1				
13Q01203FGC	43.2				
13Q01301FGC	37.0				
13Q01302FGC	0.1	0.1			
13Q01303FGC	1.5				
13Q01401FGC	1321.7	10.3			
13Q01402FGC	1244.5	379.3			
13Q01403FGC	73.6	7.2			
13Q01501FGC	0.8				
13Q01502FGC	4.9				
13Q01503FGC	71.1	5.6			
13Q01601FGC	1.11	0.3			
13Q01602FGC					
13Q01603FGC					
13Q01701FGC					
13Q01702FGC					
13Q01703FGC					
13Q01801FGC	1.4				
13Q01802FGC					

SAMPLE ID	PCE (ppb)	TCE (ppb)	1,1-DCE (ppb)	(TOTAL) 1,2-DCE (ppb)	VINYL CHLORIDE (ppb)
13Q01803FGC					
13Q01901FGC					
13Q01902FGC					
13Q01903FGC					
13Q02001FGC					
13Q02002FGC					
13Q02101FGC					
13Q02102FGC					
TEMPORARY WELL SAMPLES					
13G00901FGC					
13G00901					
13G01001FGC					
13G01001					
13G01101FGC					
13G01101					
13G01201FGC					
13G01201					
13G01301FGC					
13G01301					
13G01401FGC					
13G01401					
13G01501FGC					
13G01501					
13G01601FGC					
13G01601					
13G01701FGC	99.8	107.7			
13G01701	120	170		320	2
13G01801FGC	6.5	4.8			
13G01801	23	14		34	
13G01901FGC					
13G01901					

SAMPLE ID	PCE (ppb)	TCE (ppb)	1,1-DCE (ppb)	(TOTAL) 1,2-DCE (ppb)	VINYL CHLORIDE (ppb)
13G01901FGCD					
13G02001FGC					
13G02001					
13G02101FGC					
13G02101					

Note: The suffix "D" denotes a duplicate sample
The suffix "FGC" denotes a field GC analysis
The field GC only analyzed for PCE and TCE

2.0 FIELD PROGRAM

A focused field investigation was initiated at OU4 to support the project logic diagram implemented in the work plan, refine the sites conceptual model, and to uphold the implementation of an IRA. The investigation included: 1) defining the extent of contamination in Lake Druid's surface water and sediment; 2) evaluate the source of volatile organics in lake druid; 3) delineate the horizontal and vertical extent of volatile organic compounds (VOC) contaminants in the groundwater along the lakeshore; 4) collect physical characteristics of the lake; and 5) support a focused IRA to mitigate VOC's in Lake Druid.

2.1 SURFACE WATER AND SEDIMENT SAMPLING Samples of sediment and surface water were collected from Lake Druid and the adjoining creek to evaluate the extent of VOC contamination. Fifty-nine surface water samples and fifty-nine sediment samples were collected from Lake Druid at forty-eight locations from May 2, 1996 through May 23, 1996. Figure 2-1 shows the locations of sediment and surface water samples.

Where physically possible, samples were collected on foot from the shoreline. Locations out into the lake were accessed with the use of a jon boat. Surface water samples in shallow water (0 to 1 foot in depth) were collected by directly immersing the sample containers into the surface water. Where the depth of the lake was greater than one foot in depth, a second sample was taken directly above the lake bottom. The collection of the sample above the lake bottom was done with the use of a Beta bottle sampler, allowing for the collection of a surface water sample at the desired depth interval. This water was then transferred into the appropriate sample containers after the Beta bottle sampler was hoisted to the surface. At each sampling location, temperature, conductivity, pH, reduction-oxidation potential, and dissolved oxygen readings were taken and the data is included on the surface water and sediment sampling logs in Appendix B. The sample positions were marked with either stakes or anchored buoys, and also recorded with the use of a Global Positioning System (GPS) manufactured by Trimble.

Following each surface water sample a sediment sample was collected at the same location using one of three methods. Locations accessible by foot were sampled with a 2-inch diameter plastic sleeved stainless steel sediment corer which was pushed by hand or driven with a hammer into the sediment. Upon retrieval of the corer, the plastic sleeve was removed, capped and labelled in preparation for delivery to the onsite lab for analysis.

Where lake depths were less than six feet, a 3.0 inch-diameter stainless steel sleeved sediment sampler was used. It attached to stainless steel rods (extensions) and was lowered manually to the lake bottom from the jon boat. A slide-hammer was used to drive the sampler into the sediment and the sampler was then pulled manually back into the boat. The stainless steel sleeve was removed from the sampler with the sample inside, capped and labelled in preparation for delivery to the onsite lab.

At lake depths greater than six feet, a 1.5 inch-diameter plastic sleeved steel soil sampler was used. It was attached to threaded steel rods and was lowered manually to the lake bottom from a boat and a slide-hammer was used to

Figure 2-1 Surface Water and Sediment Sampling Locations

drive it into the sediment. Upon retrieval, the plastic sleeve was removed, capped, and labelled in preparation for delivery to the onsite lab. Surface water and sediment samples were analyzed for target VOC's in the onsite laboratory. Five sediment samples and four surface water samples were submitted to the off-site laboratory for confirmatory analysis of TCL VOC's. The results of this sampling effort are summarized in Tables 4.2 and 4.3, located in Chapter 4.0 subsection 4.2 of this report.2.1

2.2 PHYSICAL LAKE CHARACTERISTICS Lake characteristics including depth, temperature, conductivity, pH, reduction-oxidation potential, and dissolved oxygen content were measured at three locations near the center of the lake at two depth intervals (Figure 2-1). Access was gained to the lake with the use of a jon boat and then a Beta bottle sampler was used to collect the samples at 3 feet below the lake surface and 3 feet from the bottom at each of the three locations. Data is presented in Table 2-1.

The depth of the lake at the three locations ranged from 13.0 feet to 14.6 feet. The water in the lake is clear and supports abundant flora and fauna. Aquatic plants and fish were observed by investigative team field crew members. Water temperature averaged 84 degrees fahrenheit near the surface and 80 degrees fahrenheit near the bottom. The pH of the lake ranged from 7.40 to 7.69 near the surface and from 6.90 to 7.05 near the bottom, indicating that it is essentially neutral. Specific conductance averaged 157 micro-mhos/cm at the surface and 150 micro-mhos/cm near the bottom, both moderately low values when compared to sea water which has an average value of 50,000 micro-mhos/cm. Reduction-oxidation potential averaged 194.2 mV at the surface and 198.2 mV near the bottom. Dissolved oxygen ranged from 6.8 to 7.4 mg/L at the surface and from 3.3 to 4.2 mg/L near the bottom.

2.3 DIRECT PUSH TECHNOLOGY FIELD PROGRAM The stratigraphy and the distribution of VOC contaminants within the surficial aquifer adjacent to Lake Druid were evaluated using direct push technology (DPT) methods, provided by ABB Environmental Services, Inc. and Fugro Geosciences, Inc. ABB-ES's Terraprobe was used in conjunction with Fugro's DPT rig equipped with: piezocone; hydro-trap groundwater sampler; and a computer, with associated software. This equipment was used to collect:

- information regarding subsurface material characteristics based on piezocone measurements; and
- collect groundwater samples at discrete intervals.

Direct push methods were utilized at 17 locations, including four piezocone locations and 13 groundwater sampling locations, shown on Figure 2-2.

2.3.1 Difficulties Encountered During Penetration The direct push equipment had difficulty penetrating a dense fine-grained sand layer present at depths ranging from 8 to 14 feet bls. Drilling services were called in to install PVC casings through this dense layer. The procedure for installing the casings is explained later in this chapter.

At DPT locations U4Q006 and U4Q007, the casings were not installed deep enough, causing the DPT rig to reach refusal prior to advancing beneath the hard dense layer. Groundwater samples were not able to be collected at these

Table 2-1

Measurements	Locations					
	1		2		3	
Lake Depth (FT)	13.4		14.6		13	
Sample Depth (FT below water surface)	3	10.4	3	11.6	3	10
Temperature (°F)	84	78	84	81	84	81
Specific Conductivity (umhos/cm)	160	150	160	150	150	150
pH	7.69	6.9	7.4	7.05	7.68	6.92
Reduction-Oxidation Potential (mV)	192.5	200.8	203.8	190.5	186.4	203.2
Dissolved Oxygen content (mg/L)	6.8	3.3	6.8	4.9	7.4	4.2

Figure 2-2 DPT Sampling Locations

locations below the dense layer. As a result, location U4Q013 was added near these two abandoned locations. Also, a piezocone penetration was attempted at location U4Q007 where refusal occurred at the dense layer, however no stratigraphy data was collected due to limited penetration.

2.3.2 Stratigraphic Investigation Piezocone penetrations are made by hydraulically advancing a series of steel rods into the soil at a constant rate. Resistance to penetration at the cone tip and at the outer surface of the sleeve, located near the cone tip is recorded. Subsurface pore pressure is monitored with a pressure transducer. These measurements are recorded by the on-board computer. The data are compared to empirically derived measurements or parameters characteristic of different soil types. The piezocone is able to provide information regarding soil classifications consistent with the Unified Soil Classification System, relative soil density (split-spoon blow counts), water levels, and effective thickness of confining units, if any.

Piezocone penetrations were attempted at five locations in conjunction with groundwater sampling. Stratigraphic information was obtained from four of the locations at OU4, provided in Appendix C. Location U4PZ-07, also referred to as location U4Q007 was attempted, but the piezocone could not be advanced past the dense layer. U4PZ-03, also referred to as location U4Q003 was not advanced through a PVC casing, because no dense layer was encountered during split-spoon sampling for casing installations. The absence of this dense layer warranted no casing installation at this location. In addition to data gathered at U4PZ-03, data was gathered from U4PZ-01, U4PZ-04, and U4PZ-10 (also referred to as locations U4Q001, U4Q004, and U4Q010, respectively).

2.3.3 Groundwater Sampling with DPT and Terraprobe Rigs Due to the problems encountered by the DPT rig's ability to penetrate the dense layer, the TerraProbe was utilized for all the groundwater samples taken above the dense layer. This was done to speed up the sampling process. Groundwater samples beneath the dense layer were collected by the DPT rig with the use of the hydro-trap groundwater sampler.

The TerraProbe system utilized a 2 foot retractable screen for groundwater sample collection. The sampler consisted of a telescoping assembly containing a 2-foot length of stainless-steel well screen fitted with an expendable tip. This assemblage was hydraulically advanced with a series of rods. The screen was exposed in the subsurface by retracting the outer casing of the sample device, allowing natural hydrostatic pressure to force groundwater into the sampler. Teflon tubing was then lowered down to the screened interval and an appropriate amount of groundwater was purged out using a peristaltic pump. After a connection with the surrounding formation was established and the groundwater cleared, the teflon tubing was crimped and pulled to the surface for collection of the groundwater sample by gravity flow into the sample containers. Volatiles were collected for analytical analysis at both on-site and off-site laboratories.

The DPT rig utilized the hydro-trap groundwater sampler for collecting groundwater samples at discrete intervals. The hydro-trap groundwater sampler consisted of a telescoping assembly containing a 1-foot length of stainless steel well screen fitted with a cone tip. This assemblage was hydraulically advanced with a series of rods in the same manner as the piezocone penetrations. The screen was exposed in the subsurface by retracting the outer casing of the sample device, allowing natural hydrostatic pressure to force groundwater into the sample collection chamber. The sample was held in the chamber for retrieval by using nitrogen gas back-pressure to impinge a small ball into its check-valve at the bottom of the sample collection chamber. The sample collection chamber and

screen assemblage was lifted to the surface to recover the sample. To collect groundwater from multiple discrete intervals, the hole was reentered with a decontaminated sample collection chamber and screen assemblage and the hydro-trap was advanced to the next desired depth. Cross-contamination was prevented by using O-rings to form water-tight seals above and below the sample chamber.

From May 11, 1996 to June 5, 1996, groundwater samples were collected from 13 locations at OU4, adjacent to Lake Druid (Figure 2-2). A total of 168 groundwater samples were collected from depths ranging from 2 to 67 feet bls. Sample locations and depth intervals were chosen based on analytical data provided by the on-site laboratory. Table 2-2 summarizes all sample depth intervals. Thus, the location and depth interval of successive samples were selected based on analytical information from preceding samples. Sampling objectives included evaluating the horizontal and vertical extent of VOC contamination and characterizing concentrations of VOCs in the plume.

All groundwater samples collected with the DPT and TerraProbe were analyzed for target VOCs in the on-site laboratory. Ten percent of the samples were submitted to an off-site laboratory for confirmatory analysis. Off-site samples were analyzed for volatile organic compounds using the Contract Laboratory Program (CLP) Target Compound List (TCL) for Volatile Organics. Chapter 3.0 provides more detailed information about the analytical program for this investigation. The results of this sampling effort are discussed in Chapter 4.0 of this report.

2.4 DRIVE POINT WELL INSTALLATION Ten drive point wells were installed during the focused field activities to: 1) assess vertical hydraulic potential between the groundwater and the lake; 2) sample groundwater in the sediment just below the lake bottom; and 3) to assist in assessing groundwater flow direction across OU4. Well point locations are shown on Figure 2-3.

The drive point wells are constructed from 1.25-inch diameter stainless steel casing and screen. The casings are all five foot sections while the screens are one foot in length with 0.010-inch (10-slot) openings with a stainless steel cast point tip (Figures 2-4 and 2-5). They were installed with the use of a slide hammer, driven point down to below the top of the lake bottom, for the wells in the lake, or to below the top of the water table, for the wells inland.

To insure connection to the surrounding formation each drive point well was developed upon installation. The wells were developed through the use of an ISCO peristaltic pump by lowering teflon tubing into the drive point well and

Table 2-2 DPT Location Sample Intervals

SAMPLE ID	DEPTH (FT)	SAMPLE ID	DEPTH (FT)	SAMPLE ID	DEPTH (FT)
U4Q00101F	2-4	U4Q00207F	32-34	U4Q00411F	27-29
U4Q00102F	4-6	U4Q00208F	40-42	U4Q00412F	29-31
U4Q00103F	6-8	U4Q00209F	48-50	U4Q00413F	31-33
U4Q00104F	8-10	U4Q00210F	56-58	U4Q00414F	33-35
U4Q00105F	10-12	U4Q00211F	60-62	U4Q00415F	35-37
U4Q00106F	24-26	U4Q00301F	4-6	U4Q00416F	37-39
U4Q00107F	26-28	U4Q00302F	6-8	U4Q00417F	39-41
U4Q00108F	28-30	U4Q00303F	8-10	U4Q00418F	41-43
U4Q00109F	30-32	U4Q00304F	10-12	U4Q00419F	43-45
U4Q00110F	32-34	U4Q00305F	12-14	U4Q00420F	45-47
U4Q00111F	34-36	U4Q00305FD	12-14	U4Q00421F	47-49
U4Q00112F	36-38	U4Q00306F	16-18	U4Q00422F	49-51
U4Q00113F	38-40	U4Q00307F	22-24	U4Q00423F	51-53
U4Q00113FD	38-40	U4Q00308F	34-36	U4Q00424F	53-55
U4Q00114F	40-42	U4Q00309F	42-44	U4Q00425F	55-57
U4Q00115F	42-44	U4Q00309FD	42-44	U4Q00426F	57-59
U4Q00116F	44-46	U4Q00310F	52-54	U4Q00501F	4-6
U4Q00117F	46-48	U4Q00311F	60-62	U4Q00502F	6-8
U4Q00118F	48-50	U4Q00401F	2-4	U4Q00503F	20-22
U4Q00119F	50-52	U4Q00402F	4-6	U4Q00504F	24-26
U4Q00120F	52-54	U4Q00403F	6-8	U4Q00505F	28-30
U4Q00121F	59-61	U4Q00404F	8.5-10.5	U4Q00506F	32-34
U4Q00122F	65-67	U4Q00405F	15-17	U4Q00506FD	32-34
U4Q00201F	3-5	U4Q00406F	17-19	U4Q00507F	36-38
U4Q00202F	6-8	U4Q00407F	19-21	U4Q00508F	42-44
U4Q00203F	9-11	U4Q00407FD	19-21	U4Q00509F	48-50
U4Q00204F	22-24	U4Q00408F	21-23	U4Q00510F	58-60
U4Q00205F	24-26	U4Q00409F	23-25	U4Q00601F	4-6
U4Q00206F	28-30	U4Q00410F	25-27	U4Q00602F	6-8
U4Q00603F	9-11	U4Q00909F	48-50	U4Q01104F	10-12
U4Q00604F	11-13	U4Q00910F	52-54	U4Q01105F	12-14

SAMPLE ID	DEPTH (FT)	SAMPLE ID	DEPTH (FT)	SAMPLE ID	DEPTH (FT)
U4Q00605F	22-24	U4Q01001F	4-6	U4Q01106F	14-16
U4Q00606F	26-28	U4Q01002F	6-8	U4Q01107F	22-24
U4Q00607F	30-32	U4Q01003F	8-10	U4Q01108F	26-28
U4Q00701F	4-6	U4Q01004F	10-12	U4Q01109F	30-32
U4Q00702F	6-8	U4Q01005F	12-14	U4Q01110F	34-36
U4Q00703F	18-20	U4Q01006F	14-16	U4Q01111F	38-40
U4Q00801F	4-6	U4Q01007F	22-24	U4Q01112F	44-46
U4Q00802F	6-8	U4Q01008F	24-26	U4Q01113F	50-52
U4Q00803F	18-20	U4Q01009F	26-28	U4Q01114F	54-56
U4Q00804F	24-26	U4Q01010F	28-30	U4Q01115F	58-60
U4Q00805F	30-32	U4Q01011F	30-32	U4Q01115FD	58-60
U4Q00806F	38-40	U4Q01012F	32-34	U4Q01116F	62-64
U4Q00807F	46-48	U4Q01013F	34-36	U4Q01201F	4-6
U4Q00808F	50-52	U4Q01014F	38-40	U4Q01201FD	4-6
U4Q00809F	54-56	U4Q01015F	42-44	U4Q01202F	6-8
U4Q00901F	4-6	U4Q01016F	46-48	U4Q01202FD	6-8
U4Q00902F	7-9	U4Q01017F	48-50	U4Q01203F	8-10
U4Q00903F	16-18	U4Q01018F	50-52	U4Q01204F	18-20
U4Q00903FD	16-18	U4Q01019F	52-54	U4Q01205F	22-24
U4Q00904F	20-22	U4Q01020F	54-56	U4Q01205FD	22-24
U4Q00904FD	20-22	U4Q01021F	56-58	U4Q01206F	26-28
U4Q00905F	24-26	U4Q01022F	58-60	U4Q01206FD	26-28
U4Q00905FD	24-26	U4Q01023F	60-62	U4Q01207F	32-34
U4Q00906F	28-30	U4Q01024F	64-66	U4Q01207FD	32-34
U4Q00906FD	28-30	U4Q01101F	4-6	U4Q01208F	38-40
U4Q00907F	34-36	U4Q01102F	6-8	U4Q01209F	46-48
U4Q00908F	42-44	U4Q01103F	8-10	U4Q01210F	50-52
U4Q01211F	54-56	U4Q01302F	30-32	U4Q01305F	48-50
U4Q01212F	58-60	U4Q01303F	36-38	U4Q01306F	54-56
U4Q01301F	24-26	U4Q01304F	42-44	U4Q01307F	58-60

Figure 2-3 Drive Point Well Location Map

Figure 2-4 Typical Drive Point Well Construction Detail in Lake Druid

Figure 2-5 Typical Drive Point Well Construction Detail Inland

pumping at a constant rate into a five gallon bucket. The tubing was used to surge the wells while pumping. Each well was purged approximately five gallons until each pumped clear, to little or no turbidity.

In order to analyze the head potential between the surface water and the groundwater, six drive point wells were installed in Lake Druid. As shown on Figure 2-3 the wells were situated with four along the shore-line, one in the lake, and one in the creek.

Following purging, a groundwater sample was collected from each of the six drive point wells within the lake. The wells were sampled to characterize groundwater contamination just below the lake bottom. The wells were sampled using 3/4-inch I.D. teflon bailers and analyzed in the on-site laboratory for target VOA's. The sampling results are reported in Chapter 4.0, Subsection 4.3

Four drive point wells were installed inland to assist in assessing groundwater flow across the study area. The elevation of groundwater was determined by subtracting the depth of water below the top of casing (btoc) from the elevation at the top of casing at the four drive point well locations inland. The data is used along with elevation data from the monitoring wells to create a potentiometric surface map reported in Section 2.6.1. of this chapter.

2.5 DRILLING FIELD PROGRAM Drilling services were provided under subcontract, by Alliance Environmental, Inc. They were tasked to install surface casings, collect subsurface soil samples, and install monitoring wells.

2.5.1 Surface Casing Installation Alliance used mud rotary drilling-methods to construct the boreholes for surface casing installation. The casings were installed for two reasons:

- 1) to seal off the upper portion of the surficial aquifer from potentially contaminating that which is beneath the dense layer, while, penetrating through the dense layer with telescope casing & access with DPT to take groundwater samples; and
- 2) to seal off the upper portion of the surficial aquifer while installing intermediate and deep monitoring wells

The casings installed, enabling the DPT rig to sample beneath the dense layer, consisted of a 6-inch PVC section set just into the dense layer, and a 2-inch PVC section telescoping through the dense layer. The borehole for the 6-inch PVC section was created using mud rotary drilling methods with a 10.25-inch roller-cone bit. The advancement of the 2-inch section was completed using a 4.25-inch roller-cone bit. Each section of the telescoping casing was secured and sealed with a cement-bentonite grout mix that was tremied from the bottom of the casing to the ground surface. Table 2-3 summarizes the construction details for each casing.

Table 2-3
Casing Construction Details

Interim Remedial Action
Focused Field Investigation
Operable Unit 4
Naval Training Center
Orlando, Florida

Boring ID	Date Installed (Six Inch)	Date Installed (Two Inch)	Six Inch Casing Depth (feet bls)	Two Inch Casing Depth (feet bls)
U4Q001 (1)	5/17/96	5/19/96	17	23
U4Q001 (2)	5/18/96	5/19/96	17	23
U4Q002	5/18/96	5/19/96	16	22.5
U4Q004 (1)	5/20/96	5/21/96	11.5	16
U4Q004 (2)	5/20/96	5/21/96	11	16
U4Q005	5/20/96	5/21/96	11	18
U4Q006	5/20/96	5/21/96	16	20
U4Q007 (1)	5/22/96	5/23/96	10	18
U4Q007 (2)	5/22/96	5/23/96	10	18
U4Q008	5/22/96	5/23/96	12	18
U4Q009	5/22/96	5/23/96	13	15.5
U4Q010 (1)	5/29/96	5/30/96	17	22
U4Q010 (2)	5/29/96	5/30/96	17	22
U4Q011	5/29/96	5/30/96	17	22
U4Q012	5/29/96	5/30/96	12	18
U4Q013	6/03/96	6/04/96	14	24.5

All casing materials are made of PVC.

Notes: bls = below land surface

Upon completion of piezocone advancement and groundwater sample collection, the casings and associated holes were abandoned using a cement-bentonite mix that was tremied from the bottom of the associated hole and casing to the ground surface.

Casings were also installed during monitoring well installation. Eight-inch steel casings were installed to seal off contamination in the upper zones of the surficial aquifer from the deeper zones. Such casings were used in the construction of two intermediate and two deep wells. The boreholes for the four casings were created by a 10.25-inch roller-cone bit. Once installed, the casings were grouted in place by tremieing a cement-bentonite grout mix from the bottom of the casing to the surface. Details of the casings for monitoring wells is included in Table 2-4.

2.5.2 Subsurface Soil Lithologic Sampling Lithologic samples were collected at both deep monitoring well locations. Samples from the surface to the were gathered during the installation of the PVC casings used for the DPT work. The remainder of the lithologic samples were collected during the installation of the steel casings and the monitoring wells. Boring logs are included in Appendix D. Four samples from four different zones were sent off-site for grain size analysis, to assist in the design of all future monitoring and recovery wells installed at the site. Sample U4SGS01 was a composite of soil taken above the dense layer. U4SGS02 was a representative sample of the dense layer. U4SGS03 was a composite of samples from below the dense layer. U4SGS04 was a representative sample from just above the Hawthorn Group. The results are presented in Appendix E.

2.5.3 Monitoring Well Installation Six monitoring wells were installed at OU4 to characterize the groundwater quality and hydraulic characteristics of the surficial aquifer (Figure 2-6). The six monitoring wells were installed at two locations as clusters of three. Each cluster contains: a shallow well, water table well completed above the dense layer; an intermediate well, cased to the upper portion of the dense layer and intended to screen the interval containing the very dense and in some cases cemented sand; and a deep well, cased down to approximately 40 feet and screened above the uppermost clay layer within the Hawthorn Group. Monitoring well clusters were installed to have long term monitoring capabilities within the surficial aquifer and characterize groundwater within the dense layer. Cluster locations were selected (with approval from the OPT) to best characterize the site's geology and hydrology at different depth intervals.

The shallow monitoring wells were installed by using an 8-inch outside diameter, hollow stem auger. The intermediate and the deep monitoring wells were advanced through 8-inch diameter casing with the 4.25-inch roller-cone bit. All the monitoring wells installed were constructed of 2-inch inside-diameter, schedule 10S Type 304, flush-jointed, threaded, stainless steel screen and riser. The shallow wells have 10 feet of 0.010-inch wire wrapped screens. The intermediate and deep wells were constructed with 5 feet of 0.010-inch wire wrapped screen. The annular space around the well screens was backfilled with a clean silica sand (20/30), compatible with the screen slot size, extending from the bottom of the well screen to 2 feet above the top of the screen. A minimum 0.5 foot thick bentonite pellet seal was installed

Table 2-4
Monitoring Well Construction Details

Interim Remedial Action
Focused Field Investigation Report
Operable Unit 4
Naval Training Center
Orlando, Florida

Well ID	Date Installed	Borehole Depth (feet bls)	Well depth (feet bls)	Screen Interval	Filter Pack Interval	Seal Interval	Grout Interval	Casing Depth (feet bls)
OLD-13-09	5/31/96	12	11	1-11	0.5-12	0-0.5	0	N/A
OLD-13-10	6/02/96	21	21	16-21	15-21	12-15	0-12	15
OLD-13-11	6/02/96	62	62	57-62	55-62	52-55	0-52	35.5
OLD-13-12	6/04/96	11.5	11.5	1.5-11.5	1-11.5	0-1	0	N/A
OLD-13-13	6/04/96	21	21	16-21	14-21	10-14	0-10	15.5
OLD-13-14	6/04/96	62	62	57-62	55-62	53-55	0-53	45

All wells constructed with 2-inch Stainless Steel riser and screen. All wells are equipped with 0.01-inch wire wrapped screen.

Notes: bls = below land surface
N/A = No casing was installed

Figure 2-6 Monitoring Well Location Map

above the sand pack. A cement-bentonite grout was tremied from the top of the bentonite seal to the ground surface. Each well was completed with an above ground protective cover with locking cap for security, surrounded by a 3-foot by 4-foot by 6-inch concrete pad. Protective posts were placed around both clusters of wells. Table 2-4 summarizes the construction details for each well. Monitoring well construction diagrams are provided in Appendix F.

2.5.4 MONITORING WELL DEVELOPMENT Each monitoring well was developed by ABB-ES personnel following a minimum of 24 hours of grout set time. The wells were developed to remove fine soil particles, improve hydraulic connection with the natural formation, and to obtain representative groundwater samples during the groundwater sampling phase. All monitoring wells were pumped with submersible pumps. Development of the deep wells was initiated with an inertial pump and completed with a submersible pump. Wells were purged a minimum of three well volumes, until the water was clear and free of turbidity, and/or until field measurements of pH, temperature, and conductivity stabilized. All of the parameters were measured regularly during the development process and logged into the field logbook. All foreign water introduced during well installation was also developed out of the formation. The monitoring well development logs are provided in Appendix G.

Development data indicated that OLD-13-11 and OLD-13-13 may have suffered some form of grout intrusion. Evidence of this can be seen throughout the relatively high pH readings.

2.6 GROUNDWATER SAMPLING Approximately two weeks following the monitoring well installation, the first groundwater sampling event was conducted. Prior to each well being sampled, each well was purged to clear the well of stagnant water in the monitoring well which was not representative of aquifer conditions. Low-flow sampling was the method utilized to purge and sample each monitoring well installed at OU4. The purpose of using low-flow purging was to ensure that the sample taken was from the targeted aquifer zone. New 1/4 inch outside diameter (O.D.) teflon tubing was lowered into each well and connected to an ISCO peristaltic pump for purging. All investigative derived waste (IDW) generated from the purge was placed in drums at a staging area north of Building 1100 on site and labeled accordingly.

The breathing zone, as well as the mouth of each well was monitored with a flame-ionization detector. No readings were detected in the breathing zone, but were detected in the well mouths at every location. OLD-13-10 had the largest reading at 400 parts per million (ppm). A methane filter was used, however, by the time it was employed, most of the volatile organic compounds probably had escaped the well mouth. Steady readings could not be sustained long enough to compare the filter and non-filter readings accurately. It appeared the readings with and without the filter may be very similar, therefore, if it is believed that a majority of the detection was methane.

Parameters were collected regularly during purging. The parameters collected were temperature, pH, conductivity, and dissolved O₂ and were measured with an Orion model 250A (pH), YSI model 33 conductivity/temperature and a YSI model 51B dissolved O₂ meter, respectively. When those parameters stabilized and turbidity was very clear to the eye, a sample was taken. OLD-13-11 and OLD-13-13 had elevated pH readings, although they were thoroughly developed and purged. It was believed that grout and/or mud from the drilling process collected down near the screen and could not be flushed out. Refer to Appendix H, the Field Data Record forms for more specific details of each purge and sample taken.

For sampling, a new 2.5 liter amber bottle was used to collect the samples. A rubber stopper, #5 size, was wrapped in a teflon swatch. It was placed in the bottle mouth with two 1/4 inch O.D. teflon tubing sections inserted through two holes in the stopper. One piece of tubing ran up from the well and the other ran to the peristaltic pump as shown in Figure 2-7. A vacuum was created in the bottle and the sample was slowly drawn in. The 2.5 liter amber bottle was filled and the contents were poured into the containers appropriate for each parameter sent to the laboratory for analysis.

Parameters collected for laboratory analysis are summarized in Table 2-5. A .45 micron filter was connected in line with the sampling procedure to gather the filtered inorganic sample. Groundwater collected for analysis for volatile organic aromatics (VOA) were collected last in three 40 ml glass vials. They were collected as a grab sample by taking the 2.5 liter amber bottle out of line and slowly purging a sample through the teflon tubing. The tubing was removed from the well and the sample was drained in reverse out of the teflon tubing into the 40 ml vials.

Proper QA/QC was maintained during groundwater sampling as outlined in the Comprehensive Quality Assurance Plan, Section 6.5 (ABB-ES, 1995). A rinseate was taken from the teflon tubing used to sample the wells. At location OLD-13-09 a duplicate was completed for all parameters sent to the laboratory. A MS/MSD was taken at location OLD-13-10. All samples were kept on ice in the field with a trip blank. Samples were packed and then shipped by Federal Express priority overnight. Quality Analytical Laboratories in Montgomery, Alabama received all shipments and Appendix I contains copies of the chain-of-custodies.

2.7 HYDROGEOLOGIC CHARACTERIZATION SURVEY

A hydrogeologic characterization survey was conducted including: a groundwater elevation survey; a vertical potential survey; collection of aquifer parameters through slug tests; and analysis of aquifer seepage into the lake to support the sites conceptual model.

2.7.1 Groundwater Elevation Survey In order to assess groundwater flow across the site, groundwater elevations in each of the monitoring wells and inland drive point wells was measured. The horizontal and vertical coordinates of the monitoring wells and drive point wells were surveyed by a Florida licensed surveyor and are presented in Table 2-6. The elevation of groundwater is determined by subtracting the depth of water below the top of casing (btoc) from the elevation at the top of casing. One round of water level measurements were taken using a water level indicator and are reported in Table 2-7. This water level data represents the potentiometric surface shown as Figure 2-8. This data indicates groundwater flow is toward the west.

Figure 2-7 Low Flow Groundwater Sampling Detail

Table 2-5 Monitoring Well Groundwater Off-Site Laboratory Analytical Parameters

Laboratory Analysis Collected	AMOUNT	PRESERVATIVE
Total Suspended Solids, Total Dissolved Solids, Total Solids, Total Chlorides, Alkalinity, Sulfate	1 liter	none
Total Organic Carbon	100 ml	H ₂ SO ₄
Total Sulfides	250 ml	ZnAc/NaOH
Inorganics	1 liter	HNO ₃
Inorganics, .45 micron filter	1 liter	HNO ₃
Volatile Organic Aromatics	3 - 40 ml	HCL

Table 2-6
Well Point/Monitoring Well Location and Elevation Survey

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Well No.	Horizontal Coordinates ¹		TOC Elevation (msl)
	North	East	
DP-1			
DP-2			
DP-3			
DP-4			
DP-5			
DP-7			
DP-8			
DP-9			
DP-10			
OLD-13-09			
OLD-13-10			
OLD-13-11			
OLD-13-12			
OLD-13-13			
OLD-13-14			

¹ U.S. Geological Survey, North American Datum, 1927.

Notes: TOC = top of casing.
msl = mean sea level.

**Table 2-7
Water Level Elevation Survey**

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Well Number	Date	Depth to Water (feet btoc)	Well Top Elevation (feet)	Water Level Elevation (feet)
OLD-13-9A	7/23/96	4.07		
OLD-13-10B	7/23/96	3.78		
OLD-13-11C	7/23/96	3.61		
OLD-13-12A	7/23/96	4.24		
OLD-13-13B	7/23/96	4.60		
OLD-13-14C	7/23/96	4.82		
DP-7	7/23/96	9.09		
DP-8	7/23/96	4.34		
DP-9	7/23/96	5.37		
DP-10	7/23/96	7.41		

Notes: btoc = below top of casing.
msl = mean sea level.

Figure 2-8 Potentiometric Surface Map, July 23, 1996

2.7.2 Slug Testing In Situ hydraulic conductivity tests were performed on four of the monitoring wells installed during this investigation. Rising head slug tests were run for all the wells; falling head tests were run only on wells where the water table was above the screened interval of the monitoring well. The shallow monitoring wells (OLD-13-09 and OLD-13-12) had three rising head slug tests run. The intermediate and deep well (OLD-13-10 and OLD-13-14, respectively) had two rising head and two falling head slug tests run.

Before each test, the monitoring wells were opened and allowed to equilibrate with ambient air conditions. A static water level measurement was recorded after the well had equilibrated. A 10-pounds per square inch (psi) transducer was lowered into the monitoring well far enough below the water surface to prevent any collisions with the slug. In shallow wells, the transducer was lowered to within 2 feet of the bottom of the well so that accumulated silts in the bottom of the well would not interfere with the ports.

Time was allowed for the transducer to equilibrate with the new conditions and water level to return to static. The transducer was connected to a Hermit 1000c data logger. After equilibrium was reached, the slug was submerged and the data logger started. The slug test was allowed to run a minimum of 10 minutes so that the step function of the data logger could be used. When the water level had recovered to at least 90 percent of static levels, the test was stopped. The slug was removed swiftly from the well and the rising head part of the test was begun. The well was again allowed to recover to 90 percent of static water level before the test was stopped.

The data was downloaded to a computer where it was processed using the method of Bouwer and Rice (1976) as implemented in the Aqtesolv software program. For wells where the top of the screen was above the water table, the plot was analyzed using the double straight line method (Bouwer, 1989) to account for filter pack drainage. The permeability test plots are provided in Appendix J.

2.7.3 Vertical Potential Survey A vertical potential survey was conducted in order to analyze the head potential between the surface water and the groundwater. Six drive point wells were installed in Lake Druid, as shown on Figure 2-3, the wells were situated with four along the shore-line, one in the lake, and one in the creek. Head potential was analyzed by measuring the difference in water level between the groundwater inside the well and the surface water outside the well casing. By using the top of casing as a reference, a higher water level inside the well than the surface water outside the well indicates an upward potential from the surficial aquifer, i.e. water is flowing from the surficial aquifer into the lake. A lower water level inside the well than the surface water outside the well indicates an downward potential from the lake into the surficial aquifer, i.e. water is flowing from the lake into the aquifer. Table 2-8 presents the results from the head potential survey.

2.7.4 Seepage Meter As stated in the Interim Remedial Action Focused Field Investigation Work Plan, a seepage meter was to be utilized to measure the rate at which Lake Druid is being fed by the surficial aquifer. ABB-ES fabricated a seepage meter from a 55-gallon drum and some PVC hardware. The seepage meter was tested in Lake Baldwin prior to the field effort and indicated good connection between the lake and the surficial aquifer. In Lake Baldwin, the seepage meter responded the first twenty-four hour period with 25 milli-liters (ml) of groundwater flowing into the meter and the next day

**Table 2-8
Head Potential Elevation Survey**

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Well Number	Date	Depth to Water		Potential (Upward-U) (Downward-D)
		Depth to Water Inside Casing(feet btoc)	Outside Casing (feet btoc)	
DP-1	5/12/96	2.10	2.21	U
	5/28/96	2.04	2.09	U
DP-2	5/12/96	3.66	3.70	U
	5/28/96	3.54	3.58	U
DP-3	5/28/96	3.86	3.96	U
DP-4	5/28/96	2.86	2.97	U
DP-5	5/28/96	3.46	3.49	U
DP-6	5/28/96	4.34	4.36	U

Notes: btoc = below top of casing.
msl = mean sea level.

following a heavy rain fall event the meter recorded a 100 ml in a 24-hour period. However, in Lake Druid the seepage meter at this time was not able to show a response. This was probably due to the fact that in order to get a response the seepage meeter must be well connected, "sealed", to the lake's bottom. The bottom of Lake Baldwin was mostly sand allowing for good connection, where as, the bottom of Lake Druid has a thick organic mat setting above the sandy bottom making more difficult to get the proper seal. Therefore, data indicating seepage rate from the seepage meter is not available at this time.

3.0 ANALYTICAL PROGRAM

This section summarizes the analytical program for on-site and off-site analysis of soil samples, sediment samples, surface water samples and groundwater samples collected during Interim Remedial Action Focused Field Investigation at OU4. All samples were collected in accordance with procedures outlined in the Quality Assurance Project Plan for CLEAN operation, Section 6.0 (ABB-ES, 1995). In addition, this section assesses on-site and off-site data quality and useability and compares on-site and off-site analytical results.

3.1 ON-SITE CHEMICAL ANALYSIS Samples collected for on-site analysis were analyzed for target VOCs using a gas chromatographic (GC) field laboratory. The analytical methods used were based on standard USEPA methods SW-846, 5030 (purge and trap preparation), 8000A (GC calibration), 8010A (halogenated volatile organics), and 8020 (BTEX) with modifications for field analysis. Table 3-1 summarizes the sampling and analysis program for samples collected for on-site laboratory analysis.

3.1.1 On-Site Analytical Methodology Modifications to the USEPA 8010/8020 Method are summarized in this subsection. Samples were analyzed using a Tekmar 3000 purge and trap concentrator connected to a Hewlett-Packard™ 5890 Series II GC. The GC was set up with the purge and trap unit and for efficiency, a Tekmar 2016, 16 port automatic sampler was added later in the program. Two detectors, a photometric ionization detector (PID) for BTEX and an electrolytic conductivity detector (ELCD) for chlorinated hydrocarbons were used. A DB-624 75-meter megabore column was used for compound separation. The following run conditions were established:

Tekmar 3000 purge time = 6 minutes
Tekmar 3000 desorb time = 2 minutes
Tekmar 3000 bake time = 5 minutes
HP 5890 injection port temperature = 180 °C
HP 5890 PID detector port temperature = 275 °C
HP 5890 ELCD detector port temperature = 900 °C
HP 5890 initial oven temperature = 40 °C for 4 minute
HP 5890 oven temperature ramp = 6 °C per minute
HP 5890 final oven temperature = 180 °C
helium carrier flow = 10 ml per minute
hydrogen make-up flow = 110 ml per minute

3.1.2 On-Site Performance Criteria The quality control (QC) criteria for the on-site analytical method was established to monitor method performance. An initial three-point calibration for quantitation (low, mid-range, and high concentrations) was performed for each instrument. Target compounds and reporting limits are presented on Table 3-2. Instrument stabilities were monitored every 24 hours with a calibration standard at the mid-range concentration. The quantitation performance criterion for operation was the agreement of the check standard with the three-point calibration curve to within 30 percent. Samples were to be analyzed only if no more than one compound per detector exceeded these criteria. If the standard did not meet this criterion, a second standard was analyzed. If this second standard did not meet criteria, a new calibration curve was prepared.

The identities of the target compounds were based on comparison with the retention times for the standards. Retention time windows of plus or minus 3 percent were established, based on the most recent calibration curve. For some

cases, especially vinyl chloride, the peak was so broad that a 3 percent retention time window was not adequate and operator judgement was applied.

Every 24 hours, a method blank of deionized water was analyzed to confirm that no target compounds were introduced by sample handling and analysis. The method blank criterion was met if no target compounds were present above the reporting limit for the instrument. A surrogate solution containing bromofluorobromine (BFB) was injected into each sample at a known concentration to determine percentage recoveries. The recovery range of 50 to 150 percent was established for water samples and the recovery range of 30 to 170 percent was established for soil samples as one of the operating criteria for on-site analysis.

3.2 OFF-SITE CHEMICAL ANALYSIS The overall precision and variability of the field screening program is assessed through the use of split samples which are analyzed by both the ABB-ES field laboratory and a Naval Energy and Environmental Support Activity (NEESA) certified off-site laboratory. Approximately 10 percent of the environmental samples collected were sent to the off-site laboratory, consisting of 18 groundwater samples (including one field duplicate), 4 surface water samples, and 5 sediment samples.

Presented below is an evaluation of the analytical results for these samples. On-site samples were analyzed for purgeable volatile organic compounds using the field screening methodology described in Section 3.1.1. Sediment samples were analyzed off-site for the Target Compound List (TCL) volatile organics using the Contract Laboratory Program (CLP) Statement of Work (SOW) for Organics Analysis (OLM01.9). Groundwater and surface water samples were analyzed off-site for low level volatile organics, using the Superfund Analytical Method for Low Concentration Organics Analysis (SAMLCO, 10/92). Off-site laboratory results conforms to Level D (U.S. Environmental Protection Agency [USEPA] Level IV) requirements and were independently reviewed and validated by a subcontractor against Level C requirements using NEESA guidance document 20.2-047B (1988), entitled Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Program.

3.2.1 Off-Site Data Comparison Methodology As there are no specific review criteria for split samples in both the NEESA and USEPA CLP program documents, the use of the laboratory duplicate precision criteria is utilized in this evaluation. It should be noted, however, that the use of this evaluation procedure may be overly conservative especially with the sediment samples as the samples were not composited. Compositing environmental samples for determination of volatiles is generally not appropriate. Sediment duplicate results have a greater variance than water matrices due to difficulties associated with collecting identical field samples. Thus, the field samples submitted to both on-site and off-site laboratories are not considered true splits, and will more likely result in a greater variability than laboratory duplicates. Split samples measure comparability of field and laboratory results; therefore, the results may have more variability than laboratory duplicates, which measure only laboratory performance. Another source of variability is the different methods used in the analysis, i.e., gas chromatography (on-site) versus gas chromatography/mass spectroscopy (off-site).

Table 3-1 Summary of Sampling and Analysis Program for Samples Collected
for On-site Analysis

TYPE OF SAMPLING	NUMBER OF VOC ANALYSIS
Groundwater (Drive Point)	8
Groundwater (Direct Push)	168
Surface Water	59
Sediment	59
Soil	4
Quality Control Samples	
Field Duplicates	27
MS/MSD	18
Equipment Rinseate Blanks	48
Method Blanks	34

Notes:

VOC = Volatile Organic Compounds

MS/MSD = Matrix Spike / Matrix Spike Duplicate

Table 3-2 Target Compounds and Reporting Limits for On-site Analysis

COMPOUND NAME	REPORTING LIMIT (ug/l)
Vinyl Chloride	0.1
1,1 Dichloroethene	1.0
trans - 1,2 - Dichloroethene	0.5
cis - 1,2 - Dichloroethene	2.0
Trichloroethene	0.5
Tetrachloroethene	0.5
Benzene	0.5
Toluene	0.5
Ethylbenzene	0.5
m/p - Xylene	0.5
o - Xylene	0.5

Notes: ug/l = micrograms per liter

The duplicate precision criteria has been routinely used in the NEESA and USEPA Contract Laboratory Program (CLP) to evaluate comparability of laboratory duplicate samples. The same approach can be applied to field duplicates and split samples. Precision is a measure of the agreement or repeatability of a set of replicate results obtained from duplicate laboratory analyses of samples collection from the same location or depth interval. Precision is a quantitative measure that is expressed as the relative percent difference (RPD) between analytical values for two samples from the same source divided by the average of their analytical values. RPD is calculated using the equation:

$$RPD = \frac{D_1 - D_2}{\frac{1}{2}(D_1 + D_2)} \times 100 \quad (1)$$

where D_1 and D_2 are the reported values for the duplicate samples.

Laboratory duplicate precision criteria specify that RPDs be no greater than $\pm 20\%$ for water samples and $\pm 35\%$ for soil samples when both sample results are greater than 5 times the contract required quantitation limit (CRQL). It should be noted that primarily because of the greater variability expected in field duplicates, some USEPA regional offices (e.g., Region II) specifies that field duplicates be qualified as estimated if RPD is greater than 100 for paired data where sample and duplicate are both greater than 5 times CRQL.

If the sample and/or duplicate is less than five times the CRQL, the absolute difference criteria, $|D_1 - D_2|$, where D_1 and D_2 are the reported values for the duplicate samples, is used. Field duplicates are qualified as estimated if the absolute difference between the analytical values is greater than CRQL for water samples and $2 \times \text{CRQL}$ for soil samples. No calculations are made if both sample and duplicate are below quantitation limits, i.e., the nondetected parameter pairs are considered to be within control limits.

For this evaluation, the acceptance criteria for evaluating precision of field duplicates is an RPD of 20 for water matrices and an RPD of 35 for soil/sediment matrices. For sample results where one or both samples are below $5 \times \text{CRQL}$, the absolute difference criteria of $< \text{CRQL}$ for water samples and $< 2 \times \text{CRQL}$ for sediment samples is used. A CRQL value of 10 ug/L (water samples) and 10 ug/kg (sediment samples) is used as the proxy concentration for nondetected parameters in the calculation of absolute difference.

3.3 STATISTICAL COMPARISON OF ON-SITE AND OFF-SITE LABORATORY RESULTS

A comparison of the field screening results and the off-site laboratory results for VOCs is presented in Tables 3-3a,b,c, and d. Only those compounds with at least one detection in at least one sample (field lab or off-site laboratory) is shown and evaluated for each matrix (groundwater, surface water and sediment). If all nondetected compounds analyzed in both on-site and off-site laboratory are included in the calculations, the percent parameter pairs that are out of control for either the RPD or absolute difference criteria are significantly reduced.

A statistical summary of the results is presented at the end of Tables 3-3a,b,c. Following is a summary of the major findings.

Table 3-3

3.3.1 Groundwater Analytical results of 18 paired groundwater samples indicated excellent precision with much less variability expected in water matrices. Three out of the 18 samples have at least one parameter pair outside of control limits. Only 5 out of 108 parameter pairs evaluated (4.6% of the total) failed the RPD or |D| criteria, even while using a conservative laboratory duplicate criteria. These results indicate very good comparability of the field screening data with that of the higher data quality off-site data.

3.3.2 Surface Water Analytical results of 4 paired surface water samples indicated good precision. Only 5 out of 24 parameter pairs evaluated (13% of the total) failed the RPD or |D| criteria. These results indicate good comparability of the field screening surface water data with that of the higher data quality off-site data.

3.3.3 Sediment Analytical results of five paired sediment samples show a greater variability in volatile organic compound concentrations likely indicating a heterogeneous sediment matrix. Three out of five sediment samples have at least one parameter pair outside of control limits. Eight out of 25 parameter pairs (32%) evaluated were out of control, including 5 pairs with detections in both on-site and off-site samples, and 3 pairs with one detection in either the on-site or off-site sample.

4.0 INVESTIGATIVE RESULTS

The investigative results are to support the decision path within the project logic diagram and to refine the sites conceptual model.

4.1 GEOLOGIC AND HYDROGEOLOGIC INVESTIGATIVE RESULTS Stratigraphic information was obtained from four piezocone penetrations around OU4, from the north and south sides of the creek, and east of Lake Druid just above the creeks beginning. Estimates of hydraulic conductivity were made during slug test from four monitoring wells stratifying three different intervals of the aquifer. Drive point wells were installed both in the lake and on land to in order to analyze vertical head potential between the lake and the surficial and to access groundwater flow across the site. Figure 2-2 shows the locations of piezocone penetrations. Figures 2-3 and 2-6 show the drive point wells and monitoring wells where head potential survey, groundwater elevation survey and slug testing occurred.

Physical data gathered during piezocone penetrations are presented in Appendix B. Depths of piezocone penetrations ranged from the ground surface to 68 feet below ground surface (bgs). The piezocone data indicate that the subsurface is comprised of layers of fine sand interbedded with silty and/or clayey fine sand. The density of the layers, as interpreted from the piezocone data, is generally medium dense and dense. No strata were identified that would act as a confining layer or barrier to vertical contaminant migration.

Following collection of groundwater samples from the monitoring wells, slug tests were performed on four of the wells, two shallow water table wells, one intermediate well, and one deep just above the Hawthorn. This data was plotted using Aqtesolvtm to estimate permeability at specific intervals in the aquifer. Hydraulic conductivity estimates associated with the slug tests are generally consistent over the sampling area and with depth. The hydraulic conductivity estimates have been tabulated and are presented in Table 4-1. A total of 14 estimates were obtained. Hydraulic conductivity estimates range from 1.323×10^{-3} centimeters per second (cm/sec) to 4.323×10^{-3} cm/sec. Geometric means were calculated for the three depth intervals of all 14 estimates. For all 14 estimates, the geometric mean of hydraulic conductivities ranges from 4.071×10^{-3} cm/sec for the lowermost interval (just above the Hawthorn), to 1.362×10^{-3} cm/sec for the uppermost depth interval (water table well). These data indicate that the surficial aquifer is relatively homogeneous and that hydraulic conductivity values decrease slightly with depth.

Seepage velocities were calculated using hydraulic conductivity values from the newly installed monitoring wells in the wooded area of the site and an average hydraulic gradient of _____ feet per foot. This hydraulic gradient is based on water level measurements obtained on July 23, 1996, at the existing monitoring wells, newly installed monitoring wells, and drive point wells. These water levels represent the water table surface as shown on Figure 2-8. Based on these data, groundwater flow within the surficial aquifer is toward the west. Flow is assumed to be Darcian (i.e., laminar, not turbulent) and the effective porosity is assumed to be 30 percent. Seepage velocities calculated from these data and assumptions range from _____ meters per year (m/yr) (_____ feet per year [ft/yr]) to _____ m/yr (_____ ft/yr), resulting in an estimated maximum distance of

Table 4-1
SLUG TEST HYDRAULIC CONDUCTIVITY RESULTS

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WELL ID	SLUG IN/OUT	FT/MIN	FT/DAY	GPD/FT ²	CM/SEC	COMMENTS
OLD-13-09	OUT	3.964x10 ⁻³	5.708	42.70	2.014x10 ⁻³	Shallow Water Table Well
	OUT	3.964x10 ⁻³	5.708	42.70	2.014x10 ⁻³	
	OUT	4.064x10 ⁻³	5.852	43.77	2.065x10 ⁻³	
Average		3.997x10 ⁻³	5.756	43.06	2.031x10 ⁻³	
Geometric Mean		3.997x10 ⁻³	5.756	43.05	2.031x10 ⁻³	
OLD-13-12	OUT	2.761x10 ⁻³	3.976	29.74	1.403x10 ⁻³	Shallow Water Table Well
	OUT	2.604x10 ⁻³	3.750	28.05	1.323x10 ⁻³	
	OUT	2.678x10 ⁻³	3.856	28.85	1.360x10 ⁻³	
Average		2.681x10 ⁻³	3.861	28.88	1.362x10 ⁻³	
Geometric Mean		2.680x10 ⁻³	3.860	28.87	1.362x10 ⁻³	
OLD-13-10	IN	3.99x10 ⁻³	5.746	42.98	2.027x10 ⁻³	Intermediate Well Screened in Dense Layer
	IN	4.036x10 ⁻³	5.812	43.47	2.050x10 ⁻³	
	OUT	4.389x10 ⁻³	6.320	47.27	2.230x10 ⁻³	
	OUT	4.509x10 ⁻³	6.493	48.57	2.291x10 ⁻³	
Average		4.231x10 ⁻³	6.093	45.57	2.149x10 ⁻³	
Geometric Mean		4.225x10 ⁻³	6.084	45.51	2.146x10 ⁻³	
OLD-13-14	IN	7.845x10 ⁻³	11.30	84.50	3.985x10 ⁻³	Deep Well Screened Just Above Hawthorn
	IN	7.808x10 ⁻³	11.24	84.10	3.966x10 ⁻³	
	OUT	8.509x10 ⁻³	12.25	91.65	4.323x10 ⁻³	
	OUT	7.914x10 ⁻³	11.40	85.24	4.020x10 ⁻³	
Average		8.019x10 ⁻³	11.55	86.37	4.074x10 ⁻³	
Geometric Mean		8.014x10 ⁻³	11.54	86.32	4.071x10 ⁻³	
Total Average		4.931x10 ⁻³	7.101	53.11	2.505x10 ⁻³	
Total Geometric Mean		4.547x10 ⁻³	6.548	48.98	2.310x10 ⁻³	

contaminant migration (due to advection) of ____ feet. Contaminant migration is affected by dispersive movement and actual hydraulic gradient (which may vary horizontally and vertically within the aquifer).

As shown on Table 2-8 the vertical head potential survey indicates an upward vertical gradient from the surficial aquifer to Lake Druid at each of the drive point wells. This supports the conceptual model as to the transfer of groundwater into Lake Druid.

4.2 LAKE DRUID INVESTIGATION Surface water and sediment samples were analyzed by an onsite laboratory for the following parameters: vinyl chloride, 1,1-dichloroethene, trans-1,2-dichloroethene, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, benzene, toluene, ethylbenzene, m/p-xylene, and o-xylene. Analytical results tables are provided in Appendix K(a) and K(b) for the surface water and sediment samples respectively. Of the fifty-nine surface water samples and fifty-nine sediment samples, ten surface water samples and five sediment samples were sent to an offsite lab for confirmatory analyses. Results of their analyses are provided in Appendix L(a) and L(b).

Thirty-nine of the surface water samples had positive detections of the compounds mentioned above. Sample U4W01001F, located near the mouth of the creek, had the largest amount of chlorinated compound contamination of any of the surface water samples. Contamination levels decreased both North and South of the creek along the lake perimeter and westward out into the lake, however contamination was found as far away from shore as 200 feet. Figure 4-1 shows the extent of total chlorinated VOC contamination in Lake Druid based on the onsite lab analytical results.

From a total of 59 sediment samples taken from 48 locations, 45 had positive detections for at least one of the analytical parameters. Sample U4D01001F, located near the mouth of the creek (same location as U4W01001F), had the largest amount of chlorinated compound contamination of any of the sediment or surface water samples. The extent of sediment contamination mirrors the extent of surface water contamination however, the chlorinated VOC contaminant concentrations are much higher. Figure 4-2 shows the extent of total chlorinated VOC contamination in Lake Druid based on the onsite lab analytical results.

Three sediment samples were collected from two locations for treatability analysis. The samples were analyzed for methane, ethylene, ethane, NH₄, NO₃, PO₄, Cl⁻, and pH. The results of the analysis are included in Appendix M.

The main reason for running the analysis was to identify whether the target chlorinated VOCs were breaking down into their non-hazardous constituents naturally. The degradation sequence is as follows:

- 1) PCE to TCE;
- 2) TCE to DCE;
- 3) DCE to vinyl chloride; and
- 4) vinyl chloride to ethylene.

Figure 4-1

figure 4-2

Samples were collected from two areas, one an area of heavy chlorinated contamination and the second from an area of light chlorinated contamination. The idea being that the sediment could be producing ethylene naturally therefore, both samples would indicate an ethylene content. The result show that only the sample with the high concentrations of chlorinated VOCs had a positive ethylene content. The conclusion being that the chlorinated VOCs are producing ethylene in the sediment through the degradation of vinyl chloride and thus have the ability to break down the chlorinated constituents naturally.

4.3 GROUNDWATER CONTAMINATION A total of 176 groundwater samples, including 18 duplicate samples, were collected from the 13 locations along the shoreline and within the woods at OU4. Figure 2-2 shows locations where groundwater samples were collected via DPT. Analytical data from on-site analyses are presented in Appendix K(c). Ten percent of the groundwater samples, including duplicates, were submitted to an off-site laboratory for comparison analysis of the on-site data. Only five percent of the off-site analytical data for groundwater comparison with the on-site data exceeded the control criteria (Section 3.3). Validated analytical data from off-site analysis are presented in Appendix L(c).

The southern extent of VOC contamination in the area along the shoreline of Lake Druid, based on-site analytical data, was defined by seven groundwater samples collected from location U4Q012 (Figure 4-3). Sample depths ranged from 6 to 60 feet bgs. Target VOCs were detected in the six samples, however they were detected only at low concentrations. Two samples from location U4Q012 (6 to 8 ft bgs and 26 to 28 feet bgs) were submitted for off-site confirmatory analysis. The off-site data confirm the slight presents of target VOCs in the sample.

The northern extent of VOC contamination in the area along the shoreline of Lake Druid, based on-site analytical data, was defined by 22 groundwater samples collected from locations U4Q002 and U4Q003 (Figure 4-3). VOCs were detected in groundwater samples from location U4Q002 at low concentrations from depths ranging from 5 ft to 62 ft bgs approximately 50 feet from the northern boundary of the base. Concentrations of total target VOCs ranged 0.0 to 7.1 $\mu\text{g}/\text{l}$. Vinyl chloride was not detected based on-site laboratory data. Sample depths at U4Q003 ranged from 6 to 62 ft bgs. Of the eleven groundwater samples collected from U4Q003 only two detected low concentrations of VOA's. Sample depths at U4Q003 ranged from 6 to 62 ft bgs. Concentrations of total target VOCs ranged 0.0 to 10.0 $\mu\text{g}/\text{l}$, vinyl chloride was not detected based on-site laboratory data. Two samples from location U4Q002 (24 to 26 ft bgs and 32 to 34 feet bgs) and two samples from location U4Q003 (22 to 24 ft bgs and 52 to 54 ft bgs) were submitted for off-site confirmatory analysis. The off-site data confirm that target VOCs are not present in the samples at these intervals.

Figure 4-4 is a cross-section showing the distribution and concentration of total VOCs in groundwater along the shoreline of Lake Druid running north and south. The cross-section is based on-site laboratory GC data associated with the Interim Remedial Action, Focused Field Investigation. Figure 4-5 shows the location of the cross-section line. Total VOC concentrations for target compounds detected in groundwater samples from locations along the shore line of the site ranged from 0.0 to 1605 $\mu\text{g}/\text{l}$. The data indicate that the maximum depth

Figure 4-3

Figure 4-4

Figure 4-5

of contamination where target VOCs were detected along the lake shore is a depth of approximately 61 feet bgs (U4Q001). Based on the contours in Figure 4-4, the approximate maximum depth of contamination above 10 ppb for total VOA's is 52 feet bgs. The minimum depth of VOC contamination in the area along the lake shore is estimated to be approximately four feet bgs. Vinyl chloride was not detected at any of the locations along the lake shore.

Figure 4-6 is a cross-section showing the distribution and concentration of total VOCs in groundwater running east and west in the vicinity of the creek. The cross-section is based on-site laboratory GC data associated with the Interim Remedial Action, Focused Field Investigation and a preliminary screening investigation December 1995. Figure 4-5 shows the location of the cross-section line. Total VOC concentrations for target compounds detected in groundwater samples from locations along the east-west line ranged from 0.0 to 6465 $\mu\text{g}/\text{l}$. The data indicate that the maximum depth of contamination where target VOCs were detected along the east west line is a depth of approximately 66 feet bgs (U4Q010). Based on the contours in Figure 4-6, the approximate maximum depth of contamination above 10 ppb for total VOA's is 66 feet bgs. The minimum depth of VOC contamination in the area of the east-west line is estimated to be approximately six feet bgs. Vinyl chloride was detected at location U4Q010 at depths ranging from 24 feet to 36 feet bgs.

Groundwater samples were also collected from six drive point wells (DP-1 through DP-6) installed in Lake Druid shown on Figure 2-3 and the six monitoring wells installed as two clusters of three shown on Figure 2-6. The results from the drive point wells, indicated in Appendix K(c), are identified as samples U4G001xx through U4G006xx for wells DP-1 through DP-6, respectively. Sampling results from the monitoring wells are included in Appendix I.

The drive point wells in Lake Druid were sampled to characterize contamination in groundwater just below the lake's bottom. The drive point well data was compared to the surface water/sediment samples taken at these same locations. The drive point results show a direct correlation, considering degradation and volatilization, between groundwater contamination below the lake bottom and the surface water/sediment sample data at the same location. This supporting the conceptual model of the groundwater contamination contributing to the contamination in Lake Druids surface water/sediment.

Monitoring wells were installed within the wooded area for permanent long term monitoring of the aquifer at different depth intervals. Because the monitoring wells are screened over a larger area and the sample is subject to more volatilization the sample results did not compare statistically well with the DPT groundwater data. They did however, indicate the presents of the same VOC constituents.

The monitoring wells were also sampled for engineering treatability parameters (ETPs). This data is also included in Appendix I and will be analyzed more closely during the remedial phase of the project.

Figure 4-6

5.0 SUMMARY AND RECOMMENDATIONS

The investigative results indicate that the surficial aquifer between the lake and Building 1100, in line with the creek, approximately 200 feet wide and 40 feet deep (Figures 4-3 and 4-4), is the zone likely to be contributing to the majority of contamination in Lake Druid. Therefore, in order to stay focused on the goal of the IRA it is recommended that a focused feasibility study followed by remedial design and construction be implemented to control this zone of groundwater contamination. It is the foregone conclusion of the project team, following the results of the field investigation, that if the contaminant source (i.e. contaminated groundwater) is controlled from not entering the lake, then the sediment and surface water will naturally attenuate.

THIS SECTION SHOULD BE WRITTEN BY MARK SALVETTI AND OR JOHN KAISER WITH IN PUT FROM THE TEAM.

REFERENCES

APPENDIX A
AREA "C" PRELIMINARY RISK EVALUATION

APPENDIX B
SURFACE WATER AND SEDIMENT SAMPLING LOGS

APPENDIX C
PIEZOCONE STRATIGRAPHIC LOGS

APPENDIX D
SOIL BORING LOGS

APPENDIX E
GRAIN-SIZE ANALYSIS

APPENDIX F
MONITORING WELL CONSTRUCTION LOGS

APPENDIX G
MONITORING WELL DEVELOPMENT LOGS

APPENDIX H
MONITORING WELL GROUNDWATER SAMPLING LOGS

APPENDIX I
MONITORING WELL SAMPLING ANALYTICAL REPORTS

APPENDIX J
SLUG TEST GRAPHS

APPENDIX K
ON-SITE LABORATORY ANALYTICAL SUMMARY TABLES

Appendix K(a)
Summary of Onsite Laboratory Surface Water Analytical Results

SAMPLE ID	1/%Solids	Dilution Factor	Contaminants of Concern (ug/L)											
			Vinyl Chloride	1,1-Dichloroethene	trans-1,2-Dichloroethene	cis-1,2-Dichloroethene	Trichloroethene	Tetrachloroethene	Benzene	Toluene	Ethylbenzene	m/p-Xylene	o-Xylene	
			U4W03601F	1	1	0.1U	1.0U	0.5UJ	2.0U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W03602F	1	1	0.1U	1.0U	0.5UJ	2.0U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W03801F	1	1	0.1U	1.0U	0.5UJ	2.0U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W03802F	1	1	0.1U	1.0U	0.5UJ	2.0U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W03901F	1	1	0.1U	1.0U	0.5UJ	2.0U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W03902F	1	1	0.1U	1.0U	0.5UJ	2.0U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W04001F	1	1	0.1U	1.0U	0.5UJ	2.0U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W04002F	1	1	3.5	1.0U	0.5UJ	7.8	0.5U	0.5U	0.5U	0.9	0.5U	0.5U	0.5U	0.5U
U4W04101F	1	1	0.8	1.0U	0.5UJ	3.1	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W04102F	1	1	0.4	1.0U	0.5UJ	2.7	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W04201F	1	1	0.1U	1.0U	0.5UJ	2.0U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W04301F	1	1	0.1U	1.0U	0.5UJ	2.0U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W04302F	1	1	0.1U	1.0U	0.5UJ	2.0U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W04401F	1	1	0.1U	1.0U	0.5UJ	2.0U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W04402F	1	1	1.3	1.0U	0.5UJ	4.7	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W04501F	1	1	0.1U	1.0U	0.5UJ	2.0U	0.5U	1.1	0.5U	0.5U	0.5U	0.5U	0.5UJ	0.5UJ
U4W04502F	1	1	0.3	1.0U	0.5UJ	1.6	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5UJ	0.5UJ
U4W04601F	1	1	0.1U	1.0U	0.5UJ	2.0U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5UJ	0.5UJ
U4W04602F	1	1	0.1U	1.0U	0.5UJ	2.0U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5UJ	0.5UJ
U4W04701F	1	1	0.1UJ	1.0U	0.5U	2.0U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W04801F	1	1	0.1UJ	1.0U	0.5U	2.0U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4W04802F	1	1	1.3J	1.0U	0.5U	5.6	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U

Note:

- U qualifier is added when result is less than reporting limit
- J qualifier is added when result is estimated
- S qualifier is added for surrogate outside of accepted limits
- B qualifier is added for blank contamination
- E qualifier is added when result is greater than the linear calibration range

Appendix K(b)
Summary of Onsite Laboratory Sediment Analytical Results

SAMPLE ID	1/%Solids	Dilution Factor	Contaminants of Concern (ug/L)										
			Vinyl Chloride	1,1-Dichloroethene	trans-1,2-Dichloroethene	cis-1,2-Dichloroethene	Trichloroethene	Tetrachloroethene	Benzene	Toluene	Ethylbenzene	m/p-Xylene	o-Xylene
U4D01601F	1.66	1	0.166U	1.66U	0.83UJ	3.32U	0.7	1	0.83U	0.83U	0.83U	0.83U	0.83U
U4D01602F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.7	0.5U	0.5U	0.5U	0.5U	0.5U
U4D01701F	4.2	1	0.5S	4.2US	2.1USJ	8.4US	2.1US	2.1US	2.1US	150S	2.1US	2.1US	2.1US
U4D01702F	1.26	1	0.126U	1.26U	0.63UJ	2.52U	0.63U	0.63U	0.63U	0.63U	0.63U	0.63U	0.63U
U4D01801F	5	1	0.5US	5US	2.5USJ	7.9S	10S	20S	2.5US	550S	2.5US	2.5US	2.5US
U4D01802F	1.21	1	0.2	1.21U	0.605UJ	2.42U	1.3	0.605U	0.605U	0.605U	0.605U	0.605U	0.605U
U4D01901F	1.35	1	1.5	1.35U	2.4J	160	930E	78	0.675U	0.675U	0.675U	0.675U	0.675U
U4D01901FR	1.35	10	1.35U	13.5U	6.75UJ	110	800	31	6.75U	6.75U	6.75U	6.75U	6.75U
U4D02001F	1.22	10	1.22U	12.2U	6.1UJ	24.4U	7.2	6.1U	6.1U	6.1U	6.1U	6.1U	6.1U
U4D02001FR	1.22	1	0.122U	1.22U	0.61UJ	3	9	0.61U	0.61U	0.61U	0.61U	0.61U	0.61U
U4D02101F	1.32	5	0.66U	6.6U	3.3UJ	14	410	4.9	3.3U	3.3U	3.3U	3.3U	3.3U
U4D02101FR	1.32	1	0.132U	1.2	0.66UJ	36	460E	18	0.66U	0.66U	0.66U	0.66U	0.66U
U4D02201F	1.86	5	0.93U	9.3U	4.65UJ	18.6U	6.6	200	4.65U	4.65U	4.65U	4.65U	4.65U
U4D02201R	1.86	1	0.186U	1.86U	0.93UJ	3.72U	4.8	100	0.93U	0.93U	0.93U	0.93U	0.93U
U4D02301F	1.62	5	0.16U	8.1U	4.05UJ	31	3.9	4.05U	4.05U	4.05U	4.05U	4.05U	4.05U
U4D02401F	3.75	5	1.875U	18.75U	9.375UJ	41	100	1400	9.375U	9.375U	9.375U	9.375U	9.375U
U4D02501F	1.77	5	0.885U	8.85U	4.425UJ	20	42	4.4	4.425U	4.425U	4.425U	4.425U	4.425U
U4D02601F	1.72	5	0.86U	8.6U	4.3UJ	80	130	4.3U	4.3U	4.3U	4.3U	4.3U	4.3U
U4D02601FD	1.72	5	0.86U	8.6U	4.3UJ	25	42	4.3U	4.3U	4.3U	4.3U	4.3U	4.3U
U4D02701F	1.3	1	0.13UJ	1.3UJ	0.65UJ	11J	17J	1.1J	0.65UJ	0.65UJ	0.65UJ	0.65UJ	0.65UJ
U4D02801F	7.19	1	0.719UJ	7.19UJ	3.595UJ	14.38UJ	4J	3.595UJ	3.595UJ	3.595UJ	3.595UJ	3.595UJ	3.595UJ
U4D02901F	1.4	1	0.14UJ	1.4UJ	0.7UJ	2.8UJ	0.7UJ	0.7UJ	0.7UJ	0.7UJ	0.7UJ	0.7UJ	0.7UJ
U4D03001	1.24	1	0.124UJ	1.24UJ	0.62UJ	2.48UJ	0.62UJ	0.62UJ	0.62UJ	0.62UJ	0.62UJ	0.62UJ	0.62UJ
U4D03101F	1.34	1	0.134UJ	1.2J	1.1J	31J	210J	0.67UJ	0.67UJ	0.67UJ	0.67UJ	0.67UJ	0.67UJ
U4D03201F	1.88	1	0.188UJS	1.88UJS	0.94UJS	11JS	74JS	65JS	0.94UJS	0.94UJS	0.94UJS	0.94UJS	0.94UJS

Appendix K(b)
Summary of Onsite Laboratory Sediment Analytical Results

U4D03301F	1.3	1	0.13U	1.3U	0.65UJ	2.6U	0.0U	2	0.65U	0.65U	0.65U	0.65U	0.65U
U4D03401F	1.3	1	0.13U	1.3U	0.65UJ	2.6U	0.65U	8.1	0.65U	0.65U	0.65U	0.65U	0.65U
U4D03501F	1.3	1	0.13U	1.3U	0.65UJ	5.7	15	0.65U	0.65U	0.65U	0.65U	0.65U	0.65U
U4D03601F	1.24	1	0.124U	1.24U	0.62UJ	2.48U	0.62U						
U4D03701F	1.25	1	0.125U	1.25U	0.625UJ	2.5U	0.625U						
U4D03801F	2.5	1	0.3U	2.5U	1.3UJ	5.0U	1.3U						
U4D03901F	1.27	1	0.127US	1.27US	0.635UJS	2.54US	0.635US						
U4D03901FR	1.27	1	0.127U	1.27U	0.635UJ	2.54U	0.635U						
U4D04001F	1.33	1	0.133U	1.33U	0.665UJ	2.66U	0.665U						
U4D04101F	1.35	1	0.135U	1.35U	0.675UJ	2.7U	0.675U	0.675U	0.675U	0.675U	0.675U	0.675U	0.675UJ
U4D04201F	1.23	1	0.123U	1.23U	0.615UJ	2.46U	0.7	0.615U	0.615U	0.615U	0.615U	0.615U	0.615U
U4D04301F	3	1	0.3US	3US	1.5UJS	6US	1.5US						
U4D04501F	1.1	1	0.11U	1.1U	0.55UJ	2.2U	0.55U	0.55U	0.55U	0.55U	0.55U	0.55U	0.55UJ
U4D04601F	1.18	1	0.118J	1.18J	0.59UJ	2.36U	0.59U	0.59U	0.59U	0.59U	0.59U	0.59U	0.59UJ
U4D04701F	1.32	1	0.132UJ	1.32U	0.66U	2.64U	0.66U						
U4D04801F	1.34	1	0.134UJ	1.34U	1.2	160	0.67U						

Note:

- U qualifier is added when result is less than reporting limit
- J qualifier is added when result is estimated
- S qualifier is added for surrogate outside of accepted limits
- B qualifier is added for blank contamination
- E qualifier is added when result is greater than the linear calibration range

Appendix K(c)

Summary of Onsite Laboratory Groundwater Analytical Results

SAMPLE ID	1/%Solids	Dilution Factor	Contaminants of Concern (ug/L)											
			Vinyl Chloride	1,1-Dichloroethene	trans-1,2-Dichloroethene	cis-1,2-Dichloroethene	Trichloroethene	Tetrachloroethene	Benzene	Toluene	Ethylbenzene	m/p-Xylene	o-Xylene	
U4Q00208F	1	1	0.1UJ	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00209F	1	1	0.1UJ	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00210F	1	1	0.1UJ	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00211F	1	1	0.1UJ	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00301F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00302F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00303F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00304F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00305F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00305FD	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00306F	1	1	0.1U	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00307F	1	1	0.1U	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00308F	1	1	0.1U	1U	0.5U	2U	0.5U	10	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00309F	1	1	0.1U	1U	0.5U	2U	0.5U	0.8	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00309FD	1	1	0.1U	1U	0.5U	2	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00310F	1	1	0.1U	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00311F	1	1	0.1U	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00401F	1	1	0.1UJ	1UJ	0.5UJ	2UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ
U4Q00402F	1	1	0.1U	1U	0.5UJ	5.8	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00403F	1	1	3	1.6	100J	1100E	270E	1.7	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00404F	1	1	0.1UJ	1UJ	19J	640E	680E	8.1J	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ
U4Q00405F	1	1	0.1U	1U	0.5U	4.4	190	64	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00406F	1	1	0.1U	1U	0.5U	4.8	270E	97	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00407F	1	1	0.1	1U	0.5U	2.2	160	19	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00407FD	1	1	0.1U	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00408F	1	1	0.1U	1U	0.4	5	310E	44	0.4	0.4	3.8	0.5U	0.7	0.5U
U4Q00409F	1	1	0.1U	1U	0.5U	3	130	170	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00410F	1	1	0.1U	1U	0.5U	4.7	180	180	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00411F	1	1	0.1U	1U	0.5U	4.2	56	130	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00412F	1	1	0.1U	1U	0.5U	2U	11	120	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00413F	1	1	0.1U	1U	0.5U	2U	12	120	0.5U	0.5U	0.5U	0.5U	3.1	0.5U
U4Q00414F	1	1	0.1U	1U	0.5U	2U	1.7	99	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00415F	1	1	0.1U	1U	0.5U	2U	0.4	13	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00416F	1	1	0.1U	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00417F	1	1	0.1U	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00418F	1	1	0.1U	1U	0.5U	2U	0.8	0.8	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00419F	1	1	0.1U	1U	0.5U	2U	0.9	2.8	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00420F	1	1	0.1U	1U	0.5U	2U	1	4.9	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00421F	1	1	0.1U	1U	0.5U	2U	0.5U	1	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00422F	1	1	0.1U	1U	0.5U	2U	0.5U	0.9	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00423F	1	1	0.1U	1U	0.5U	2U	0.5U	0.8	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00424F	1	1	0.1U	1U	0.5U	2U	0.5U	4.4	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U

Appendix K(c)

Summary of Onsite Laboratory Groundwater Analytical Results

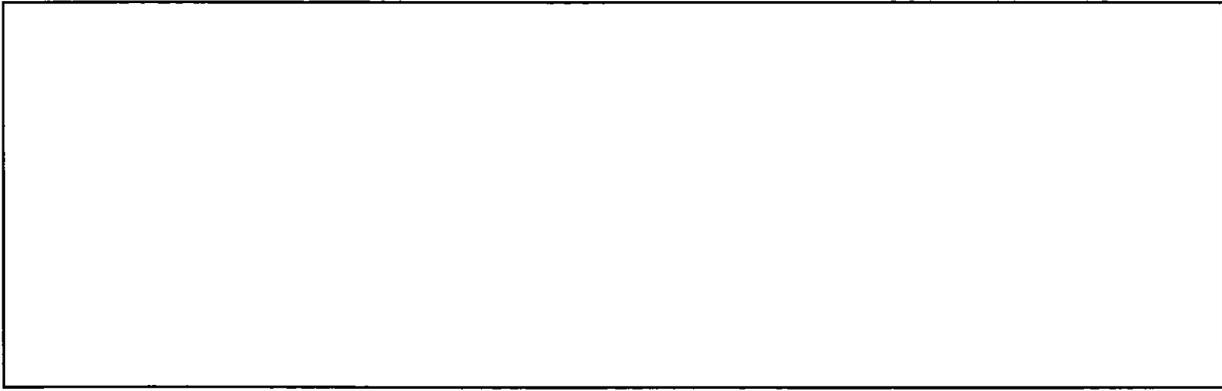
SAMPLE ID	1/1	1	Contaminants of Concern (ug/L)										
			Vinyl Chloride	1,1-Dichloroethene	trans-1,2-Dichloroethene	cis-1,2-Dichloroethene	Trichloroethene	Tetrachloroethene	Benzene	Toluene	Ethylbenzene	m/p-Xylene	o-Xylene
U4Q00425F	1	1	0.1U	1U	0.5U	2U	9.9	220	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00426F	1	1	0.1U	1U	0.5U	2U	1	4.3	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00501F	1	1	0.1UJ	1UJ	0.5UJ	2UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ
U4Q00502F	1	1	0.1UJ	1UJ	0.5UJ	3.5J	7.1J	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ
U4Q00503F	1	1	0.1U	1U	0.5U	6.7	23	950E	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00504F	1	1	0.1U	1U	0.5U	1.6	5	300E	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00505F	1	1	0.1U	1U	0.5U	1.2	3	300E	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00506F	1	1	0.1U	1U	0.5U	2U	3.1	48	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00506FD	1	1	0.1	1U	0.5U	2U	2.5	50	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00507F	1	1	0.1U	1U	0.5U	2U	0.5U	0.4	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00508F	1	1	0.1U	1U	0.5U	2U	0.5U	0.4	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00509F	1	1	0.1U	1U	0.5U	2U	1.2	1.7	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00510F	1	1	0.1U	1U	0.5U	2U	0.5U	0.5	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00601F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00602F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00603F	1	1	0.1U	1U	0.5UJ	5.4	9	1.5	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00604F	1	1	0.1U	1U	1.2	54	71	2.4	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00605F	1	1	0.1U	U	0.5U	1.9	10	2	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00606F	1	1	0.1U	1U	0.5U	3	13	3.7	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00607F	1	1	0.1U	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00701F	1	1	0.1U	1U	0.5UJ	3.8	26	3.2	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00701F	1	1	0.1U	1U	0.5U	14	28E	24	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00702F	1	1	0.1U	1U	0.5UJ	2	14	12	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00801F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00802F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00803F	1	1	0.1U	1U	0.5U	3.2	7	15	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00804F	1	1	0.1U	1U	0.5U	2.7	13	7	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00805F	1	1	0.1U	1U	0.5U	2U	16	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00806F	1	1	0.1U	1U	0.5U	2U	15	11	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00807F	1	1	0.1U	1U	0.5U	2U	0.6	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00808F	1	1	0.3	1U	0.5U	2U	18	5.2	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00809F	1	1	0.1U	1U	0.5U	2U	0.5	0.5	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00901F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00902F	1	1	0.1U	1U	0.5UJ	1.5	3.4	2.8	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00903F	1	1	0.1U	1U	0.5U	2U	12	9.6	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00903FD	1	1	0.1U	1U	0.5U	2U	8.9	8.3	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00904F	1	1	0.1U	1U	0.5U	2U	2.4	10	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00904FD	1	1	0.1U	1U	0.5U	2U	4.4	10	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00905F	1	1	0.3	1U	0.5U	2U	5.5	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00905FD	1	1	0.1U	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00906F	1	1	0.1U	1U	0.5U	2U	10	7.8	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00906FD	1	1	0.1U	1U	0.5U	2U	2.6	1.9	0.5U	0.5U	0.5U	0.5U	0.5U

Appendix K(c)

Summary of Onsite Laboratory Groundwater Analytical Results

SAMPLE ID	1/%Solids	Dilution Factor	Contaminants of Concern (ug/L)										
			Vinyl Chloride	1,1-Dichloroethene	trans-1,2-Dichloroethene	cis-1,2-Dichloroethene	Trichloroethene	Tetrachloroethene	Benzene	Toluene	Ethylbenzene	m/p-Xylene	o-Xylene
U4Q00907F	1	1	0.1U	1U	0.5U	2U	1	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00908F	1	1	0.1U	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00909F	1	1	0.1U	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q00910F	1	1	0.1U	1U	0.5U	2U	0.8	0.5	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01001F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01002F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01003F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01004F	1	1	0.1U	1U	0.5UJ	12	4.8	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01005F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01006F	1	1	5	0.9	69J	800E	84	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01007F	1	1	8.3	1	20	800E	780EJ	17	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01008F	1	1	3	1U	20	790E	960EJ	21	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01009F	1	1	0.9	1U	16	550E	41J	1500EJ	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01010F	1	1	2.1	1	14	100	2000EJ	43J	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01011F	1	1	0.1U	4	10	65	3800EJ	2600EJ	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01012F	1	1	2.7	7.2	16	150	3200EJ	290EJ	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01013F	1	1	0.9	1U	3.8	54	1500EJ	240J	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01014F	1	1	0.1U	1U	0.5U	3.9	190J	45J	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01015F	1	1	0.1U	1U	0.5U	2U	15J	3.4J	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01016F	1	1	0.1U	1U	0.5U	1.8	14	3.4	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01017F	1	1	0.1U	1U	0.5U	1.8	32	1.2	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01018F	1	1	0.1U	1U	0.5U	2U	39	17	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01019F	1	1	0.1U	1U	0.5U	2U	33	4	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01020F	1	1	0.1U	1U	0.5U	2.7	45E	4.9	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01021F	1	1	0.1U	1U	1	71E	60E	7.2E	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01022F	1	1	0.1U	1U	0.5U	2U	18	9.1	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01023F	1	1	0.1U	1U	0.5U	2U	8.4	1.3	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01024F	1	1	0.1U	1U	0.5U	3	24	4.6	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01101F	1	1	0.1U	1U	0.5	75	12	65	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01102F	1	1	0.1U	1U	0.5J	110	5.4	7.7	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01103F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01104F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01105F	1	1	0.1U	1U	0.5UJ	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01106F	1	1	0.1U	1U	0.5UJ	3.4	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01107F	1	1	0.1U	1U	0.5U	69	9.8	1	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01108F	1	1	0.1U	1U	0.5U	2U	1.9	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01109F	1	1	0.1U	1U	0.5U	1.8	4.6	6.4	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01110F	1	1	0.1U	1U	0.5U	2U	0.5U	1.6	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01111F	1	1	0.1U	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01112F	1	1	0.1U	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01113F	1	1	0.1U	1U	0.5U	2U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
U4Q01113FD	1	1	0.1U	1U	0.5U	2U	0.5U	1.4	0.5U	0.5U	0.5U	0.5U	0.5U

Appendix K(c)
Summary of Onsite Laboratory Groundwater Analytical Results



APPENDIX L
OFF-SITE LABORATORY ANALYTICAL SUMMARY TABLES

Appendix L(a). Summary of Off-Site Laboratory Surface Water Analytical Results
Operable Unit 4

OU4 Interim Remedial Action
Naval Training Center, Orlando
Orlando, FL

Sample ID	U4W00201	U4W01201	U4W03101	U4W03401	U4W03401D
Lab ID	MA882004	MA900001	MA913003	MA942003	MA942004
Sampling Date	7-May-96	9-May-96	13-May-96	15-May-96	15-May-96
1,1,1-Trichloroethane	150 U	10 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	150 U	10 U	1 U	1 U	1 U
1,1,2-Trichloroethane	150 U	10 U	1 U	1 U	1 U
1,1-Dichloroethane	150 U	10 U	1 U	1 U	1 U
1,1-Dichloroethene	150 U	10 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane	150 U	10 U	1 U	1 U	1 U
1,2-Dibromoethane	150 U	10 U	1 U	1 U	1 U
1,2-Dichlorobenzene	150 U	10 U	1 U	1 U	1 U
1,2-Dichloroethane	150 U	10 U	1 U	1 U	1 U
1,2-Dichloropropane	150 U	10 U	1 U	1 U	1 U
1,3-Dichlorobenzene	150 U	10 U	1 U	1 U	1 U
1,4-Dichlorobenzene	150 U	10 U	1 U	1 U	1 U
2-Butanone	750 R	7 J	5 UR	5 UR	5 UR
2-Chloroethylvinylether	NA	NA	NA	NA	NA
2-Hexanone	750 U	50 U	5 U	5 U	5 U
4-Methyl-2-pentanone	750 U	50 U	5 U	5 U	5 U
Acetone	480 J	38 J	2 R	2 UR	2 UR
Benzene	150 U	10 U	1 U	1 U	1 U
Bromochloromethane	150 U	10 U	1 U	1 U	1 U
Bromodichloromethane	150 U	10 U	1 U	1 U	1 U
Bromoform	150 U	10 U	1 U	1 U	1 U
Bromomethane	150 U	10 U	1 U	1 U	1 U
Carbon disulfide	150 U	10 U	1 U	1 U	1 U
Carbon tetrachloride	150 U	10 U	1 U	1 U	1 U
Chlorobenzene	150 U	10 U	1 U	1 U	1 U
Chloroethane	150 U	10 U	1 U	1 U	1 U
Chloroform	150 U	10 U	1 U	1 U	1 U
Chloromethane	47 J	10 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	2300	170	1	1	1
cis-1,3-Dichloropropene	150 U	10 U	1 U	1 U	1 U
Dibromochloromethane	150 U	10 U	1 U	1 U	1 U
Dichlorodifluoromethane	NA	NA	NA	NA	NA
Ethylbenzene	150 U	10 U	1 U	1 U	1 U

Appendix L(a). Summary of Off-Site Laboratory Surface Water Analytical Results
Operable Unit 4

OU4 Interim Remedial Action
Naval Training Center, Orlando
Orlando, FL

Sample ID	U4W00201	U4W01201	U4W03101	U4W03401	U4W03401D
Lab ID	MA882004	MA900001	MA913003	MA942003	MA942004
Sampling Date	7-May-96	9-May-96	13-May-96	15-May-96	15-May-96
Methylene chloride	47 J	20 U	2 U	2 U	2 U
Styrene	150 U	10 U	1 U	1 U	1 U
Tetrachloroethene	54 J	10 U	1 U	1 U	1 U
Toluene	150 U	7 J	1 J	1 U	1 U
trans-1,2-Dichloroethene	150 U	10 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	150 U	10 U	1 U	1 U	1 U
Trichloroethene	800	5 J	1 U	1 U	1 U
Trichlorofluoromethane	NA	NA	NA	NA	NA
Vinyl chloride	150 U	54	1 J	1 U	1 U
Xylene (total)	150 U	10 U	1 U	1 U	1 U

Appendix L(b). Summary of Off-Site Laboratory Sediment Analytical Results
Operable Unit 4

OU4 Interim Remedial Action
Naval Training Center, Orlando
Orlando, FL

Sample ID	U4D00201		U4D01201		U4D03101	U4D03501	U4D03501D	U4D04201	
	Lab ID	MA882006	MA882006DL	MA900002	MA900002DL	MA913004	MA942005	MA942006	MA964002
Sampling Date	7-May-96	7-May-96	9-May-96	9-May-96	13-May-96	15-May-96	15-May-96	15-May-96	21-May-96
1,1,1-Trichloroethane	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
1,1,2,2-Tetrachloroethane	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
1,1,2-Trichloroethane	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
1,1-Dichloroethane	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
1,1-Dichloroethene	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	
1,2-Dichloroethane	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
1,2-Dichloroethene (total)	46	37 DR	130	150 DR	5 J	2 J	12 U	12 U	
1,2-Dichloropropane	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	
2-Butanone	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
2-Chloroethylvinylether	NA	NA	NA	NA	NA	NA	NA	NA	
2-Hexanone	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
4-Methyl-2-pentanone	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
Acetone	20	55 DR	21 J	23 DR	26 U	12 U	12 U	12 U	
Benzene	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
Bromodichloromethane	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
Bromoform	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
Bromomethane	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
Carbon disulfide	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
Carbon tetrachloride	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
Chlorobenzene	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
Chloroethane	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
Chloroform	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
Chloromethane	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	
cis-1,3-Dichloropropene	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
Dibromochloromethane	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
Dichlorodifluoromethane	NA	NA	NA	NA	NA	NA	NA	NA	
Ethylbenzene	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
Methylene chloride	12 J	31 DR	5 J	36 UR	25 U	2 J	2 J	12 U	
Styrene	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	

Appendix L(b). Summary of Off-Site Laboratory Sediment Analytical Results
Operable Unit 4

OU4 Interim Remedial Action
Naval Training Center, Orlando
Orlando, FL

Sample ID	U4D00201		U4D01201		U4D03101	U4D03501	U4D03501D	U4D04201	
	Lab ID	MA882006	MA882006DL	MA900002	MA900002DL	MA913004	MA942005	MA942006	MA964002
	Sampling Date	7-May-96	7-May-96	9-May-96	9-May-96	13-May-96	15-May-96	15-May-96	21-May-96
Tetrachloroethene	340 ER	300 D	24 J	26 DR	48	12 U	12 U	12 U	
Toluene	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	2 J	
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	
trans-1,3-Dichloropropene	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
Trichloroethene	790 ER	760 D	530 ER	570 D	330	6 J	1 J	12 U	
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	NA	
Vinyl chloride	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	
Xylene (total)	12 U	60 UR	24 U	36 UR	25 U	12 U	12 U	12 U	

Appendix L(c). Summary of Off-Site Laboratory Groundwater Analytical Results - From DPT Groundwater Investigation
Operable Unit 4

OU4 Interim Remedial Action
Naval Training Center, Orlando
Orlando, FL

Sample ID	U4Q00107	U4Q00205	U4Q00205D	U4Q00207	U4Q00307	U4Q00310	U4Q00403	U4Q00418	U4Q00426
Lab ID	MA961001	MA979002	MA979003	MA979004	MA984001	MA984002	MA913001	MB007002	MB007003
Sampling Date	21-May-96	23-May-96	23-May-96	23-May-96	24-May-96	24-May-96	13-May-96	28-May-96	28-May-96
1,1,1-Trichloroethane	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
1,1,2,2-Tetrachloroethane	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
1,1,2-Trichloroethane	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
1,1-Dichloroethane	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
1,1-Dichloroethene	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
1,2-Dibromo-3-chloropropane	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
1,2-Dibromoethane	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
1,2-Dichlorobenzene	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
1,2-Dichloroethane	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
1,2-Dichloroethene (total)	NA								
1,2-Dichloropropane	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
1,3-Dichlorobenzene	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
1,4-Dichlorobenzene	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
2-Butanone	12 UR	750 UR	5 UR	5 UR					
2-Chloroethylvinylether	NA								
2-Hexanone	12 U	750 U	5 U	5 U					
4-Methyl-2-pentanone	12 U	750 U	5 U	5 U					
Acetone	170 J	16 UR	10 R	12 R	32 R	40 UR	480 J	24 R	4 R
Benzene	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
Bromochloromethane	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
Bromodichloromethane	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
Bromoform	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
Bromomethane	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
Carbon disulfide	1 J	5	0.9 J	8	2 U	3	150 U	0.4 J	1 U
Carbon tetrachloride	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
Chlorobenzene	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
Chloroethane	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
Chloroform	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
Chloromethane	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
cis-1,2-Dichloroethene	0.8 J	2 U	2 U	2 U	2 U	2 U	2300	1 U	1 U
cis-1,3-Dichloropropene	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
Dibromochloromethane	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
Dichlorodifluoromethane	NA								

Appendix L(c). Summary of Off-Site Laboratory Groundwater Analytical Results - From DPT Groundwater Investigation
Operable Unit 4

OU4 Interim Remedial Action
Naval Training Center, Orlando
Orlando, FL

Sample ID	U4Q00107	U4Q00205	U4Q00205D	U4Q00207	U4Q00307	U4Q00310	U4Q00403	U4Q00418	U4Q00426
Lab ID	MA961001	MA979002	MA979003	MA979004	MA984001	MA984002	MA913001	MB007002	MB007003
Sampling Date	21-May-96	23-May-96	23-May-96	23-May-96	24-May-96	24-May-96	13-May-96	28-May-96	28-May-96
Ethylbenzene	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
Methylene chloride	5 U	5 U	5 U	5 U	5 U	5 U	300 U	2 U	2 U
Styrene	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
Tetrachloroethene	7	2 U	2 U	2 U	2 U	2 U	150 U	0.6 J	2
Toluene	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
trans-1,2-Dichloroethene	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
trans-1,3-Dichloropropene	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
Trichloroethene	10	2 U	2 U	2 U	2 U	2 U	290	1 U	0.7 J
Trichlorofluoromethane	NA								
Vinyl chloride	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U
Xylene (total)	2 U	2 U	2 U	2 U	2 U	2 U	150 U	1 U	1 U

Appendix L(c). Summary of Off-Site Laboratory Groundwater Analytical Results - From DPT Groundwater Investigation
Operable Unit 4

OU4 Interim Remedial Action
Naval Training Center, Orlando
Orlando, FL

Sample ID	U4Q00504		U4Q00802	U4Q00803	U4Q00805	U4Q01004	U4Q01011	U4Q01109	U4Q01202	
	Lab ID	MB007004	MB007004DL	MA919002	MB031004	MB031005	MA944001	MB031003	MB031001	MB063001
	Sampling Date	29-May-96	29-May-96	14-May-96	3-Jun-96	3-Jun-96	16-May-96	1-Jun-96	31-May-96	4-Jun-96
1,1,1-Trichloroethane	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
1,1,2,2-Tetrachloroethane	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
1,1,2-Trichloroethane	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
1,1-Dichloroethane	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
1,1-Dichloroethene	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
1,2-Dibromo-3-chloropropane	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
1,2-Dibromoethane	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
1,2-Dichlorobenzene	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
1,2-Dichloroethane	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1,2-Dichloropropane	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
1,3-Dichlorobenzene	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
1,4-Dichlorobenzene	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
2-Butanone	5 UR	62 UR	5 UR	10 UR	5 UR	5 UR	6200 UR	10 UR	5 UR	
2-Chloroethylvinylether	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2-Hexanone	5 U	62 UR	5 U	10 U	5 U	5 U	6200 U	10 U	5 U	
4-Methyl-2-pentanone	5 U	62 UR	5 U	10 U	5 U	5 U	6200 U	10 U	5 U	
Acetone	7 R	53 DR	2 R	71 J	24 J	3 R	2200 R	29 J	4 R	
Benzene	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
Bromochloromethane	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
Bromodichloromethane	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
Bromoform	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
Bromomethane	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
Carbon disulfide	0.5 J	12 UR	1 U	1 J	2	10	1200 U	0.8 J	1 U	
Carbon tetrachloride	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
Chlorobenzene	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
Chloroethane	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
Chloroform	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
Chloromethane	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
cis-1,2-Dichloroethene	2	12 UR	1 U	5	1 U	12	1200 U	2	1 U	
cis-1,3-Dichloropropene	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
Dibromochloromethane	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U	
Dichlorodifluoromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	

Appendix L(c). Summary of Off-Site Laboratory Groundwater Analytical Results - From DPT Groundwater Investigation
Operable Unit 4

OU4 Interim Remedial Action
Naval Training Center, Orlando
Orlando, FL

Sample ID	U4Q00504		U4Q00802	U4Q00803	U4Q00805	U4Q01004	U4Q01011	U4Q01109	U4Q01202
Lab ID	MB007004	MB007004DL	MA919002	MB031004	MB031005	MA944001	MB031003	MB031001	MB063001
Sampling Date	29-May-96	29-May-96	14-May-96	3-Jun-96	3-Jun-96	16-May-96	1-Jun-96	31-May-96	4-Jun-96
Ethylbenzene	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U
Methylene chloride	2 U	25 UR	2 U	4 U	2 U	2 U	2500 U	4 U	2 U
Styrene	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U
Tetrachloroethene	290 ER	280 D	1 U	17	1 U	1 U	10000	6	1 U
Toluene	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U
trans-1,2-Dichloroethene	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U
trans-1,3-Dichloropropene	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U
Trichloroethene	4	4 DR	1 U	8	4	5	25000	4	0.7 J
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U
Xylene (total)	1 U	12 UR	1 U	2 U	1 U	1 U	1200 U	2 U	1 U

Appendix L(c). Summary of Off-Site Laboratory Groundwater Analytical Results - From DPT Groundwater Investigation
Operable Unit 4

OU4 Interim Remedial Action
Naval Training Center, Orlando
Orlando, FL

Sample ID	U4Q01202D	U4Q01205	U4Q01302
Lab ID	MB063002	MB063003	MB063004
Sampling Date	4-Jun-96	4-Jun-96	5-Jun-96
1,1,1-Trichloroethane	1 U	1 U	2 U
1,1,2,2-Tetrachloroethane	1 U	1 U	2 U
1,1,2-Trichloroethane	1 U	1 U	2 U
1,1-Dichloroethane	1 U	1 U	2 U
1,1-Dichloroethene	1 U	1 U	2 U
1,2-Dibromo-3-chloropropane	1 U	1 U	2 U
1,2-Dibromoethane	1 U	1 U	2 U
1,2-Dichlorobenzene	1 U	1 U	2 U
1,2-Dichloroethane	1 U	1 U	2 U
1,2-Dichloroethene (total)	NA	NA	NA
1,2-Dichloropropane	1 U	1 U	2 U
1,3-Dichlorobenzene	1 U	1 U	2 U
1,4-Dichlorobenzene	1 U	1 U	2 U
2-Butanone	5 UR	5 UR	12 UR
2-Chloroethylvinylether	NA	NA	NA
2-Hexanone	5 U	5 U	12 U
4-Methyl-2-pentanone	5 U	5 U	12 U
Acetone	10 R	15 R	22 R
Benzene	1 U	1 U	2 U
Bromochloromethane	1 U	1 U	2 U
Bromodichloromethane	1 U	1 U	2 U
Bromoform	1 U	1 U	2 U
Bromomethane	1 U	1 U	2 U
Carbon disulfide	1 U	0.3 J	2 U
Carbon tetrachloride	1 U	1 U	2 U
Chlorobenzene	1 U	1 U	2 U
Chloroethane	1 U	1 U	2 U
Chloroform	1 U	1 U	2 U
Chloromethane	1 U	1 U	2 U
cis-1,2-Dichloroethene	1 U	1 U	2 U
cis-1,3-Dichloropropene	1 U	1 U	2 U
Dibromochloromethane	1 U	1 U	2 U
Dichlorodifluoromethane	NA	NA	NA

Appendix L(c). Summary of Off-Site Laboratory Groundwater Analytical Results - From DPT Groundwater Investigation
Operable Unit 4

OU4 Interim Remedial Action
Naval Training Center, Orlando
Orlando, FL

Sample ID	U4Q01202D	U4Q01205	U4Q01302
Lab ID	MB063002	MB063003	MB063004
Sampling Date	4-Jun-96	4-Jun-96	5-Jun-96
Ethylbenzene	1 U	1 U	2 U
Methylene chloride	2 U	2 U	5 U
Styrene	1 U	1 U	2 U
Tetrachloroethene	1 U	6	2 U
Toluene	1 U	1 U	2 U
trans-1,2-Dichloroethene	1 U	1 U	2 U
trans-1,3-Dichloropropene	1 U	1 U	2 U
Trichloroethene	0.6 J	2	2 U
Trichlorofluoromethane	NA	NA	NA
Vinyl chloride	1 U	1 U	2 U
Xylene (total)	1 U	1 U	2 U

APPENDIX M
SEDIMENT TREATABILITY ANALYTICAL RESULTS

Appendix M
Sediment Treatability Analytical Results

Sample ID	Sample Date	Methane mg/l	Ethylene mg/L	Ethane mg/L	NH ₄ -N ppm	NO ₃ -N ppm	PO ₄ -PO ₄	Cl ⁻ ppm	pH
U4D01002	6/1/96	0.373	0	0.006	<5	<1.3	<5	5	5
U4D01002D	6/1/96	0	0	0	n/a	n/a	n/a	n/a	n/a
U4D01003	6/1/96	21.977	0.02	0.079	<5	<1.3	<5	10	5
U4D01403	6/1/96	0	0	0	<5	<1.3	<5	35	4.7

APPENDIX N
OFF-SITE LABORATORY ANALYTICAL REPORTS

