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NAB LITTLE CREEK
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DRAFT FINAL WORK PLAN FOR SUPPLEMENTAL INVESTIGATION REPORT FOR SITE 12 AND 13 NAB LITTLE CREEK VA

6/23/1995

FOSTER WHEELER ENVIRONMENTAL SERVICES, INC.

DRAFT FINAL
WORK PLAN

for

SUPPLEMENTAL REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
SITE 12 - EXCHANGE LAUNDRY WASTE
DISPOSAL AREA
SITE 13 - PUBLIC WORKS PCP DIP-TANK AND
WASH RACK

at

NAVAL AMPHIBIOUS BASE, LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
CONTRACT TASK ORDER 0247

Prepared For:
NAVAL FACILITIES
ENGINEERING COMMAND
ATLANTIC DIVISION
Norfolk, Virginia

Under:
Contract N62470-89-D-4814

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June 23, 1995

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1.0 INTRODUCTION

The Naval Facilities Engineering Command, Atlantic Division (LANTDIV) issued a Scope of Work (RFP Appendix A) for a Supplemental Remedial Investigation/Feasibility Study (SRI/FS) at the Naval Amphibious Base Little Creek (NAB Little Creek), Virginia Beach, Virginia. Foster Wheeler Environmental Services (FWES), initiated the SRI/FS for NAB Little Creek on June 24, 1994. The work is being performed under Contract N62470-89-D-4814, Contract Task Order (CTO) 0247.

An Implementation Plan/Fee Proposal (IP/FP) was issued on June 24, 1994. This Work Plan has been prepared according to the guidelines included in the (1) Request for Proposal (RFP) and (2) IP/FP dated June 24, 1994, and (3) recommendations provided by FWES in the November 1994 report entitled "Final Remedial Investigation/Feasibility Study, Naval Amphibious Base Little Creek, Virginia Beach, Virginia."

The SRI/FS will be performed on two sites located at NAB Little Creek:

- Site 12 - Exchange Laundry Waste Disposal Area, and
- Site 13 - Public Works PCP Dip Tank and Wash Rack

Previous investigations at these sites include:

- Initial Assessment Study (IAS) - Rogers, Golden, and Halpern, December 1984.
- Round 1 Verification Step (RVS) - CH2M Hill, October 1986.
- Draft Final Interim Remedial Investigation (Draft Final Interim RI) - Ebasco Environmental, November 1991.
- Phase II Environmental Study, NAB Commissary - ATEC Environmental Consultants, August 1990.
- Phase II Environmental Study, NAB Commissary - ATEC Environmental Consultants, April 1991.
- Pipeline Sampling Program, Little Creek Commissary - ATEC Environmental Consultants, December 1991.
- Background Ground Water Quality Study (Draft) - Applied Environmental, Inc., January 1992.
- Site Characterization Report for the Commisary Construction Project - Baker Environmental, Inc., June 1992.
- Remedial Investigation/Feasibility Study (Final) (CTO-0042) - Foster Wheeler Environmental Services, November 1994.

1.1 Purpose and Objectives

The Work Plan (WP) is designed to obtain confirmation of soil, groundwater, surface water, and sediment quality conditions which are necessary to conclude fieldwork and for final determination of the necessary remedial actions at these sites. The WP is based on work previously completed at the site, work to be completed at the site and the analysis of both. The specific objectives of the WP are:

- to define underlying aquifer characteristics,
- to further define groundwater quality,
- to further define the quality and character of surface water and underlying sediments,
- to characterize sub-surface soil quality,
- to formulate a baseline risk assessment of the site conditions, and,
- to provide final recommendations for remedial action.

Specific activities in this Scope of Work include:

- Installation of additional monitoring wells;
- Performance of pump and "slug" tests to define underlying aquifer characteristics;
- Sampling of groundwater, surface water, sediment and sub-surface soil to gather additional

information;

- Analysis of data gathered under this CTO together with existing data;
- Evaluation of potential remedial options at appropriate sites; and,
- Presentation of data and recommendations in reports suitable for the Restoration Advisory Board (RAB) review.

All phases of the investigation will be coordinated with LANTDIV and the Activity at Little Creek. It is the intention of FWES to work in full cooperation with LANTDIV, the Activity, the Federal and State regulatory agencies, as appropriate.

1.2 Guide to the Work Plan Document

This Work Plan addresses the tasks, activities and administration of the RI/FS to be performed at NAB Little Creek. A Field Sampling Plan (FSP) and an addendum to the CTO-0042 Health and Safety Plan (HASP) have also been prepared under separate covers to describe those activities in detail. The scope and objective of the investigations at each site differ; however, many activities will be performed common to all sites. The common activities are described collectively when possible.

Section 2.0, Site Background and Physical Setting, provides the background information for each site. This section also provides the history, setting, geology and hydrogeologic characteristics of the Base and each site. In Section 2.6, a summary of previous environmental investigations is provided. The media sampled, analysis performed and constituents detected for each site are also provided in Section 2.6.

Section 3.0 provides the SRI/FS Work Plan Rationale, with specific objectives for each investigation. Task plans including a description of the field activities that are to be performed at each site, including sampling and analysis, are also supplied in this section.

In Section 4.0, Project Management and Staffing, key personnel of the organizations participating in CTO-0247 are introduced. The positions and responsibilities are outlined and an organization chart for the project is provided. The project schedule is also included.

2.0 SITE BACKGROUND AND PHYSICAL SETTING

NAB Little Creek, located in Virginia Beach, Virginia, provides logistic facilities and support services for local commands, organizations, homeported ships, etc., to meet the amphibious warfare training requirements of the Armed Forces of the United States. The facility is adjacent to the city line of Norfolk. The area surrounding this 2,147-acre facility is low lying and relatively flat with several fresh water lakes. Chub Lake, Lake Bradford, Little Creek Reservoir/Lake Smith, and Lake Whitehurst are located on, or adjacent to, the facility.

NAB Little Creek was commissioned on July 30, 1945 by combining four contiguous activities. The Navy began purchasing land in the area from private estates and the Pennsylvania Railroad just prior to the outbreak of World War II. The first activity to be commissioned was the Amphibious Training Base in the southwestern corner of the present base near Little Creek Harbor. The base's mission was the training of landing craft personnel for operational assignments. Over the last fifty years, NAB Little Creek has expanded in both area and the complexity of its mission (PSI, 1991).

Environmental investigations at the base were initially documented in the IAS. In 1975, the Department of Defense initiated a program to investigate past disposal sites at military installations. This program, the Navy Assessment and Control of Installation Pollutants (NACIP), called for a three-phase operation. Phase One was the IAS to identify potentially contaminated areas. Phase Two was the Confirmation Study to verify and/or characterize the contamination. Phase Three includes the Remedial Action. The program was changed in 1986 to reflect the requirements of the Superfund Amendment and Reauthorization Act (SARA) and is now called the Installation Restoration Program (IRP). This SRI/FS is being conducted as part of the IRP.

2.1 General Site Characteristics, Location and History

The following sections focus on the overall facility and are common to both Sites 12 and 13 at NAB Little Creek.

2.1.1 Location

NAB Little Creek is located in the Atlantic Coastal Plain physiographic province in southeastern Virginia. This portion of Virginia is also referred to as the Hampton Roads Area. **Figure 2-1** shows the base location. The facility is bounded on the north by Chesapeake Bay, the east by Lake Bradford, and the south by Shore Drive. The facility's western boundary stretches over the Norfolk-Virginia Beach border. The central portion of the base is composed of Little Creek Cove, Desert Cove, and the Little Creek channel that connects with Chesapeake Bay. All of the installation lies within the jurisdictional boundary of Virginia Beach (IRI, 1991). Land use at the base is primarily industrial, while land development surrounding the site is suburban and industrial. The industrial development supports many large shipyards in the area.

NAB Little Creek has low subdued relief. Elevations at NAB Little Creek range from mean sea level along the Chesapeake Bay and Little Creek Cove to elevations as high as 40 feet above mean sea level at some of the larger dunes along the Bay. The average elevation of the facility is 10 feet above mean sea level. The primary surface features of the Hampton Roads Area are many rivers, lakes, and marshy areas (IRI, 1991).

2.1.2 Climate

The climate of the Hampton Roads Area is affected by the proximity of the Chesapeake Bay and Atlantic Ocean. These two large water bodies attenuate seasonal climatic changes resulting in mild winters and warm summers. Average total annual precipitation is 45 inches, with approximately 56 percent of the rainfall occurring from April to September. The maximum 24-hour rainfall reported at Norfolk is 11.4 inches in August 1964. Snowfall in the area averages approximately 7.2 inches per year. Temperatures for the region range from a winter average of 42°F

Table 2-1

Summary of Disposal and Spill Sites at Naval Amphibious Base, Little Creek

Site Number	Name	Period of Operation	Types of Materials Disposal	Comments
12	Exchange Laundry Waste Disposal Area	1973-1978	Perchlorethylene (PCE) sludge, soap, sizing dyes	Disposed of in storm drains with 1,320 gallons of soap sizing, sludges
13	Public Works PCP Dip Tank and Wash Rack	Early 1960s-1974	Pentachloro-phenol (PCP) JP5 paint thinner solvents degreasers	PCP dripped from lumber onto ground, 150 to 200 gallons of kerosene, tar, paint, and solvents near wash rack

RI/FS SITES
7 AMPHIBIOUS BASE LANDFILL
9 DRIVING RANGE LANDFILL
IC SEWAGE TREATMENT PLANT LANDFILLS
11 SCHOOL OF MUSIC PLATING SHOP
12 EXCHANGE LAUNDRY WASTE DISPOSAL AREA MAP
13 PCP DIP TANK/WASH RACK

SI SITES
5 BUILDINGS 9-H DISPOSAL AREA
16 POLE 425 PCB SPILL

SITE 10
SITE 9
SITE 13
SITE 7
SITE 5
SITE 11
SITE 16
SITE 12

SOURCE: BASE MAP PROVIDED BY LANTDIV

0 500 1000' 1500'
1" = 500

FIGURE 2-2
BASE LOCATION MAP WITH
SITE LOCATIONS
NAB - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

DRAWN BY: SAH 9-30-98 SCALE: AS NOTED
CHECKED BY:
APPROVED BY:
DRAWING NO. 7001/52.001 REV A

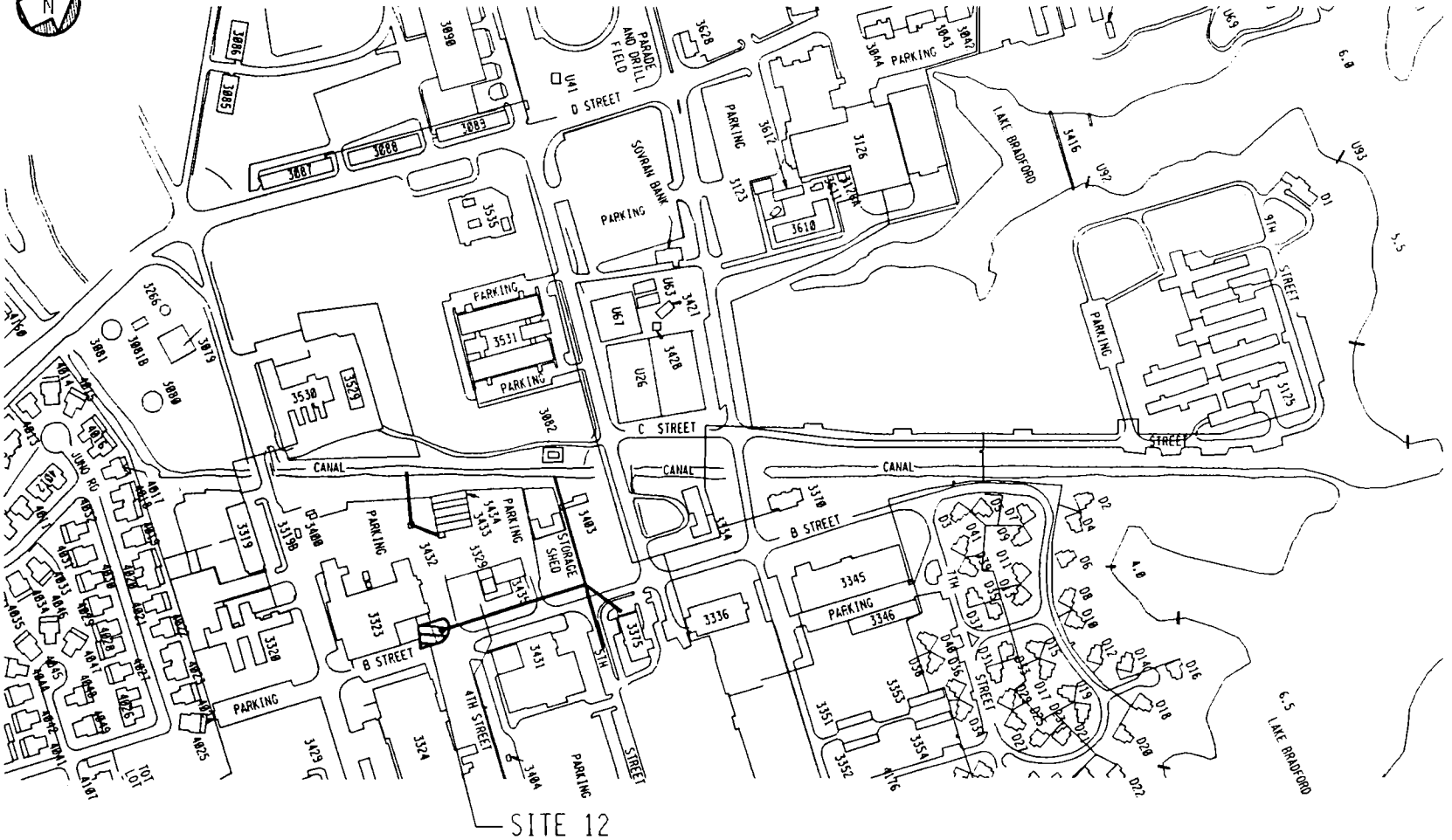

Figure 2-3
SITE MAP
SITE 12
EXCHANGE LAUNDRY WASTE DISPOSAL AREA
NAB - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

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similar to the southern outfall. The catch basin used for disposal, located southwest of the intersection of 4th and B Streets, has since been removed.

The drainage canal is approximately 20 feet wide and 9 feet deep from grade. The sides of the canal are steep and covered with a relatively thick growth of vegetation. At the time of the April 1991 IRI site visit, the canal contained approximately 2 to 3 feet of water, i.e., the water level was 5 to 6 feet below grade. The canal is bordered by a 50-foot wide strip of vegetation on either side containing abundant trees, bushes, and weeds. Water within the canal was brownish in color and appeared to be stagnant during the IRI. During a field visit by FWES personnel during January 1992, the water in the canal was flowing in a southwest direction. Miscellaneous trash and refuse were observed in many places along the banks of the canal and the wooded areas (IRI, 1991).

The IAS reported that wastes dumped into the storm sewer and canal included tetrachloroethane (PCE) sludges, soap, sizing, and dyes. The period of operation and disposal lasted from 1973 until 1978, during which an estimated 1,320 gallons of waste were dumped into the storm sewer drain. Of this total, approximately 200 gallons were PCE sludges. In addition to the dumping, smaller quantities of PCE and other wastes may have entered the storm sewer through run-off from spills or overflow of waste containers (IRI, 1991).

2.1.4.2 Site 13 - Public Works PCP Dip Tank and Wash Rack

The PCP Dip Tank and Wash Rack, shown on **Figure 2-4**, is located near the intersection of 7th and F Streets in the eastern portion of NAB Little Creek installation, approximately one block west of Site 11. The site consisted of the dip tank formerly used to treat wood with pentachlorophenol (PCP), an adjacent area that contained drying racks for the PCP-treated wood, an open area formerly used by the Public Works Department for storage of supplies and equipment, and a concrete wash rack at the southwestern end of that area. The site is bounded on the north by 7th Street, on the east by Buildings 3165D and 3165E, on the south by Building 3165, and on the west by a paved driveway and fenced storage area. The combined areas consist of approximately 30,000 square feet.

The PCP Dip Tank was located behind Building 3165E and used from the early 1960s until 1974. The dimensions and construction materials are unknown, but it reportedly contained 300 to 400 gallons of PCP. Wood was dipped into the tank and set on racks for drying. These racks were located immediately north of the dip tank between the tank and 7th Street. The area formerly containing the PCP dip tank and drying racks has since been paved with asphalt, fenced, and converted to a Public Works Department storage area. The dip tank was cleaned out approximately every 6 months, at which time the approximately 55 gallons of PCP sludge generated are believed to have been disposed in the Amphibious Base Landfill (IAS, 1984). All remaining PCP solution and associated sludges were removed from the tank in 1975. The tank itself was dismantled and disposed of in 1982.

The wash rack and associated storage area, both of which were immediately south of the dip tank and west of Building 3165D, continue to be used by the Public Works Department. The wash rack, located at the southwestern corner of the storage area, is a concrete pad with bermed sides and centrally-located deck drain. The rack is used by the Public Works Department to clean vehicles, equipment, and miscellaneous objects with steam and chemical cleaners. Wash water and other run-off from the rack drains through the central deck drain into an oil/water separator located under the paved driveway between the wash rack and Building 3165. The oil/water separator is accessible via a rectangular steel manhole located in the driveway. The contents of the separator, as observed in April 1991, included both oily sludge and oil.

The unpaved storage area immediately north of the wash rack, between the wash rack and the former location of the PCP dip tank, was used for the storage of various materials and equipment. The IAS reported evidence of readily observable solvents, paint, fuel, and tar staining the surface in this area. At the time of the April 1991 site investigation during the IRI, the graveled area was free of surface staining, indicating that although the area continues to be used as a storage yard by Public Works, the occurrence of spillage and other releases has been significantly reduced (IRI, 1991).

2.2 Regional Geology

and the average width is approximately 515 feet. The location of Site 12 is presented in Figure 2-2 and a site map is presented in Figure 2-3. The majority of the site is related to the Base Commissary. It was recently constructed and was completed in May, 1993.

The Base Commissary building covers approximately 20 percent of the site. A car wash and a waste water transfer station are located in the southwest corner of the site. Paved parking areas cover a large portion of the remaining surface area of Site 12. Grass covered areas lie between the Commissary and parking lots, and between the Commissary and the wooded area along the drainage canal.

The site is relatively level with an elevation of approximately 11.5 feet above msl. Surveyed ground elevations range from 11.1 feet above msl to 12.4 feet above msl. The lowest elevations surveyed on the site occur along the western boundary near the drainage canal. Canal elevations range from 3.7 feet above msl to 4.6 feet above msl.

Surface water drainage on the site is controlled by a network of storm sewers, with the outflow being directed into the drainage canal. Water in the drainage canal is shallow (less than 1 foot in depth) and appeared stagnant, or very slow moving to the north during observations made at the time of the June 1993 field effort.

2.5.1.2 Site Hydrogeology

Based on data obtained during the RI/FS, groundwater beneath the site is located in the undisturbed natural soils and sediment. Depth to groundwater is approximately 5 feet below ground surface. Groundwater flows to the west, towards the drainage canal. The hydraulic gradient is 8.69×10^{4} ft/ft. These findings are based on the 1993 RI field data.

2.5.2 Site 13 - Public Works PCP Dip Tank and Wash Rack

Data collected during the field program are used to characterize Site 13. Results of the physical characterization are presented in the following.

2.5.2.1 Site Topography, Drainage, and Surface Features

Site 13 is located in an area with numerous buildings which house utility and maintenance departments for the base. The majority of the area surrounding the site is covered by either asphalt or by buildings. There are buildings located east and south of the site; west of the site is another secure storage area surrounded by chain link fence; and north of the site is 7th Street. Just south of 7th Street is a narrow strip of lawn area.

Site 13 proper covers approximately 8500 square feet based on a length of 170 feet and an average width of 50 feet, as shown on Figure 2-4. Nearly all of the north half of the site proper is located in an asphalt covered secure storage area surrounded by chain link fence. The south half of the site is on a gravel parking area or weeded area.

The site is relatively level with an average elevation of approximately 7.5 feet above msl. Surveyed ground elevations of the monitoring wells and surface soil sample locations located near or on the site, range from 6.0 feet above msl in a swale in the lawn along 7th Street, to 8.51 feet above msl along the concrete sidewalk. The lowest ground elevations occur east of the site along 7th Street elevations averaging 6.1 feet above msl.

2.5.2.2 Site Hydrogeology

Based on data obtained during the RI/FS, groundwater beneath the site is located in the undisturbed natural soils and sediment. Groundwater was measured at between 5.04 and 5.65 feet below ground surface in the three new wells installed during the 1993 RI field work. Groundwater flows in the southwest direction. The hydraulic gradient is 4.7×10^{4} ft/ft. These findings are based on the 1993 RI field data.

2.6 Summary and Review of Existing Data

FWES's review of existing data concentrated primarily on assessing the chemical and hydrogeologic data generated during previous investigations. The focus was on site contaminants, soil contamination, areal hydrogeology, groundwater contamination, and surface water/sediment contamination.

2.6.1 Base Investigations

2.6.1.1 Initial Assessment Study

The Initial Assessment Study (IAS) at NAB Little Creek was completed in December 1984 by Rogers, Golden, and Halpern, of Philadelphia, Pennsylvania. Its purpose was to identify and assess sites posing a potential threat to human health or the environment due to contamination resulting from prior hazardous waste management activities. The study entailed the collection and evaluation of archival and activity records relating to waste generation, handling and disposal, characterization of physical conditions at the site such as soil, hydrogeology, etc., and identification of migration pathways and potential receptors. The results of these data evaluation efforts were used to develop recommendations concerning the need for a Confirmation Study at a given site, the goal of which was to verify the presence of contamination and determine the need for further characterization and/or remediation.

The IAS examined 17 sites at NAB Little Creek. Six sites were recommended for Confirmation Studies, Sites 7, 9, 10, 11, 12, and 13. Of the remaining 11 sites, mitigation measures were recommended for four of the sites, Sites 4, 5, 15, and 16, and no further action was recommended for six of the sites, Sites 1, 2, 6, 8, 14, and 17. Site 3, the West Annex Fuel Spill, was addressed under a separate action to recover free-floating oil from the water table. Site 17, the Building 1256 Motor Oil Disposal Area, was added to the PSI by the Navy.

The IAS recommendations to conduct Confirmation Studies were based largely on the finding that contaminants from disposal areas may migrate toward surface water bodies with little attenuation, owing to a lack of clays and organic material, and in a relatively short time because of high hydraulic conductivities. The potentially affected surface water include Little Creek Cove, Lake Bradford, and Lake Smith. Lake Bradford and Lake Smith are used for recreational purposes, and Lake Smith serves as the back-up municipal water supply for the Norfolk-Virginia Beach area. Delineation of an actual threat or risk was not possible due to the lack of site-specific hydrogeologic and groundwater quality data.

The IAS presented a number of detailed recommendations concerning the installation and sampling of monitoring wells, the sampling of surface soil, surface water and sediment, and the types of laboratory analyses to be completed. The recommendations also addressed well completion depths and water level monitoring requirements. Many of the recommendations were aimed at resolving the data gaps identified in the IAS. These recommendations, with slight changes, became the Scope of Work for the RVS.

2.6.1.2 Round 1 Verification Step

The Round 1 Verification Step (RVS) at NAB Little Creek, the first step in the Confirmation Study process, was completed in October 1986. The purpose of the study was to verify the presence and/or absence of contamination at the six sites recommended in the IAS for a Confirmation Study. The scope of the RVS activities at each site was established by the recommendations presented in the IAS, with notable deviations concerning the number of monitoring wells completed and samples collected.

As part of the work conducted for the RVS, 31 monitoring wells were installed to facilitate the collection of groundwater samples and hydraulic head data to determine groundwater flow directions. Surface water and sediment samples were collected to investigate impacts on nearby surface water bodies and determine whether contaminated

run-off was migrating from the three sites. Subsurface soil samples also were collected to delineate the vertical extent of contamination in probable source areas.

As stated in the RVS, the results of the Round 1 sampling and analysis activities indicated that little or no contamination was leaving any of the landfill sites. Contamination was detected in one or more environmental media at the other three sites. These results indicated that contamination was being released from these three sites, but the magnitude and distribution of this contamination could not be determined on the basis of the Round 1 findings alone. The results of the sampling and analysis activities were used to develop recommendations for additional investigations at all six sites. These recommendations were generally limited to continued or expanded sampling conducted during the Interim RI to confirm the Round 1 activities (IRI, 1991).

2.6.1.3 Interim Remedial Investigation

The IRI was conducted to determine whether or not further characterization activities or remedial action was warranted at Sites 7, 9, 10, 11, 12, or 13. The objectives of this investigation, as identified by Naval Facilities Engineering Command, were to conduct a second round of sampling at the six sites sampled for the RVS, and to integrate the historical and newly acquired data along with site-specific recommendations for further action into a single document. The data were used to develop recommended response action, a human health assessment, and site specific recommendations concerning additional characterization.

2.6.1.4 Environment Assessment - Site 12

ATEC Environmental Consultants (ATEC) completed a two-phase environmental assessment of Site 12 in 1990 and 1991. The Phase I analysis, conducted from June 1990 through August 1990, entailed the drilling, installation, and sampling of eight monitoring wells, the collection of a soil sample from each monitoring well boring, and the collection of three sediment samples from along the drainage canal.

The second phase of the ATEC assessment was conducted from March 1991 through April 1991. The purpose of this work was to verify the Phase 1 findings and provide a more detailed delineation of the extent of groundwater contamination at Site 12. The specific activities completed for Phase 2 included the drilling, installation, and sampling of two additional monitoring wells, collection of a second round of samples from the eight existing wells, and the establishment of vertical well elevation data in order to determine the direction of groundwater flow.

2.6.1.5 Background Groundwater Quality Study

A background groundwater quality study was conducted at NAB Little Creek in October 1991. The purpose of this study was to collect, organize, and present data on background water quality and groundwater conditions. The groundwater quality information was obtained from a network of monitoring wells installed for this study. Since the objective was to obtain representative samples from all portions of the base, the wells were located throughout the base, and areas of known or suspected contamination were avoided. Information on the hydraulic characteristics of the water table aquifer was obtained by conducting pump tests at three locations.

Eight monitoring wells were installed at NAB Little Creek. Soil samples were collected from each well boring and analyzed for TAL Metals and moisture content. The wells were sampled and analyzed for TCL organics, TAL inorganics, TPH, TOC, TOX, ethylene dibromide, cyanide, hexavalent chromium, and anions.

Water level measurements were taken in the background monitoring wells and plotted to determine groundwater flow patterns. The data was not collected at the same time, however, and groundwater may be subject to tidal fluctuations. The general direction of groundwater flow for most of the eastern portion of the site is to the north, towards Chesapeake Bay and Little Creek Harbor. In the western portion of the base, the groundwater appears to generally flow to the west.

2.6.1.6 Site Characterization - Site 12

A Site Characterization was conducted for the new commissary construction site at NAB Little Creek in January 1992. A subsurface investigation evaluated the lateral and vertical extent of potentially contaminated environmental media at the site. Soil borings were drilled in proximity to the location of former USTs, and each boring was converted into a monitoring well. Soil and groundwater samples from the borings and wells were analyzed to evaluate the extent of contamination. A geophysical investigation and soil gas survey also were conducted to identify potential contaminated areas of concern for subsequent sampling. The geophysical data indicated the presence of existing utilities and buried metal objects from the demolition at the site. The Site Characterization recommended the installation of a passive soil gas reduction system with a liner to reduce the possibility of vapor migration into the proposed new building.

2.6.1.7 RI/FS

In 1993, FWES conducted an RI/FS/RA of Sites 7, 9, 10, 12, and 13. At this same time, FWES conducted an SI at Sites 5 and 16. These investigation included soil, groundwater, sediment, surface water, and soil gas sampling. Additional groundwater monitoring wells were also installed.

2.6.2 Site Specific Background

The following sections detail the specific field activities and findings of the previous studies performed at each site.

2.6.2.1 Site 12 Exchange Laundry Waste Disposal Area

Initial Assessment Study Because of the time that had passed since the disposal practice ended, the IAS anticipated that the PCE-laden sediments may have been buried by more recent material. It was recommended that a total of six lake and canal sediment samples be collected. The sampling program should be designed to determine the proper depth interval for the sampling, along with the geographic location.

Round 1 Verification Step The RVS included the collection of six surface water and six sediment samples. The sample locations are illustrated on **Figure 2-5**. The results of sampling are provided in **Table 2-2**. The sediment samples were collected at depths of 0.0 to 0.5 feet.

VOCs were detected in four of the surface water and all of the sediment samples. Total VOCs in the surface water ranged from not detected to 43.3 μg/l. Total VOCs in the sediment ranged from 11 μg/l to 598 μg/l.

The RVS concluded the primary potential pathway for contaminant migration from the site was likely to be surface water transport southwest toward Little Creek Cove from Lake Bradford. However, at the time of sampling, the direction of surface water flow was not easily discernible. The presence of VOC contaminants downstream of the site indicates there was a potential for contamination leaving the site to pose a threat to human health. However, there may be other sources of VOCs in the surface water, and contamination cannot be directly attributed to the site. The RVS recommended a second round of sampling including six surface water and two sediment samples. The sediment samples should be collected near the outlet of the drainage pipe.

Phase II Environmental Site Study A two-phase environmental study was performed by ATEC Environmental Consultants in the Exchange Laundry Waste Area. The initial phase was performed in June and July of 1990 and the follow-up was performed in March 1991. The location of the wells installed are indicated on **Figure 2-6**. Soil and groundwater samples were collected. The results of sampling are provided in **Tables 2-3** and **2-4**.

Table 2-2

SUMMARY OF ANALYTICAL RESULTS FOR SURFACE WATER AND SEDIMENT SAMPLES
SITE 12: EXCHANGE LAUNDRY WASTE DISPOSAL AREA
NAB LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
ROUND 1 VERIFICATION STEP
OCTOBER 1986

PARAMETER	LC12-SW1	LC12-SW2	LC12-SW3	LC12-SW4	LC12-SW5	LC12-SW6	LC12-SED1	LC12-SED2	LC12-SED3	LC12-SED4	LC12-SED5	LC12-SED6
VOLATILE ORGANIC COMPOUNDS												
TRICHLOROETHENE				7.3	4.1	3.1						
TETRACHLOROETHENE				17	6.7	5.3						
TRANS-1,2-DICHLOROETHENE					26	19						2.5
VINYL CHLORIDE												2.9
TOLUENE												9.1
METHYLENE CHLORIDE				19			280	22	11	7.9	37	5.5
ACETONE							230			18		
CHLOROFORM	2.1				1.6			4.6			2.4	2.7
TRICHLORO TRIFLUOROETHANE	NR	NR	NR	NR	NR	NR	71	NR	NR	NR	NR	NR
3-METHYL PENTANE	NR	NR	NR	NR	NR	NR	1.7	NR	NR	NR	NR	NR

NOTES:
All results in parts per billion (ppb)
Blank indicates compound was not detected
NR indicates value was reported only if observed

VOCs were detected in both soil samples. Methylene chloride and chloroform were detected in both samples, and 1,1,1-trichloroethane was detected in MWS-9. Several VOCs were detected in the groundwater samples at levels ranging from not detected to 470 μg/l.

The extent of VOCs has not been fully delineated. Based upon their study, ATEC stated that the groundwater appears to be migrating from the site to the drainage ditch. ATEC recommended that additional monitoring wells be installed and sampled for VOCs in order to delineate the extent and magnitude of the contamination plume.

Interim Remedial Investigation IRI field activities at the Exchange Laundry Waste Disposal Area consisted of the collection and analysis of surface water and sediment samples from the drainage canal linking Lake Bradford and Little Creek Cove. The sediment samples were both collected directly adjacent to the southern discharge pipe from depths of 0 to 6 inches and 6 to 12 inches. A total of seven surface water and three sediment samples were collected from the canal for analysis. The data generated by these activities were used to confirm the RVS findings concerning whether discharge of wastes from the former laundry facility had resulted in contamination of the canal.

Groundwater flow and contamination data were not generated as part of the IRI, but were the subject of a separate study completed by ATEC. The results of this study have also been incorporated into the IRI. Potentiometric data presented in the 1991 ATEC report indicated that groundwater flow at Site 12 is westward, toward the drainage canal. Given the assumed depth of the canal, this feature probably functions as a local hydrologic boundary, or discharge area, for the water table aquifer. If so, groundwater in the water table aquifer beneath the site would eventually discharge into the drainage canal.

Surface water and sediment samples were collected in December 1990 from the locations shown on **Figure 2-7**. **Table 2-5** presents the results of the sampling. No VOCs were detected in any of the surface water or sediment samples.

As a result of the sampling and analysis operations, the IRI concluded that there had been a significant decline in the number of contaminants and magnitude of contamination in the drainage canal that formerly received discharges from the laundry waste disposal area. The canal appeared to have cleaned itself up, even though it apparently still receives discharging groundwater that contains high concentrations of volatile organics. The apparent clean-up of the canal is probably a result of discontinued discharge of waste from the storm sewer. Specific mechanisms to account for the reduction in contamination in the canal include volatilization, dilution, and biodegradation. Periodic flushing of the canal occurs during heavy precipitation events and overflows of Lake Bradford. These flushings could remove contaminated surface water and, if the flow rate is great enough, contaminated sediment as well.

The IRI recommended delineation of the area of volatile organic contamination. Once this has been defined, various remedial alternatives, such as no-action, containment, and treatment, can be evaluated.

Site Characterization A subsurface investigation evaluated the lateral and vertical extent of potentially contaminated environmental media at the site. Soil borings were drilled in proximity to the location of the former USTs, and each boring was converted into a monitoring well. Soil and groundwater samples from the borings and wells were analyzed to evaluate the extent of contamination. Tetrachloroethene was detected in the soil samples at concentrations ranging from 4 μg/kg to 120 μg/kg. Trace levels of TPH were detected in three of the groundwater samples at concentrations ranging from 0.03 mg/l to 0.25 mg/l, well below the Virginia Water Quality Standard of 1.0 mg/l. A geophysical investigation and soil gas survey also were conducted to identify potential contaminated areas of concern for subsequent sampling. The geophysical data indicated the presence of existing utilities and buried metal objects from the demolition at the site. The soil gas survey indicated the presence of significant levels of tetrachloroethene primarily in the southeast corner of the site. The Site Characterization recommended the installation of a passive soil gas reduction system with a liner to reduce the possibility of vapor migration into the proposed new building, and the removal of the storm sewer.

Table 2–3

SUMMARY OF ANALYTICAL RESULTS FOR SOIL SAMPLES
SITE 12: EXCHANGE LAUNDRY WASTE DISPOSAL AREA
NAB LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
PHASE II ENVIRONMENTAL SITE STUDY
MARCH 1991

PARAMETER	MWS–9	MWS–10
PURGEABLE HALOCARBONS		
METHYLENE CHLORIDE	3.2	16
CHLOROFORM	0.30	24
1,1,1–TRICHLOROETHANE	0.35	

NOTES:
All results in parts per billion (ppb)
Blank indicates compound was not detected

PH2S12.WK1

Table 2-4

SUMMARY OF ANALYTICAL RESULTS FOR GROUNDWATER
SITE 12: EXCHANGE LAUNDRY WASTE DISPOSAL AREA
NAB LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
PHASE II ENVIRONMENTAL SITE STUDY
MARCH 1991

PARAMETER	LCWW-1	LCWW-2	LCWW-3	LCWW-4	LCWW-5	LCWW-6	LCWW-7	LCWW-8	LCWW-9	LCWW-10	LCWW-11	LCWW-12
VOLATILE ORGANIC COMPOUNDS												
1,1,1-TRICHLOROETHENE	1.1		0.34							0.34		
TRICHLOROETHENE		180		6.5		2.5	13		30	2.8	1.5	100
TETRACHLOROETHENE		470		4.0					160	4.7		230
CHLOROFORM				0.20	1.6	0.13	0.15	1.7	2.1	0.57	47	0.72
DICHLORODIFLUOROMETHANE							130					
VINYL CHLORIDE										210		
TRANS-1,2-DICHLOROETHENE										9.9		
BROMODICHLOROMETHANE											12	

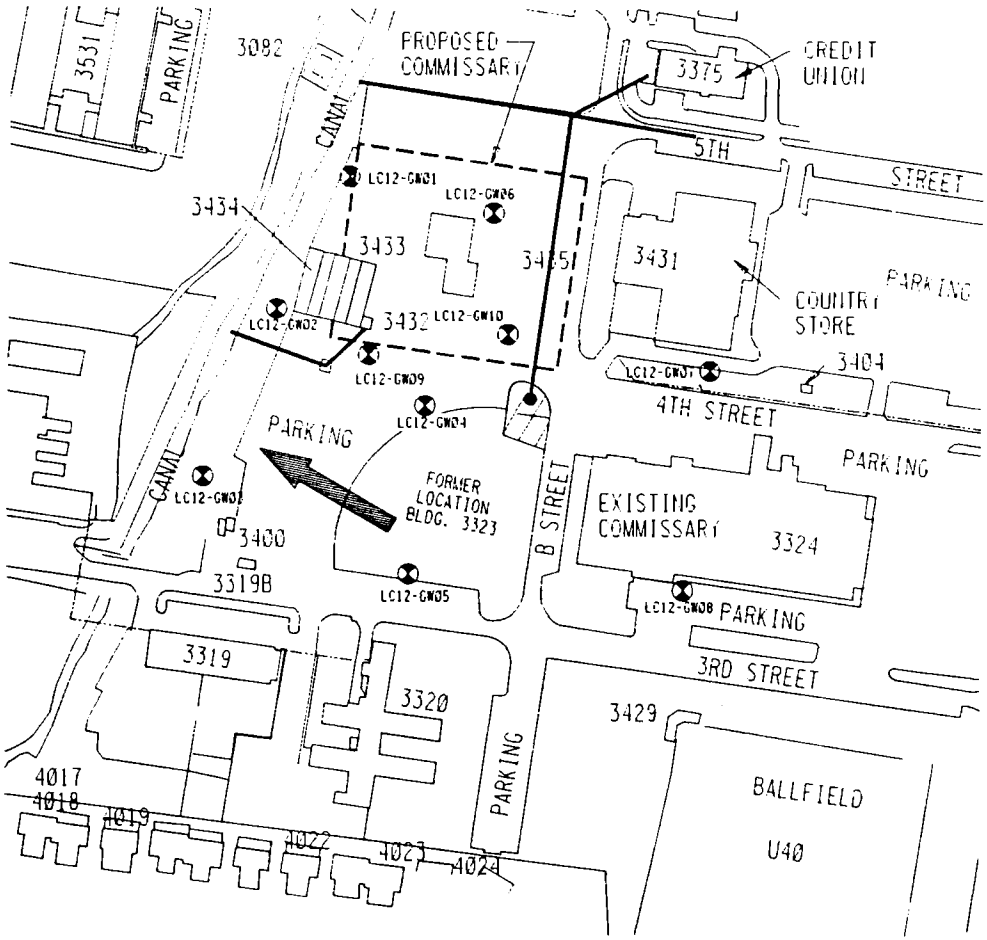
NOTES:
All results in parts per billion (ppb)
Blank indicates compound was not detected

Table 2–5

SUMMARY OF ANALYTICAL RESULTS FOR SURFACE WATER AND SEDIMENT SAMPLES
SITE 12: EXCHANGE LAUNDRY WASTE DISPOSAL AREA
NAB LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
INTERIM REMIDIAL INVESTIGATION
NOVEMBER 1991

PARAMETER	LC12–SW1	LC12–SW2	LC12–SW3	LC12–SW4	LC12–SW5	LC12–SW6	LC12–SW7	LC12–SED1	LC12–SED2	LC12–SED3
VOLATILE ORGANIC COMPOUNDS										

NOTES:
All results in parts per billion (ppb)
Blank indicates compound was not detected



LEGEND

⊗ MONITORING WELLS

GROUNDWATER FLOW DIRECTION

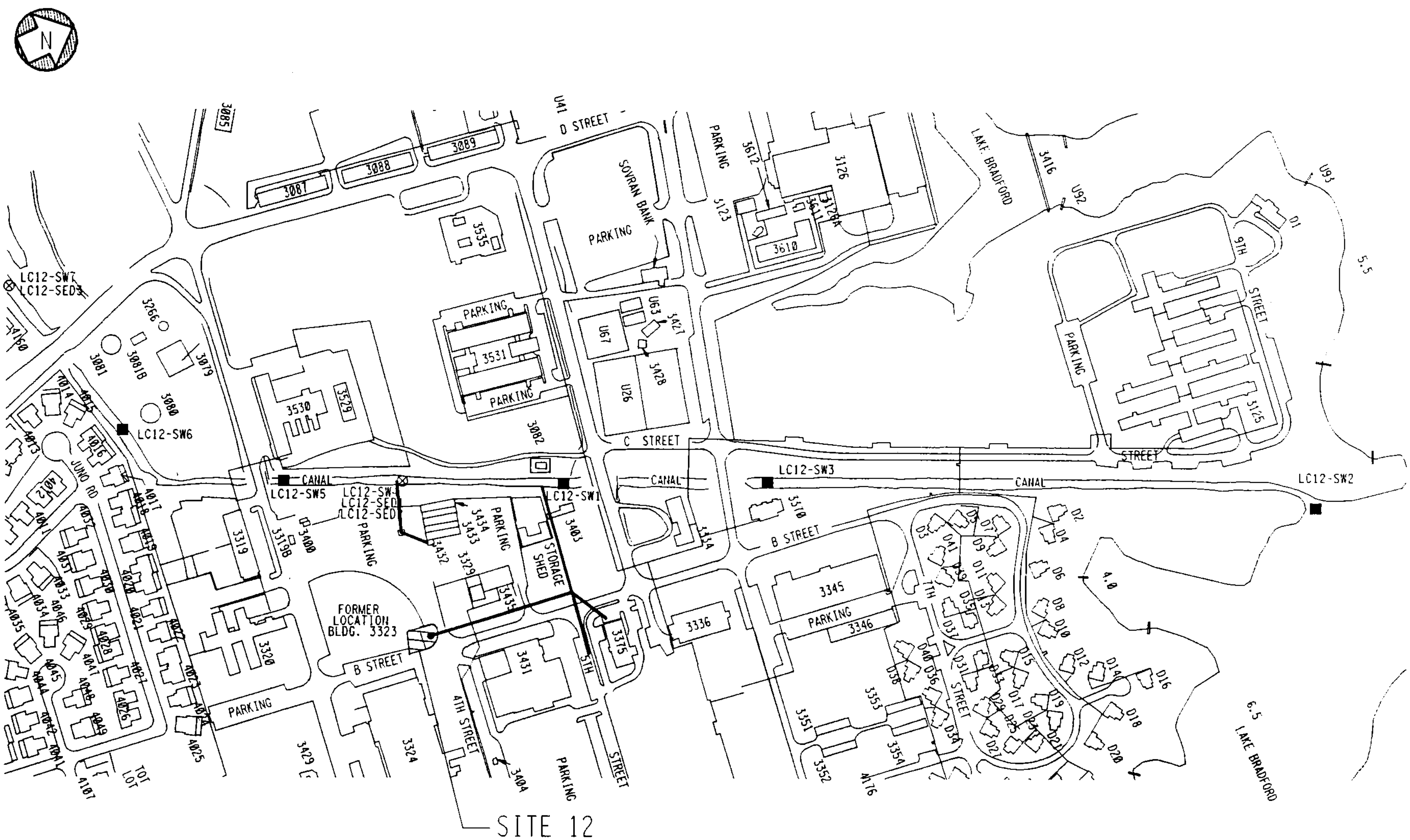
SOURCE: DRAFT INTERIM REMEDIAL INVESTIGATION REPORT, EBASCO, 5/91

0 100' 200' 300'

SCALE IN FEET

Figure 2-6
PREVIOUS SAMPLING LOCATIONS
SITE 12
ATEC ENVIRONMENTAL SITE STUDY
LITTLE CREEK AMPHIBIOUS BASE
VIRGINIA BEACH, VIRGINIA

c:\rita\dgns\071602.dgn Apr. 22, 1994 13:23:03



LEGEND

⊗ SURFACE WATER AND SEDIMENT SAMPLING LOCATION

■ SURFACE WATER SAMPLING LOCATION

— DRAINAGE LINE

Ø 500′
SCALE IN FEET

SOURCE: DRAFT INTERIM REMEDIAL INVESTIGATION REPORT, EBASCO, 5/91

FIGURE 2-7
PREVIOUS SAMPLING LOCATIONS
SITE 12
INTERIM REMEDIAL INVESTIGATION
NAB - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

This Drawing is the Property of the
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SAB | AS NOTED | 01-23-92 | DWG.No.- 192073-1-41-603 | H

071603.DGN

RI/FS As part of the RI effort completed by FWES at NAB Little Creek in the summer of 1993, a Geoprobe investigation was conducted and four monitoring wells were subsequently installed at Site 12. In addition, groundwater, surface water, and sediment samples were also collected and analyzed during this investigation. The sampling locations are presented in **Figure 2-8**.

Four groundwater samples were collected from four groundwater monitoring wells at Site 12 and were analyzed for VOCs. Toluene, 1,2-dichloroethane (total), trichloroethene, and tetrachloroethene were among the VOCs detected in surface water samples at Site 12. The highest total VOCs were 18,200 µg/L at 12-GW-102. **Table 2-6** presents a summary of this data.

Four surface water samples were collected from the stream adjacent to Site 12. These samples were analyzed for VOCs and TAL metals. The highest total VOCs was 144 µg/L at 12-SW-102. **Table 2-7** presents a summary of the surface water VOC data. TAL metals detected at each surface water location include barium, calcium, copper, iron, lead magnesium, manganese, potassium, sodium, and zinc. Highest TAL metals concentrations were detected at 12-GW-102. **Table 2-8** presents a summary of the TAL metals data.

Four sediment samples were collected at Site 12; two from the location of 12-SW-102 at depths from 0-6 inches and 6-12 inches, and two from the location of 12-SW-103 at the same depths. These samples were analyzed for VOCs, TAL metals, and TOC. VOCs were detected in all of the sediment samples. 1,2-Dichloroethene (total), trichloroethene, and tetrachloroethene were among the VOCs detected with the highest concentrations of these compounds at 12-SW-102 at the 0-6 inch depth. The highest total VOCs detected was 82 µg/L at 12-SW-102 at the 6-12 inch depth. **Table 2-9** presents a summary of the VOC sediment sampling data. The TCL metals aluminum, arsenic, barium, calcium, chromium, copper, iron, lead, magnesium, manganese, potassium, vanadium, and zinc were detected at all the sediment sample locations and depths. With the exception of lead, the highest levels of these metals were detected at 12-SED-102 at the 0-6 inch depth. Lead was detected at highest concentrations (110 mg/kg) at 12-SED-106 at the 0-6 inch depth. **Table 2-10** presents a summary of the TCL metals sediment sampling data. TOC was detected in all the samples. TOC sediment sampling data is presented in **Table 2-11**.

2.6.2.2 Site 13--Public Works PCP Dip Tank and Wash Rack

Initial Assessment Study The IAS recommended the installation of five monitoring wells to sample and analyze the groundwater. The sampling of the groundwater was to occur quarterly for one year. In addition, six composite soil samples were to be collected in the open lot between the wash rack and the paved compound where the PCP dip tank and layout yard were located to determine the extent of contamination.

Round 1 Verification Step The RVS involved the collection of samples from the area near Site 13, five groundwater and six soil. LC13-S4, LC13-S5, and LC13-S6 were collected at a depth of 0.0 to 0.5 feet. LC13-S1 and LC13-S2 were collected between 0.5 and 2.5 feet and LC13-S3 was collected between 3.0 and 5.0 feet. Sample locations are shown on **Figure 2-9**. The results of sampling are provided in **Tables 2-12** and **2-13**.

VOCs were detected in four of the groundwater samples at levels ranging from not detected to 21 µg/l. Base neutral compounds were detected in two groundwater samples at levels ranging from 2.1 µg/l to 27 µg/l. Acid extractable compounds were detected in four groundwater samples at levels ranging from 1.6 µg/l to 55 µg/l. Oil and grease also were detected in three groundwater samples at levels ranging from not detected to 7,000 µg/l.

VOCs were detected in all six of the soil samples at levels ranging from not detected to 0.38 µg/l. Base neutral compounds were detected in soil samples LC13-S3 and LC13-S4 at levels ranging from not detected to 49 µg/l. Acid extractable compounds were detected in LC13-S3 at a level of 79 µg/l. Oil and grease also were detected in the soil samples at levels ranging from 115 µg/l to 5,805 µg/l.

Table 2-6

**SUMMARY OF VOLATILE ORGANIC COMPOUNDS
DETECTED IN GROUNDWATER SAMPLES
AND ASSOCIATED QUALITY CONTROL SAMPLES
SITE 12 - EXCHANGE LAUNDRY WASTE DISPOSAL AREA
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
JUNE 28, 1993**

SAMPLE LOCATION/NUMBER SAMPLE MATRIX UNITS	12-GW-101 Water ug/L	12-GW-102 Water ug/L	12-GW-103 Water ug/L	12-GW-104 Water ug/L
VOLATILE ORGANIC COMPOUNDS (VOCs):				
1,2-Dichloroethene (total)	ND	11,000	2 J	ND
Chloroform	ND	ND	1 J	ND
Trichloroethene	ND	2,300	2 J	2 J
Tetrachloroethene	ND	4,900	4 J	2 J
TOTAL VOCs:	ND	18,200	9 J	4 J
TOTAL TICs:	ND	ND	ND	ND

NOTES:

ND indicates compound was not detected

ug/L indicates micrograms per liter

J indicates an estimated value

TICs indicates tentatively identified compounds

Trip Blank is shared with Site 13

Equipment Rinsate and Field Blank shared with the Background Well samples

Table 2-7

**SUMMARY OF VOLATILE ORGANIC COMPOUNDS
DETECTED IN SURFACE WATER SAMPLES
AND ASSOCIATED QUALITY CONTROL SAMPLES
SITE 12 - EXCHANGE LAUNDRY WASTE DISPOSAL AREA
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
JUNE 28, 1993**

SAMPLE LOCATION/NUMBER SAMPLE MATRIX UNITS	12-SW-101 Water ug/L	12-SW-102 Water ug/L	12-SW-103 Water ug/L	12-SW-104 Water ug/L
VOLATILE ORGANIC COMPOUNDS (VOCs):				
Acetone	ND	50 B	31 B	20 B
1,2-Dichloroethene (total)	ND	ND	11	ND
2-Butanone	ND	36	ND	ND
Trichloroethene	ND	ND	3 J	ND
Tetrachloroethene	ND	ND	3 J	ND
Toluene	4 J	58	2 J	ND
TOTAL VOCs:	4 J	144	50 J	20
TOTAL TICs:	ND	7 J	ND	ND

NOTES:

ND indicates compound was not detected
ug/L indicates micrograms per liter
J indicates an estimated value
B indicates compound detected in lab blank
TICs indicates tentatively identified compounds
Equipment rinsate, field blank, and trip blank shared with Background Well samples
Matrix spike/matrix spike duplicate (MS/MSD) shared with Site 10

Table 2-8

**SUMMARY OF TAL METALS
DETECTED IN SURFACE WATER SAMPLES
AND ASSOCIATED QUALITY CONTROL SAMPLES
SITE 12 - EXCHANGE LAUNDRY WASTE DISPOSAL AREA
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
JUNE 28, 1993**

SAMPLE LOCATION/NUMBER SAMPLE MATRIX UNITS	12-SW-101 Water ug/L		12-SW-102 Water ug/L		12-SW-103 Water ug/L		12-SW-104 Water ug/L	
TAL METALS:								
Aluminum	4,320	J	81,800	J	ND		ND	
Arsenic	2.8	J	23.4	J	ND		2.2	J
Barium	50.4	J	669	J	25.6	J	25.3	J
Beryllium	ND		3.1	J	ND		ND	
Cadmium	ND		7.5	J	ND		ND	
Calcium	15,700	J	84,500	J	16,400	J	15,600	J
Chromium	ND		148	J	ND		ND	
Cobalt	ND		64.0	J	ND		ND	
Copper	21.5	J	305	J	10.1	J	4.7	J
Iron	10,300	J	94,800	J	3,930	J	2,900	J
Lead	25.2	J	312	J	2.0	J	3.0	J
Magnesium	5,300	J	26,600	J	5,150	J	6,160	J
Manganese	547	J	1,240	J	507	J	529	J
Mercury	ND		0.79	J	ND		ND	
Nickel	ND		143	J	ND		ND	
Potassium	3,880	J	21,300	J	3,600	J	2,800	J
Sodium	13,700	J	26,200	J	13,300	J	13,400	J
Vanadium	11.8	J	162	J	ND		ND	
Zinc	204	J	3,800	J	153	J	39.1	J

NOTES:

ND indicates compound was not detected
ug/L indicates micrograms per liter
J indicates an estimated value
Equipment Rinsate and Field Blank shared with Background Well samples
Matrix spike/matrix spike duplicate (MS/MSD) shared with Site 10

Table 2-9

**SUMMARY OF VOLATILE ORGANIC COMPOUNDS
DETECTED IN SEDIMENT SAMPLES
AND ASSOCIATED QUALITY CONTROL SAMPLES
SITE 12 - EXCHANGE LAUNDRY WASTE DISPOSAL AREA
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
JUNE 28, 1993**

SAMPLE LOCATION/NUMBER SAMPLE DEPTH SAMPLE MATRIX UNITS	12-SED-102-00 0 - 6 inches Sediment ug/kg		12-SED-102-06 6 - 12 inches Sediment ug/kg		12-SED-103-00 0 - 6 inches Sediment ug/kg		12-SED-103-06 6 - 12 inches Sediment ug/kg	
VOLATILE ORGANIC COMPOUNDS (VOCs):								
Acetone	30	J	82	J	ND		8	J
1,2-Dichloroethene (total)	14	J	ND		2	J	ND	
Trichloroethene	19	J	ND		3	J	ND	
Tetrachloroethene	15	J	ND		6	J	ND	
Toluene	ND		ND		ND		5	J
Xylene (total)	ND		ND		ND		4	J
TOTAL VOCs:	78	J	82	J	11	J	17	J
TOTAL TICs:	131	J	ND		100	J	228	J

NOTES:

ND indicates compound was not detected
ug/kg indicates micrograms per kilogram
J indicates an estimated value
TICs indicates tentatively identified compounds
Equipment rinsate, trip blank, matrix spike/matrix spike duplicate, and duplicate sample shared with Site 13

Table 2-10

**SUMMARY OF TAL METALS
DETECTED IN SEDIMENT SAMPLES
AND ASSOCIATED QUALITY CONTROL SAMPLES
SITE 12 - EXCHANGE LAUNDRY WASTE DISPOSAL AREA
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
JUNE 28, 1993**

SAMPLE LOCATION/NUMBER SAMPLE DEPTH SAMPLE MATRIX UNITS	12-SED-102-00 0 - 6 inches Sediment mg/kg		12-SED-102-06 6 - 12 inches Sediment mg/kg		12-SED-103-00 0 - 6 inches Sediment mg/kg		12-SED-103-06 6 - 12 inches Sediment mg/kg	
TAL METALS:								
Aluminum	11,700	J	4,180	J	2,690	J	1,130	J
Arsenic	5.6	J	3.8	J	2.1	J	0.64	J
Barium	72.0	J	30.1	J	12.5	J	3.4	J
Cadmium	ND		1.2	J	ND		ND	
Calcium	2,970	J	793	J	217	J	72.5	J
Chromium	20.6	J	8.4	J	3.0	J	1.3	J
Cobalt	4.8	J	1.5	J	1.3	J	ND	
Copper	36.0	J	18.0	J	7.5	J	2.3	J
Iron	12,900		4,940	J	2,560	J	1,220	J
Lead	66.3		38.3	J	110	J	8.7	J
Magnesium	1,990	J	541	J	274	J	83.6	J
Manganese	144	J	35.2	J	11.7	J	3.7	J
Mercury	ND		ND		0.28	J	ND	
Nickel	13.8	J	5.1	J	2.9	J	ND	
Potassium	1,350	J	340	J	115	J	45.8	J
Sodium	346	J	ND		ND		ND	
Vanadium	26.9	J	11.9	J	8.1	J	1.9	J
Zinc	383	J	233	J	30.1	J	6.1	J

NOTES:

ND indicates compound was not detected
mg/kg indicates milligrams per kilogram
J indicates an estimated value
Equipment rinsate, matrix spike/matrix spike duplicate, and duplicate sample shared with Site 13

Table 2–11

SUMMARY OF TOTAL ORGANIC CARBON
DETECTED IN SEDIMENT SAMPLES
AND ASSOCIATED QUALITY CONTROL SAMPLES
SITE 12 – EXCHANGE LAUNDRY WASTE DISPOSAL AREA
NAVAL AMPHIBIOUS BASE – LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
JUNE 28, 1993

SAMPLE LOCATION/NUMBER SAMPLE DEPTH SAMPLE MATRIX UNITS	12–SED–102–00 0 – 6 inches Sediment mg/kg	12–SED–102–06 6 – 12 inches Sediment mg/kg	12–SED–103–00 0 – 6 inches Sediment mg/kg	12–SED–103–06 6 – 12 inches Sediment mg/kg
TOTAL ORGANIC CARBON:	77,000	52,500	5,940	488

NOTES:

mg/kg indicates milligrams per kilogram

Equipment rinsate, matrix spike/matrix spike duplicate, and duplicate sample shared with Site 13

Table 2-12

SUMMARY OF ANALYTICAL RESULTS FOR SOIL SAMPLES
SITE 13: PUBLIC WORKS COMPOUND PCP DIP TANK/METALS SHOP
NAB LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
ROUND 1 VERIFICATION STEP
OCTOBER 1986

PARAMETER	LC13-S1	LC13-S2	LC13-S3	LC13-S4	LC132-S5	LC13-S6
OIL AND GREASE	**115**	**144**	**1,039**	**421**	**5,805**	**3,726**
VOLATILE ORGANIC COMPOUNDS						
METHYL CHLORIDE	0.38	0.29	0.05	0.13	0.33	0.4
ACETONE	0.019	0.070	0.077	0.12	0.035	0.024
TOLUENE	0.0028	0.026				
ETHYL BENZENE			0.0016			
TOTAL XYLENES			0.0094			
BASE/NEUTRAL COMPOUNDS						
NAPHTHALENE	NR	NR	8.9	NR	NR	NR
ACENAPHTHALENE	NR	NR	1.2	NR	NR	NR
PHENANTHRENE	NR	NR	4.2	NR	NR	NR
FLUORANTHENE	NR	NR	2.2	NR	NR	NR
PYRENE	NR	NR	3.8	NR	NR	NR
2-METHYLNAPHTHALENE	NR	NR	4.5	NR	NR	NR
1-METHYLNAPHTHALENE	NR	NR	2.3	NR	NR	NR
DI-METHYLNAPHTHALENE	NR	NR	49	NR	NR	NR
TRI-METHYLNAPHTHALENE	NR	NR	34	NR	NR	NR
SATURATED HYDROCARBONS	NR	NR	34	NR	NR	NR
BIS(2-ETHYLHEXYL)PHTHALATE	NR	NR		11	NR	NR
ACIDEXTRACTABLE COMPOUNTS						
PENTACHLOROPHENOL		79				

NOTES:
All results in parts per million (ppm)
Black indicates compound was not detected
NR indicates results were reported only if observed

RVSS13.WK1

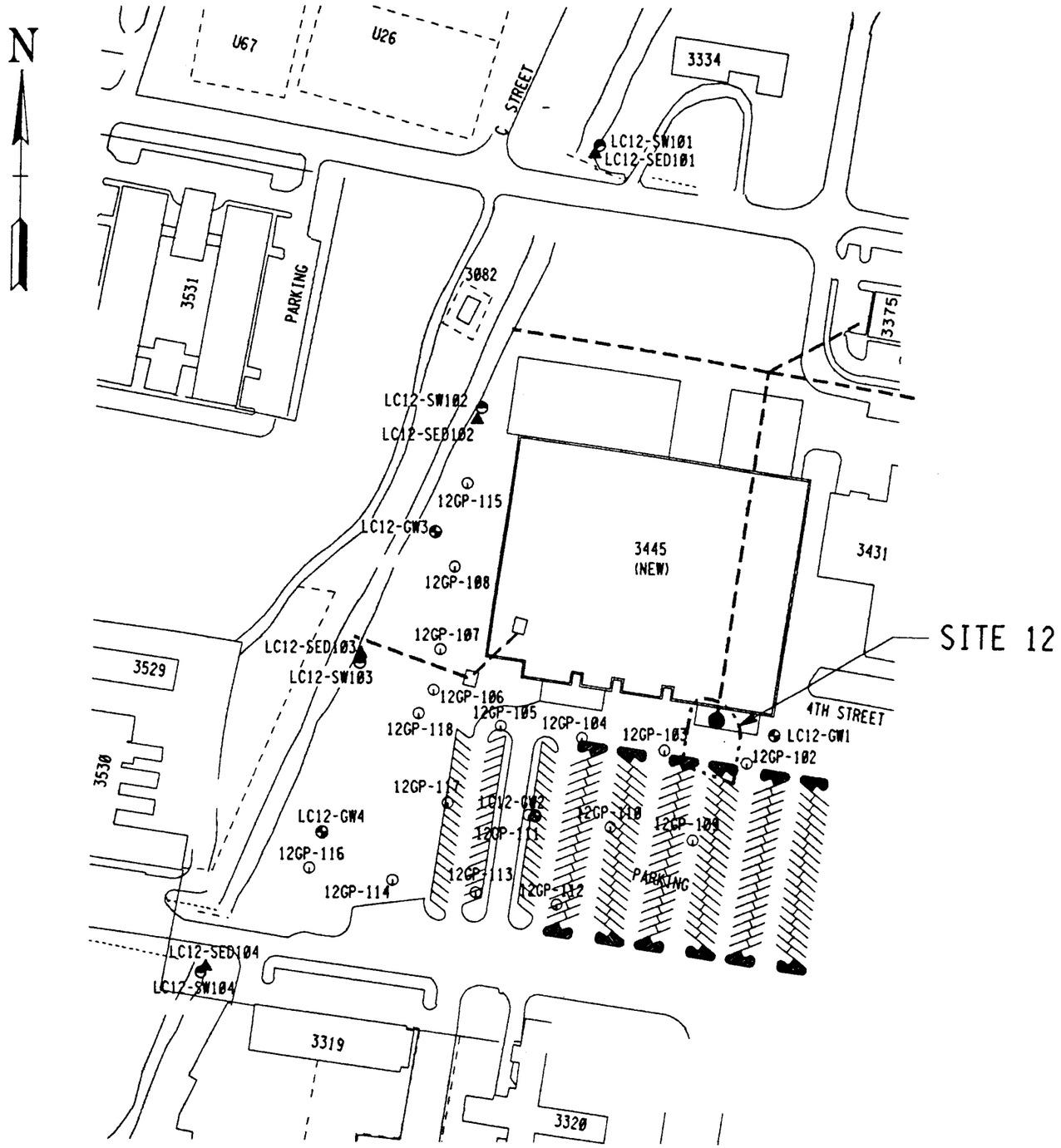
Table 2-13

SUMMARY OF ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES
SITE 13: PUBLIC WORKS COMPOUND PCP DIP TANK/METALS SHOP
NAB LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
ROUND 1 VERIFICATION STEP
OCTOBER 1986

PARAMETER	LC13-GW1	LC13-GW2	LC13-GW3	LC13-GW4	LC132-GW5
OIL AND GREASE	7,000		7,000		7,000
VOLATILE ORGANIC COMPOUNDS					
METHYL CHLORIDE					6.4
TRICHLOROETHENE	8.5		7.7	16	15
TRANS-1,2-DICHLOROETHENE			8.9		
TETRACHLOROETHENE			14	21	
CHLOROBENZENE				6.7	
BASE/NEUTRAL COMPOUNDS					
BIS(2-ETHYLHEXYL)PHTHALATE		27			
1,4-DICHLOROBENZENE				2.1	
1,2-DICHLOROBENZENE				2.4	
ACID EXTRACTABLE COMPOUNDS					
PENTACHLOROPHENOL		55	17	8.1	
PHENOL					1.6

NOTES:
All results in parts per billion (ppb)
Blank indicates compound was not detected

RVSGW13.WK1



LEGEND

- FORMER WATER AND STORM SEWER LINE
- SITE BOUNDARY
- 12GP-103 GEOPROBE
- LC12-GW4 MONITORING WELL INSTALLED BY FWES
- LC12-SW104 SURFACE WATER SAMPLE
- SED104 SEDIMENT

GRAPHIC SCALE

0 150′ 300′ 450′

1" = 150′-0"

REV.	DATE	DESCRIPTION	APPR.
A	10-29-93	DRAFT TO LANTDIV	

REVISIONS

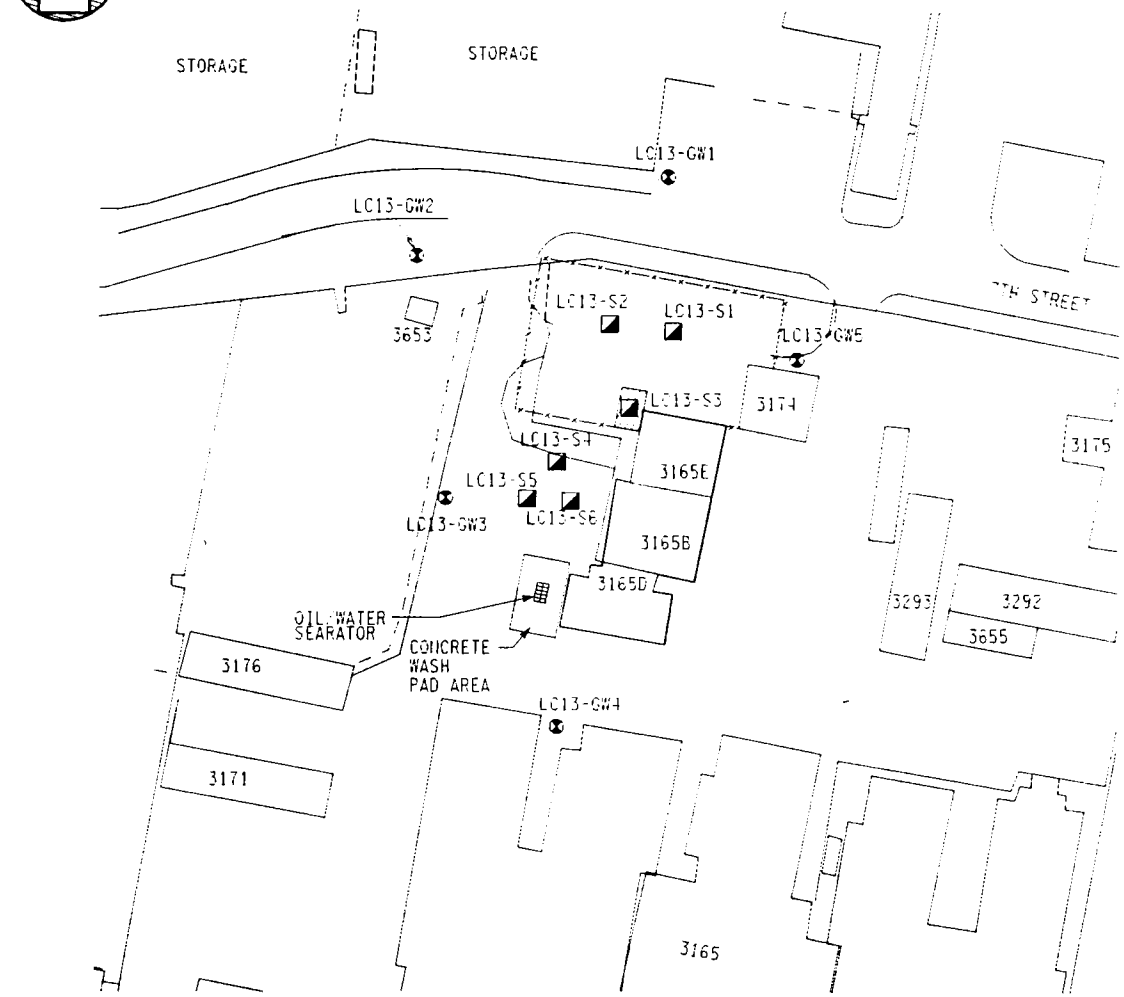
FIGURE 2-8

SAMPLING LOCATIONS

SITE 12
NAB - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

DRAWN BY:	SAW	10/11/93	SCALE: 1"=150'-0"	
CHECKED BY:			DRAWING No. 192071-4-48-1201	REV. A
APPROVED BY:				

CAD Rev No 01 28-OCT-93



LEGEND

- LOCATION OF FORMER PCP DIP TANK
- LC13-GW4 — MONITORING WELL
- LC13-S1 — SOIL SAMPLE
- FENCING INDICATES APPRO*. DRILLING AREA BOUNDARY.

0 100 200

SCALE IN FEET

SOURCE: ROUND I VERIFICATION STEP, CH_2M HILL, 10/86

Figure 2-9
PREVIOUS SAMPLING LOCATIONS
SITE 13
ROUND I VERIFICATION STEP

NAB - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

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The RVS results indicated that contamination is present in the soil near the location of the former dip tank and is currently leaving the site via groundwater. The source of VOCs in groundwater may not be attributed to the site. The RVS suggested that potential human health risks can be posed by the site contaminants if groundwater from the site is used as a drinking water supply, or if contact is made with the soil beneath the asphalt at the former dip tank location. The RVS recommended a second round of samples be collected from the five monitoring wells.

Interim Remedial Investigation The IRI field activities at the Public Works PCP Dip Tank and Wash Rack consisted of the collection and analysis of groundwater samples and water level data from the monitoring wells at the site. A total of five groundwater samples were collected and analyzed. The sample locations are indicated on **Figure 2-10**. The results of sampling are provided in **Table 2-14**. The data generated by these activities were used to determine groundwater circulation patterns and whether the site has impacted groundwater quality in the area.

VOCs were detected only in LC13-GW4, while base neutral compounds were detected only in LC13-GW2. TPH were not detected in any of the five groundwater samples. Metals were detected in all five groundwater samples.

Water level data were collected from the five monitoring wells at Site 13 in December 1990 and March 1991. Groundwater flow at the PCP Dip Tank changed markedly between January and March 1991. In January, the direction of flow was south-southeast. In March, the elevation of the water table declined significantly in well LC13-GW2, resulting in both southward and northward components of flow. The reasons for this reversal in direction are not known, but may be related to precipitation or seasonal variations. Additional water level measurements would be needed to support a more definitive explanation of the observed trend.

The presence of increasing concentrations of PCP in well LC13-GW1 between 1986 and 1990 suggests that the source of PCP contamination is still active. The occurrence of PCP in wells LC13-GW2 and LC13-GW3, both of which are west of the former dip tank and drying yard location, supports earlier interpretations regarding the highly variable nature of groundwater flow at the site, including occasional reversals in the direction of flow. PCP contamination in well LC13-GW4, located south-southeast of the former dip tank location, can be attributed to the southward gradient that has also been documented for the site.

Volatile organic contamination detected in well LC13-GW4 indicates that the source of contamination at the site is still active. The probable source of this contamination is leaky drains, sewer lines, adjacent to Building 3165 or the oil/water separator that lies beneath the driveway, midway between well LC13-GW4 and the wash rack. The use of TCE and other solvents on the wash rack would have resulted in temporary storage in the separator. A sustained release from the separator would have created a relatively significant volume of contaminated soil. A similar situation would have been created if the source were leaky sewer lines beneath Building 3165.

The extent of volatile organic contamination has decreased considerably between 1986 and 1990. The decline in TCE concentrations between 1986 and 1990 in wells LC13-GW1, LC13-GW3, and LC13-GW5 is most likely due to the on-going depletion of the source. This depletion would be expected considering TCE and other chlorinated solvents are no longer used at the wash rack or in Building 3165. Fluctuations in the gradient and direction of groundwater flow, as observed with the December and March water level data, are regularly occurring and have probably minimized migration of contamination in any one direction.

The IRI recommended groundwater monitoring should continue at Site 13 to confirm that a natural clean-up of the aquifer is occurring. However, no additional remedial response was recommended unless the current land use changes or human and/or environmental receptors are identified.

RI/FS As part of the RI effort completed by FWES at NAB Little Creek in the summer of 1993, three new monitoring wells were installed. In addition, groundwater, surface and subsurface soil samples were also collected and analyzed during this investigation. The sampling locations are shown in **Figure 2-11**.

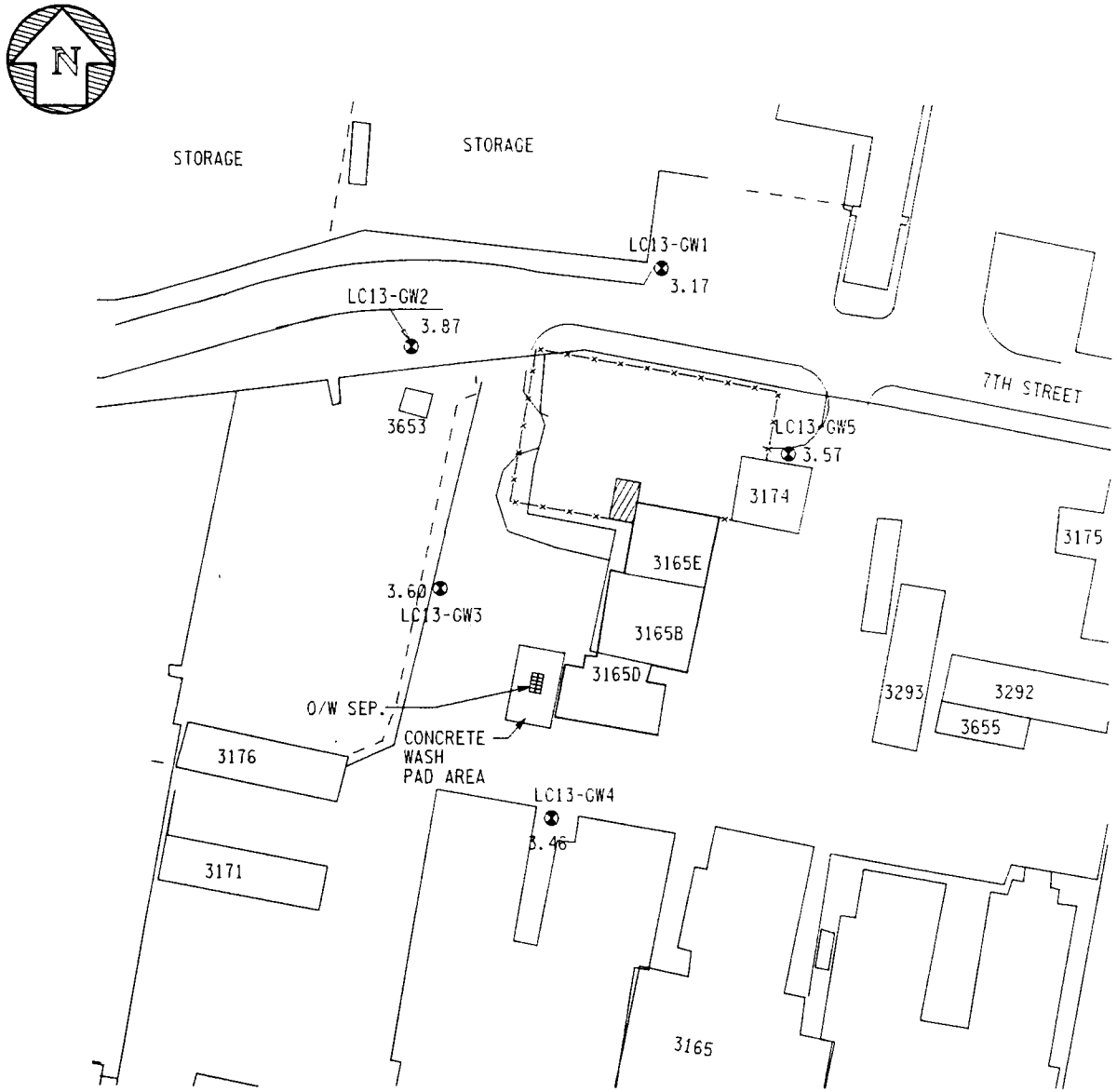
Table 2-14

SUMMARY OF ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES
SITE 13: PUBLIC WORKS COMPOUND PCP DIP TANK/METALS SHOP
NAB LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
INTERIM REMEDIAL INVESTIGATION
NOVEMBER 1991

PARAMETER	LC13-GW1	LC13-GW2	LC13-GW3	LC13-GW4	LC13-GW5
VOLATILE ORGANIC COMPOUNDS (ug/l)					
TOLUENE				3 J	
TETRACHLOROETHENE				4 J	
TRANS-1,2-DICHLOROETHENE				5 J	
TETRACHLOROETHENE				4 J	
CHLOROFORM				7	
TOTAL PETROLEUM HYDROCARBONS (mg/l)					
BASE/NEUTRAL AND ACID EXTRACTABLE COMPOUNDS (ug/l)					
NAPHTHALENE		3 J			
2-METHYLNAPHTHALENE		1 J			
PENTACHLOROPHENOL		130			
METALS (ug/l)					
BERYLLIUM	2		4		2
CADMIUM	11	7	13	7	138
CHROMIUM (TOTAL)	56	64	78	46	64
COPPER	85		96		93
LEAD	23	17	33	19	44
MERCURY	0.3			0.3	
NICKEL	40		24		32
THALLIUM		44	4.1		
ZINC	169	98	189	75	648 J
ALUMINUM	70,800	68,900	168,000	57,400	96,900
BARIUM	268	197	448	165	322
CALCIUM	39,600	11,400	11,000	28,100	8,930
COBALT	33	16	28		96
IRON	77,800	75,800	164,000	39,850	12,000
MAGNESIUM	12,100	9,370	16,500	12,200	10,700 J
MANGANESE	1,810	673	772	1,180	954
POTASSIUM	9,140	5,560	11,000	8,650	7,650
SODIUM	26,500	17,900	18,900	19,600	14,700
VANADIUM	86		200		82

NOTES:
All results in parts per billion (ppb)
Blank indicates compound was not detected
J indicates an estimated concentration

IRIGW13.WK1



LEGEND

- LOCATION OF FORMER PCP DIP TANK
- LC13-GW4 / 3.46 — MONITORING WELL, WITH WATER LEVEL, FEET M.S.L.
- -x—x—x- FENCING INDICATES APPROX. DRYING AREA BOUNDARY.

Ø 100' 200'

SCALE IN FEET

SOURCE: DRAFT INTERIM REMEDIAL INVESTIGATION REPORT, EBASCO, 5/91

FIGURE 2-10
PREVIOUS SAMPLING LOCATIONS
SITE 13
INTERIM REMEDIAL INVESTIGATION
NAB - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

SAM | AS NOTED | 01-23-92 | DRG.No.- 1628TI-1-41-702

Five surface soil samples were collected from the former location of the pentachlorophenol dip tank and a drainage ditch on site. These samples were collected from a depth of 0 to 6 inches below ground surface and were analyzed for VOCs and SVOCs, and TOC. VOCs were detected at all five surface soil sampling locations. **Table 2-15** presents a summary of VOCs detected in surface soil samples at Site 13. Acetone and toluene were among the VOCs detected at the surface soil sampling locations. The highest total VOCs detected was 19 µg/kg at 13-SS-104. SVOCs were detected at all five surface soil sampling locations. Highest concentrations of SVOC compounds were mostly detected at the 13-SS-103 sampling location. **Table 2-16** presents a summary of SVOCs detected in surface soil samples at Site 13. locations. Total SVOCs detected ranged from 1,210 µg/kg (J) at 13-SS-102 to 95,800 µg/kg (J) at 13-SS-106 (duplicate of 13-SS-103). TOC was detected at all five of the surface soil sampling locations at Site 13. **Table 2-17** presents a summary of TOC detected in surface soil samples and associated quality control samples.

Three subsurface soil samples and one duplicate were collected at varying depths from soil boring which was converted to monitoring well LC13-GW08 at Site 13. These samples were analyzed for VOCs and SVOCs, and TOC. VOCs were detected at two of the three subsurface soil sampling locations. Xylene (total), acetone, and ethylbenzene were among the VOCs detected. The highest total VOCs was 250 µg/kg (J) at 13-SB-108-01. **Table 2-18** presents a summary of the subsurface soil VOC analytical data. SVOCs were detected at all three subsurface soil sampling locations. **Table 2-19** presents a summary of SVOCs detected in subsurface soil. Pentachlorophenol was detected at all three subsurface soil sampling locations; concentrations detected ranged from 11,000 µg/kg at 13-SB-108-02 to 890,000 µg/kg at 13-SB-108-01. 2-Methylnaphthalene was detected at two of the three subsurface soil sampling locations; the highest concentration detected was 6,300 µg/kg (J) at 13-SB-108-03. Naphthalene and bis (2-ethylhexyl)phthalate were each detected only at 13-SB-108-02 at concentrations of 85 µg/kg (J) and 55 µg/kg (J), respectively. Total concentrations of SVOCs detected ranged from 11,260 µg/kg (J) at 13-SB-108-02 to 890,000 µg/kg at 13-SB-108-01. TOC was detected at all three subsurface soil sampling locations. **Table 2-20** presents a summary of TOC detected in subsurface soil samples at Site 13.

Six groundwater samples and one duplicate were collected from monitoring wells at Site 13. These samples were analyzed for VOCs and SVOCs. VOCs were detected at all six groundwater sampling locations. **Table 2-21** presents a summary of VOCs detected in groundwater samples at Site 13. Total VOCs ranged in concentration from 1 µg/l (J) at 13GW07 to 262 µg/l (J) at 13GW06.Trichloroethene, chlorobenzene, and tetrachloroethene were detected at highest concentrations, 5 µg/L, 110 µg/L, and 7 µg/L, respectively, at 13GW04. The highest concentration of vinyl chloride detected was 200 µg/l at 13GW06. The highest concentration of ethylbenzene detected was 15 µg/l at 13GW05. The highest concentration of xylene (total) detected was 77 µg/l at 13GW09 (duplicate of 13GW08). The highest concentration of total VOCs was 262 µg/l (J) at 13GW06. SVOCs were detected at four of the six groundwater sampling locations. Pentachlorophenol was detected at three of the six groundwater sampling locations; the highest concentration detected was 1,700 µg/l at 13GW08. Naphthalene was detected at two of the six groundwater sampling locations; the highest concentration detected was 96 µg/l (J) at 13GW08. **Table 2-22** presents a summary of SVOCs detected in groundwater samples and associated quality control samples at Site 13.

Table 2–15

SUMMARY OF VOLATILE ORGANIC COMPOUNDS
DETECTED IN SURFACE SOIL SAMPLES
AND ASSOCIATED QUALITY CONTROL SAMPLES
SITE 13 – PUBLIC WORKS PCP DIP TANK AND WASH RACK
NAVAL AMPHIBIOUS BASE – LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
MAY 13, 1993

SAMPLE LOCATION/NUMBER	13–SS–101	13–SS–102	13–SS–103	13–SS–106 (Duplicate 13–SS–103)	13–SS–104	13–SS–105
SAMPLE MATRIX	Soil	Soil	Soil	Soil	Soil	Soil
UNITS	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
VOLATILE ORGANIC COMPOUNDS (VOCs):						
Acetone	8 J	8 J	13	ND	19	ND
Toluene	2 J	ND	3 J	3 J	ND	ND
TOTAL VOCs:	10 J	8 J	16 J	3 J	19	ND
TOTAL TICs:	ND	ND	ND	7 J	ND	ND

NOTES:

ND indicates compound was not detected

ug/kg indicates micrograms per kilogram

J indicates an estimated value

TICs indicates tentatively identified compounds

Equipment rinsate, field blank, matrix spike/matrix spike duplicate, and trip blank shared with Site 11

Table 2-16

SUMMARY OF SEMI-VOLATILE ORGANIC COMPOUNDS
DETECTED IN SURFACE SOIL SAMPLES
AND ASSOCIATED QUALITY CONTROL SAMPLES
SITE 13 - PUBLIC WORKS PCP DIP TANK AND WASH RACK
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
MAY 13, 1993

SAMPLE LOCATION/NUMBER	13-SS-101	13-SS-102	13-SS-103	13-SS-106 (Duplicate 13-SS-103)	13-SS-104	13-SS-105	11-SS-ER	11-FB-101
SAMPLE MATRIX	Soil	Soil	Soil	Soil	Soil	Soil	Water	Water
UNITS	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L
SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs):								
Naphthalene	ND	ND	ND	ND	ND	ND	1 J	ND
2-Methylnaphthalene	410 J	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	950 J	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	870 J	ND	ND	ND	ND	ND	ND	ND
Fluorene	1,300 J	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	2,400	ND	13,000	13,000	520 J	5,500	ND	ND
Phenanthrene	7,900	81 J	820 J	970 J	240 J	ND	ND	ND
Anthracene	1,800 J	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	5,900 J	120 J	4,500	9,800	360 J	ND	ND	ND
Carbazole	1,200 J	ND	ND	ND	ND	ND	ND	ND
Pyrene	9,500	420 J	ND	21,000	1,600	410 J	ND	ND
Butylbenzylphthalate	ND	38 J	ND	ND	44 J	ND	ND	ND
Benzo (a) anthracene	5,000	110 J	5,700	10,000	420	ND	ND	ND
Chrysene	3,100	120 J	7,200	10,000	450	ND	ND	ND
bis (2-Ethylhexyl) phthalate	ND	ND	550 J	630 J	230 J	230 J	6 J	ND
Benzo (b) fluoranthene	3,800	140 J	8,800	13,000	520 J	210 J	ND	ND
Benzo (k) fluoranthene	1,600 J	81 J	1,200 J	3,400 J	170 J	ND	ND	ND
Benzo (a) pyrene	2,800	100 J	3,900	6,400	320 J	ND	ND	ND
Indeno (1,2,3-cd) pyrene	2,400	ND	2,300 J	4,000 J	200 J	ND	ND	ND
Dibenzo (a,h) anthracene	700 J	ND	ND	ND	ND	ND	ND	ND
Benzo (g,h,i) perylene	2,000	ND	2,100 J	3,600 J	190 J	ND	ND	ND
TOTAL SVOCs:	53,630 J	1,210 J	50,070 J	95,800 J	5,264 J	6,350 J	7 J	ND
TOTAL TICs:	9,040 J	2,450 J	11,700 J	14,300 J	3,600 J	3,160 J	38 J	ND

NOTES:

ND indicates compound was not detected
ug/kg indicates micrograms per kilogram
ug/L indicates micrograms per liter
J indicates an estimated value
TICs indicates tentatively identified compounds
ER indicates equipment rinsate blank
FB indicates field blank
Matrix spike/matrix spike duplicate (MS/MSD) sample shared with Site 11

Table 2-17

SUMMARY OF TOTAL ORGANIC CARBON
DETECTED IN SURFACE SOIL SAMPLES
AND ASSOCIATED QUALITY CONTROL SAMPLES
SITE 13 - PUBLIC WORKS PCP DIP TANK AND WASH RACK
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
MAY 13, 1993

SAMPLE LOCATION/NUMBER SAMPLE MATRIX UNITS	13-SS-101 Soil mg/kg	13-SS-102 Soil mg/kg	13-SS-103 Soil mg/kg	13-SS-106 (Duplicate 13-SS-103) Soil mg/kg	13-SS-104 Soil mg/kg	13-SS-105 Soil mg/kg
TOTAL ORGANIC CARBON:	51,700 J	14,200 J	21,200 J	55,700 J	7,060 J	15,100 J

NOTES:

ND indicates compound was not detected
mg/kg indicates milligrams per kilogram
J indicates an estimated value
Equipment rinsate, field blank, and matrix spike/matrix spike duplicate shared with Site 11

Table 2-18

SUMMARY OF VOLATILE ORGANIC COMPOUNDS
DETECTED IN SUBSURFACE SOIL SAMPLES
AND ASSOCIATED QUALITY CONTROL SAMPLES
SITE 13 - PUBLIC WORKS PCP DIP TANK AND WASH RACK
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
JUNE 28, 1993

SAMPLE LOCATION/NUMBER	13-SB-108-01(1)	13-SB-108-02	13-SB-109-02 (Duplicate 13-SB-109-02)	13-SB-108-03	13-SB-RB-101	13-SB-RB-102	TB-P2-101
SAMPLE MATRIX	Soil	Soil	Soil	Soil	Water	Water	Water
UNITS	ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L	ug/L
VOLATILE ORGANIC COMPOUNDS (VOCs):							
Acetone	130 J	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	2 J	ND
Trichloroethene	ND	ND	ND	ND	ND	6 J	ND
Ethylbenzene	ND	ND	ND	17 J	ND	ND	ND
Xylene (total)	120	ND	ND	190	ND	ND	ND
TOTAL VOCs:	250 J	ND	ND	207 J	ND	8 J	ND
TOTAL TICs:	20,355 J	244 J	51 J	17,365 J	ND	ND	ND

NOTES:

ND indicates compound was not detected
ug/kg indicates micrograms per kilogram
ug/L indicates micrograms per liter
J indicates an estimated value
TICs indicates tentatively identified compounds
(1) indicates a matrix spike/matrix spike duplicate (MS/MSD) sample was collected with this sample.
RB indicates equipment rinsate blank
TB indicates trip blank

Table 2-19

SUMMARY OF SEMI-VOLATILE ORGANIC COMPOUNDS
DETECTED IN SUBSURFACE SOIL SAMPLES
AND ASSOCIATED QUALITY CONTROL SAMPLES
SITE 13 – PUBLIC WORKS PCP DIP TANK AND WASH RACK
NAVAL AMPHIBIOUS BASE – LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
JUNE 28, 1993

SAMPLE LOCATION/NUMBER	13-SB-108-01(1)	13-SB-108-02	13-SB-109-02 (Duplicate 13-SB-108-02)	13-SB-108-03	13-SB-RB-101	13-SB-RB-102
SAMPLE MATRIX	Soil	Soil	Soil	Soil	Water	Water
UNITS	ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L
SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs):						
Naphthalene	ND	85 J	ND	ND	ND	ND
2-Methylnaphthalene	ND	120 J	ND	6,300 J	ND	ND
3-Nitroaniline	ND	ND	ND	ND	ND	R
Pentachlorophenol	890,000	11,000	30,000	89,000	ND	ND
bis (2-Ethylhexyl) phthalate	ND	55 J	ND	ND	ND	ND
TOTAL SVOCs:	890,000	11,260 J	30,000	95,300 J	ND	ND
TOTAL TICs:	130,000 J	26,472 J	R	99,900 J	8 J	ND

NOTES:

ND indicates compound was not detected
ug/kg indicates micrograms per kilogram
ug/L indicates micrograms per liter
J indicates an estimated value
R indicates data rejected and unusable
TICs indicates tentatively identified compounds
(1) indicates a matrix spike/matrix spike duplicate (MS/MSD) sample was collected with this sample.
RB indicates equipment rinsate blank

Table 2-20

**SUMMARY OF TOTAL ORGANIC CARBON
DETECTED IN SUBSURFACE SOIL SAMPLES
AND ASSOCIATED QUALITY CONTROL SAMPLES
SITE 13 - PUBLIC WORKS PCP DIP TANK AND WASH RACK
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
JUNE 28, 1993**

SAMPLE LOCATION/NUMBER SAMPLE MATRIX UNITS	13-SB-108-01(1) Soil mg/kg	13-SB-108-02 Soil mg/kg	13-SB-109-02 (Duplicate 13-SB-108-02) Soil mg/kg	13-SB-108-03 Soil mg/kg	13-SB-RB-101 Water mg/L	13-SB-RB-102 Water mg/L
TOTAL ORGANIC CARBON:	12,800	1,850	2,230	3,310	ND	ND

NOTES:

ND indicates compound was not detected

mg/kg indicates milligrams per kilogram

mg/L indicates milligrams per liter

(1) indicates a matrix spike/matrix spike duplicate (MS/MSD) sample was collected with this sample.

RB indicates equipment rinsate blank

Table 2-21

SUMMARY OF VOLATILE ORGANIC COMPOUNDS
DETECTED IN GROUNDWATER SAMPLES
AND ASSOCIATED QUALITY CONTROL SAMPLES
SITE 13 – PUBLIC WORKS PCP DIP TANK AND WASH RACK
NAVAL AMPHIBIOUS BASE – LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
JULY 29, 1993

SAMPLE LOCATION/NUMBER	13GW03(1)	13GW04	13GW05	13GW06	13GW07	13GW08	13GW09 (Duplicate 13-GW06)	13GWERB	13GWFB	13GWTB
SAMPLE MATRIX	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
UNITS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
VOLATILE ORGANIC COMPOUNDS (VOCs):										
Vinyl Chloride	4 J	ND	ND	200	ND	ND	ND	ND	ND	ND
Acetone	ND	ND	ND	ND	ND	ND	ND	ND	12	ND
Carbon Disulfide	ND	ND	ND	ND	ND	2 J	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	7 J	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene (total)	5 J	ND	ND	R	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND	3 J	ND	ND
Trichloroethene	2 J	5 J	1 J	R	1 J	ND	ND	ND	ND	ND
Tetrachloroethene	2 J	7 J	ND	R	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	55	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND	2 J	2 J	ND	ND	ND
Chlorobenzene	3 J	110	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	15	ND	ND	6 J	5 J	ND	ND	ND
Xylene (total)	ND	ND	5 J	ND	ND	59	77	ND	ND	ND
TOTAL VOCs:	16 J	122 J	21 J	262 J	1 J	69 J	84 J	3 J	12	ND
TOTAL TICs:	ND	ND	19 J	ND	ND	42 J	70 J	ND	ND	ND

NOTES:

ND indicates a compound is not detected.
ug/L indicates micrograms per liter
J indicates an estimated value
R indicates data rejected and unusable
TICs indicates tentatively identified compounds
(1) indicates a matrix spike/matrix spike duplicate (MS/MSD) sample was collected with this sample.
ERB indicates equipment rinsate blank
FB indicates field blank
TB indicates trip blank

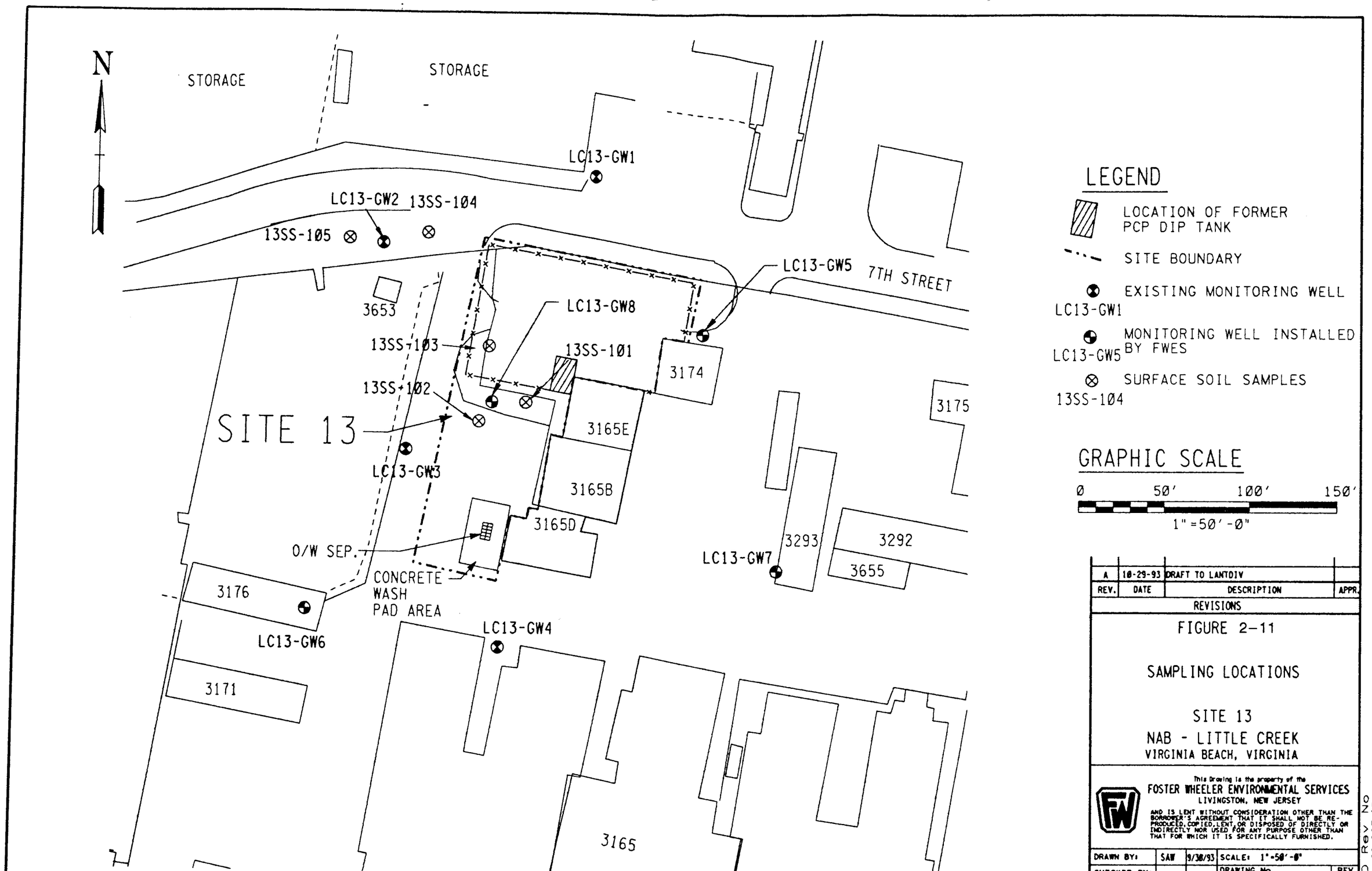
Table 2-22

SUMMARY OF SEMI-VOLATILE ORGANIC COMPOUNDS
DETECTED IN GROUNDWATER SAMPLES
AND ASSOCIATED QUALITY CONTROL SAMPLES
SITE 13 – PUBLIC WORKS PCP DIP TANK AND WASH RACK
NAVAL AMPHIBIOUS BASE – LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
JULY 29, 1993

SAMPLE LOCATION/NUMBER	13GW03(1)	13GW04	13GW05	13GW06	13GW07	13GW08	13GW09 (Duplicate 13GW06)	13GWERB	13GWFB
SAMPLE MATRIX	Water	Water	Water	Water	Water	Water	Water	Water	Water
UNITS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs):									
1,4-Dichlorobenzene	1 J	ND	ND	ND	ND	ND	NA	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	NA	ND	ND
Naphthalene	ND	ND	3 J	ND	ND	96 J	NA	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	170 J	NA	ND	ND
Acenaphthene	ND	ND	ND	1 J	ND	ND	NA	ND	ND
Dibenzofuran	ND	ND	ND	2 J	ND	ND	NA	ND	ND
Fluorene	ND	ND	ND	1 J	ND	ND	NA	ND	ND
Pentachlorophenol	32	ND	ND	20 J	ND	1,700	NA	ND	ND
TOTAL SVOCs:	33 J	ND	3 J	24 J	ND	1,966 J	NA	ND	ND
TOTAL TICs:	26 J	36 J	84 J	354 J	3 J	630 J	NA	5 J	18 J

NOTES:

ND indicates compound was not detected
NA indicates sample was not analyzed
ug/L indicates micrograms per liter
J indicates an estimated value
TICs indicates tentatively identified compounds
(1) indicates a matrix spike/matrix spike duplicate (MS/MSD) sample was collected with this sample.
ERB indicates equipment rinsate blank
FB indicates field blank



LEGEND

- LOCATION OF FORMER PCP DIP TANK
- SITE BOUNDARY
- EXISTING MONITORING WELL (LC13-GW1)
- MONITORING WELL INSTALLED BY FWES (LC13-GW5)
- SURFACE SOIL SAMPLES (13SS-104)

GRAPHIC SCALE

0 50' 100' 150'

1" = 50'-0"

REV.	DATE	DESCRIPTION	APPR.
A	10-29-93	DRAFT TO LANTDIV	

REVISIONS

FIGURE 2-11

SAMPLING LOCATIONS

SITE 13
NAB - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

DRAWN BY:	SAW	9/30/93	SCALE: 1"=50'-0"	
CHECKED BY:			DRAWING No.	REV.
APPROVED BY:			192071-4-48-1301	A

CAD Rev No 02 28-OCT-93

FWES04.REF

esd167010:71581301.dgn

3.0 SRI/FS WORK PLAN RATIONALE AND TASK PLAN

This section describes the particular tasks that will be performed at each site. The tasks are based on the objectives of the program as presented in the IP/FP dated June 24, 1994.

3.1 Site Specific Purposes and Objectives of SRI/FS

The overall objectives of the SRI/FS are to:

- Further characterize the nature and extent of contamination in site soils, groundwater, surface water, and sediments;
- Identify potential risks to the site community and on-site workers; and,
- Identify the types of remedial actions that may be required to address site issues and problems.

At Site 12, the specific SRI/FS objectives are

- Identify/determine if the subsurface soil is acting as the source of the VOC plume as detected in previous investigations by sampling and analyzing subsurface soil samples.
- Determine aquifer characteristics, such as hydraulic conductivity, through pumping and slug tests to define the mobility of contaminants and to aid in remediation design.
- Formulate a baseline risk assessment of possible threats to human health and/or the environment.

At Site 13, the specific SRI/FS objectives are:

- Identify/determine if the subsurface soil is acting as the source of the PCP and vinyl chloride plumes as detected in previous investigations by sampling and analyzing subsurface soil samples.
- Determine the extent of a range of constituents which may impact human health and/or the environment by sampling and analyzing subsurface soil and shallow groundwater.
- Formulate a baseline risk assessment of any possible threat to human health and/or the environment by sampling and analyzing appropriate site media.

3.2 Task Descriptions

3.2.1 Task 1 - Site Visit and Background Review

The initial task of this SRI/FS is to collect site-specific background information, review existing information and perform a site reconnaissance survey. FWES has participated in a site visit at NAB Little Creek. The objectives are to assess existing conditions, and the adequacy and usefulness of the descriptions of past and present site conditions.

3.2.2 Task 2 - Preparation of Project Plans

The Project Plans to be generated under this CTO consist of: the Work Plan (WP); the Field Sampling Plan (FSP); and an addendum to the CTO-0042 Health and Safety Plan (HASP). The FSP and HASP addendum accompany this Work Plan under separate cover.

For the field work that is to be performed at Sites 12 and 13, the project plans shall be prepared to specifically document the efforts needed to obtain information necessary to conclude field work and make final determination of the necessary remedial actions at these sites. The plans document the procedures to be used, the resources needed, and the rationale for the tasks to be undertaken. These documents insure that all necessary planning and review has been done before field work begins. Due to the nature of these plans, some repetition is required between the plans. However, this does not reflect a duplication of efforts throughout the program.

3.2.2.1 Work Plan

The Work Plan pulls all the plans together. The Work Plan provides for the efficient scheduling of resources such as manpower, equipment, and laboratory services. The Work Plan includes:

- Introduction. This section briefly describes the facility and the objectives of the SRI/FS. A context for the information to follow and a basis for evaluating the plan is presented.
- Investigative Procedures. This is discussed in greater detail in the SAP. The specific standard operating procedures (SOPs) and field quality control procedures to be used are provided.
- Personnel Requirements. Persons responsible for overseeing the field activities and their specific responsibilities are presented in Section 5.0.
- Equipment Requirements. This is discussed in greater detail in the SAP and HASP. Safety and sampling equipment and supplies are identified.
- Contractual Services. Contractual services needed to accomplish the field work are provided in Section 4.4 of this plan.

The objective of the Work Plan is to document the decisions and evaluations made during the review and planning process and to present the scheme of execution for the SRI/FS. The Work Plan also assigns responsibilities and sets project schedules.

This Work Plan addresses issues specific to Sites 12, and 13 only. Although the Work Plan is a detailed description of on-site activities, the supporting plans (the Sampling and Analysis Plan, and Health and Safety Plan) will be referred to for specific details.

3.2.2.2 Field Sampling Plan

This plan discusses the sequence for conducting the field activities, the general locations of each sample, identification of the analytical laboratory, analytical requirements, sample handling procedures, and schedule.

The Field Sampling Plan for this SRI/FS presents a comprehensive approach for conducting the required field investigation for Sites 12, and 13 at NAB Little Creek. This plan is to be used in conjunction with the Quality Assurance Project Plan (QAPP) found in the Sampling and Analysis Plan (SAP) for CTO-0042. The QAPP

specifies the procedures and protocols to be followed (both in the field and in the laboratory) to assure data quality. Together, the FSP and QAPP provide guidance to all field work. The FSP also details the sampling and data-gathering methods to be used. The purpose of the FSP and QAPP is to ensure that sampling and data collection activities will be comparable to and compatible with the previous data collection activities performed at the site. The FSP also provides a mechanism for planning and approving field activities before, during and after implementation of the SRI/FS.

3.2.2.3 Health and Safety Plan Addendum

The CTO-0042 HASP addendum for work under CTO-0247 addresses and governs activity-specific precautions for the prevention of accidents and injury and establishes safety protocols applicable throughout the field investigation for CTO-0247. The HASP addendum provides a list of emergency telephone numbers, directions to the nearest hospital, and ingress and egress areas to and from each site to the nearest emergency center.

3.2.3 Task 3 - Subcontract Procurement

Upon approval and finalization of all project plans, Baker will finalize applicable scopes of work and procure subcontractors, such as drillers and surveyors, as necessary. This task includes awarding subcontracts, as necessary, notifying the subcontractors of potential start dates, and coordination between Baker/FWES, the subcontractors, LANTDIV, and NAB Little Creek.

Selection and award of a contract to an analytical laboratory will follow the requirements of NEESA 20.2-047B.

3.2.4 Task 4 - Field Investigations

This task of Field Investigations reflects the provisions of the Implementation Plan/ Fee Proposal for CTO-0247, which are, in turn, based on the findings of the RI. The following descriptions of the field investigations present the activities common to all sites as well as the activities specific to individual sites. The RI field activities conducted in the summer of 1993 confirmed the existence of contamination at Sites 12 and 13. The purpose of the SRI/FS investigation is to determine the extent and source of this contamination.

3.2.4.1 Activities Common to Sites 12 and 13

Activities common to Sites 12 and 13 will be performed sequentially based on convenience and suitability. This is done to avoid re-mobilization to the site and idle operations time. Activities that are common to the sites are:

- Field Mobilization
- Air Monitoring
- Geoprobe Field Screening
- General Sampling Approach (Soil and Groundwater)
- Decontamination Procedures
- Materials Disposal

These activities are described below.

Field Mobilization Field mobilization activities will commence after the approval of Final Project Plans. Field mobilization involves coordinating with appropriate LANTDIV and Activity staff to:

- Assure that access to the site and other areas to be considered for investigation under the present scope are cleared by the Navy, prior to entering the site;
- Procure necessary contractors to perform site investigation activities;
- Ship personnel protection equipment, air monitoring devices, sampling equipment, and related decontamination apparatus;
- Coordinate with the analytical laboratory on sampling schedules, sampling bottle acquisition, chain-of-custody records, and so forth; and
- Establish local facilities for administration and logistics, and for decontamination; identify locations on-site for storing equipment and supplies, and disposal of materials.

These activities will be executed under the direction of FWES with close coordination with LANTDIV and Activity staff. No field trailers will be mobilized to the site. The Team will seek LANTDIV or NAB Little Creek assistance in finding space for field equipment storage and a local office.

Air Monitoring Procedures for on-site air monitoring for health and safety purposes are considered common for all sites. Air monitoring will be performed during field sampling activities using a HNu meter with a 10.2 eV probe. Background ambient air concentrations will be recorded every day prior to the commencement of field activities. Respiratory and other personnel protective equipment requirements, as determined by air monitoring will be selected for on-site activities in accordance with the HASP.

Geoprobe Field Screening Geoprobe field screening activities are common to both sites and will be used to increase accuracy during field sampling efforts by confirming the selected locations for sampling and monitoring well installation. Geoprobe field screening will also help to avoid potential re-mobilization efforts.

General Sampling Approach (Soil and Groundwater Sampling) Procedures for collecting samples of soil, groundwater, surface water, and sediment will be consistent throughout for all sites and are explained in detail in the FSP. Sample packing and shipping procedures, such as the use of sample labels, chain-of-custody form, custody seals, and related documents will be performed together. Laboratory QC samples will be selected according to the total number of samples for the day, the matrices sampled and the number of samples for each matrix, and the analytical requirements for the individual site.

Soil Sampling:

Prior to collecting soil samples at each location, surface materials (such as grass, debris, etc.) will be removed. Sample locations encountering auger refusal will be rejected and alternative locations nearby will be sampled. All sample composites will be collected in a clean, stainless steel pan, mixed thoroughly and placed in the appropriate sample jars. Any soil samples to be analyzed for Volatile Organic Compounds (VOCs) will not be mixed.

Groundwater Sampling:

Groundwater sampling will consist of sampling the previously installed wells plus supplemental wells installed during this SRI/FS. General procedures common to these sites during groundwater sampling activities will be followed consistently. These methods are described below.

Initially, wells will be vented by unlocking the well caps. Ambient air quality readings using an HNu meter will be recorded prior to well purging and sampling. If sustained concentrations of greater than 1 ppm above background are recorded on the HNu, the Level of Personal Protective Equipment will be upgraded to Level C prior to sampling the well.

Wells will be purged to 3 times the volume prior to sampling. Wells may be bailed sequentially due to potential insufficient well recovery and field time constraints. Groundwater samples will be collected using a disposable sampling bailer for each well. A teflon coated steel wire will be used to retrieve the sample bailer from each well. The wire will be discarded appropriately after sampling the each well. Bailers will be dedicated for each well to avoid potential cross contamination between sites.

Field observations, such as initial and final water levels and recovery time, will be recorded in the field log book.

Details on procedures for well sampling and equipment decontamination are provided in the FSP.

Decontamination Procedures Field decontamination procedures are classified as:

- Equipment decontamination
- Personnel decontamination

Equipment decontamination procedures will require decontamination of hand or mechanical augers, stainless steel pans used for compositing samples, trowels, sampling spoons and well bailers. Many of these items will be used only once and then discarded into drums used for waste disposal.

Personnel decontamination procedures require establishing a method for the removal of contamination or contaminated protective equipment from the field personnel. This will be performed in accordance with the HASP.

Materials Disposal Decontamination solutions and purged well water will be collected in 5 gallon buckets and placed in a holding area. A holding area will be identified during mobilization activities. This area will be selected in coordination with LANTDIV and NAB Little Creek personnel, and marked.

Excess soil materials, resulting from soil sampling activities, will be backfilled into the auger hole.

Groundwater Collected during the 72 hour pump test at Site 12 will be treated using a mobile air stripper and carbon filter system, operated by a subcontracting firm. The units will be installed in such a manner that water samples may be obtained before and after the stripper/carbon filter system to evaluate its efficiency. Treated water will be discharged into an HRSD sanitary manhole near Site 12. NAB Little Creek personnel will be responsible for obtaining the necessary permits/approvals for discharging treated water into the HRSD treatment system.

3.2.4.2 Rationale and Description of Site Specific Activities

The site-specific sampling activities will be conducted as outlined in the Fee Proposal dated June 24, 1984. Detailed sampling and analysis procedures are outlined in the FSP.

Site 12 - Exchange Laundry Waste Disposal Area

- Two soil borings will be installed. Subsurface soil samples will be collected from these borings to determine if the soil is a source for the VOC plume and TAL Metals detected in the canal during the RI/FS.

- Five additional soil borings will be installed to the depth of the clay confining layer. Shelby tube samples of the confining clay layer will be collected to determine vertical hydraulic conductivity and for grain size analysis. Subsurface soil samples and samples of the clay confining layer will also be collected for full TCL and TCL VOC analysis, respectively. Both types of data will be used in the determination of the confining-layer/aquifer boundary and the extent and rate of contaminant migration.

- Five monitoring wells will be installed in the five borings. These wells will be screened at a deeper interval than the existing wells. One of these wells will serve as a 4-inch recovery well.

- The five new wells and the four existing wells at the site will be sampled. This data will also be used to determine the contaminant source and its extent.

- A 72-hour pump test will be conducted on the 4-inch well. Four slug tests will be conducted using one of the new deeper wells and three of the existing shallow wells. These tests will be utilized to determine aquifer characteristics such as hydraulic conductivity.

- Four surface water and sediment samples will be collected from the adjacent canal. The samples will be taken upgradient (towards Lake Bradford) from those taken in the RI/FS in order to determine the potential extent of contaminant migration.

- All borings, monitoring wells, surface soil and sediment sample locations shall be surveyed and permanently marked with a concrete block or other suitable marker so that sampling locations may be relocated in the future.

Site 13 - Public Works PCP Dip Tank

- Geoprobe sampling will be conducted as a screening technique to the west and southwest of the site to help identify well placement locations in order to characterize the potential extent of the vinyl chloride plume, if any.

- Three new monitoring wells will be installed to the same depths as those installed in the previous round RI/FS. A soil sample will be collected from the initial well boring and analyzed for TCL VOCs and SVOCs.

- Groundwater samples will be collected from the new and existing wells. Three samples will be analyzed for full TCL (including filtered and unfiltered TAL) and the other 8 shall be analyzed for TCL VOCs and SVOCs.

- Four slug tests will be conducted at the site.

- Eight soil samples will be collected form the source area of PCP (dip tank and drying rack area). The samples will be collected from a 2-4 foot depth and in a grid with 4 samples in the outer circle and 4 samples in the inner circle. Three of these samples will be analyzed for full TCL and the other 5 for TCL VOCs and SVOCs.

- All soil sample, geoprobe, and well locations will be surveyed.

3.2.5 Task 5 - Data Management, Analysis and Validation

Data review procedures specified under NEESA 20.2-047B will be followed to ensure that raw data are not altered and that an audit trail is developed for those data which require reduction. These activities will require a rigorous data control program that will ensure that data quality is maintained throughout data reduction activities. This section describes data management, analysis, and reduction procedures; project specific data collection efforts are discussed in detail in the QAPP.

Data reduction activities consist primarily of entering validated data onto computerized spreadsheet or database software, tabulating analytical results for presentation, performing statistical analyses, and presenting the results of these analyses. Review of the analytical data will be performed primarily as a part of the Preliminary RA and the FS. However, the SRI will contain mapping representation of contaminant distribution, if appropriate, as well as tabulations of data. This task will be performed for Sites 12 and 13.

The SRI/FS will generate extensive information and data for which quality and consistency must be well documented. This information will be used to support remedy selection. Therefore, field sampling and analytical procedures for the acquisition and compilation of field and laboratory data are subject to data management procedures. The raw data obtained from the laboratory will be validated by an independent data validation subcontractor, prior to its use in the Risk Assessment report.

During site characterization and sampling, consistent documentation and accurate record keeping will be used. As described in the QAPP, aspects of data management for sampling activities during site characterization include:

3.2.5.1 Quality Assurance/Quality Control (QA/QC)

All field investigations and associated tasks involving data collection will adhere to the QA/QC procedures stated in the QAPP. The QAPP for work at NABLC can be found in the SAP for CTO-0042. This document will assist in guiding field staff on providing records of responsibility, adherence to prescribed protocols, nonconformity events, corrective measures, and data deficiencies.

3.2.5.2 Data Security System

Measures will be taken to maintain chain-of-custody records and prevent uncontrolled access; this will aid in protecting field records, and guarding against accidental loss, damage or alteration of field records.

3.2.5.3 Field Logs

Data collected will be recorded in field logs that will form the basic reference sources for the site studies. Field logs will be used for recording data directly and legibly with all entries signed and dated. Changes made to original notes will not obliterate the original information and will be signed and dated.

In addition, a record of sample shipment, receipt of analytical results for QA/QC review, completion of QA/QC review and evaluation of QA/QC packages will be maintained. Details on the acceptable QA/QC package are defined in QAPP found in the CTO-0042 SAP. Sample results will be maintained in a standardized form to promote easy reporting of data in the SRI report.

3.2.6 Task 6 - Baseline Risk Assessment

An updated risk assessment, incorporating SRI data into the 1993 RI/FS Baseline Risk Assessment will be conducted for Sites 12 and 13 to assess the potential human health and environmental risks currently posed by the sites based on no additional remedial action. This will include, at a minimum, hazard identification, toxicity assessment, exposure assessment and risk characterization. Also, the environmental evaluation will include identification of critical habitats and endangered species as well as proximity of aquatic and wetland systems to the sites.

Federal and State Applicable And Relevant or Appropriate Requirements (ARARs) and "To Be Considered (TBC)" information for each site will be compiled. Rationale for their selection will be provided.

The risk assessment will be completed in accordance with the following guidance: EPA's "Risk Assessment Guidance for Superfund," dated December 1989; "Exposure Factors Handbook," dated 1989; "Setting Exposure Routes And Contaminants Of Concern By Risk-Based Screening," dated 1993; and EPA's "Superfund Exposure Assessment Manual," dated December 1989.

The results of the risk assessments for Sites 12 and 13 will be documented in the SRI Report.

3.2.7 Task 7 - SRI Report Preparation

The objective of the SRI Report will be to present the results, conclusions, and recommendations of the SRI. The report will be submitted after the completion of SRI activities for Sites 12 and 13.

The results of the remedial investigation and the risk assessment will be compiled into a Remedial Investigation Report. This report will address Sites 12 and 13 and include the following items:

- History and background of the sites;
- Features and environmental settings of each site;
- Condensation of all previous information at each site;
- Site investigations;
- Geology and hydrogeology of the sites;
- Sampling and analytical methods used;
- QA/QC data discussion;
- Presentation and evaluation of the analytical data for each site to relevant standards and criteria;
- A discussion of the nature and extent of contamination at each site;
- The results of the risk assessment for each site;
- Site characterization;
- FS analysis; and,
- Recommendations for future work.

The SRI report will include, as appropriate, site maps with sampling location, boring logs, cross sections, and raw and validated analytical data. The risk assessment for the SRI report generally will provide a discussion of whether site contamination has the potential to, of is presently affecting the environment or public health. More specifically, the risk assessment will provide a contaminant evaluation, develop exposure scenarios, conduct a toxicity assessment and produce and compile a risk characterization.

3.2.8 Task 8 - Feasibility Study Report

A separate, detailed Feasibility Study (FS) Report will be prepared based on information obtained from the remedial investigation and other site investigations for Sites 12 and 13. Remedial action technologies will be listed with a discussion of advantages and disadvantages for potential site use taking into account media effectiveness. The FS will be conducted following EPA guidance (EPA/540/G-89/004). It is unknown at this time whether other field investigation work, treatability studies or pilot-scale tests, in addition to that conducted in the CTO will be necessary in the future. For any additional studies, recommendations will be provided as part of the SRI Report.

FWES, under Bakers's supervision, will develop a listing of general response actions for each site that potentially will remediate or control contaminated media (i.e., soil, surface water, groundwater, sediments) as deemed necessary in the SRI to provide adequate protection of human health and the environment. Based on existing information, and information obtained from the SRI, preliminary site-specific remedial objectives to protect human health and the environment will be developed. The preliminary objectives will specify the contaminants and media of concern, the exposure routes and receptors, and an acceptable contaminant level or range of levels for each exposure route (i.e., preliminary remediation goals). The preliminary remediation goals will be based on readily available information, such as reference doses of chemical specific ARARs, such as MCLs, and the results of the preliminary risk assessment. From this a preliminary list of remedial technologies will be provided, developed into preliminary remedial action alternatives, with an initial screening to narrow the list of potential remedial action alternatives.

3.2.9 Task 9 - Project Management

Task 9, common to both sites, includes project management and administrative activities, such as day-to-day technical management of this CTO, project-level technical oversight, budget and schedule review and tracking, preparation and review of invoices, manpower resources planning and allocation, and coordination with LANTDIV and NAB Little Creek. QA/QC efforts will focus on data quality; documentation of field activities; and document clarity, completeness, and adherence to the SOW (in addition to the general QAPP requirements). In addition, monthly progress reports will be prepared.

Activities at NAB Little Creek will be conducted with technical support provided by FWES under Baker's general supervision. In all such efforts where a TEAM subcontractor is providing technical support, a Baker Activity Coordinator will be the primary point of contact for both LANTDIV and the subcontractor's project team.

4.0 PROJECT MANAGEMENT AND STAFFING

All SRI/FAUST activities at NAB Little Creek will be conducted with technical support provided by FWES, and specialty contractors for Navy CLEAN, under FWES supervision. In all such efforts where a contractor is providing technical support, a Baker Activity Coordinator will be the primary point of contact between LANTDIV and the project Team. The Baker Activity Coordinator will have the following primary responsibilities: (1) monitoring technical, budgetary, and schedule performance; (2) orchestrating Baker's overall QA efforts -- audits, document reviews, and cost/schedule reviews with Baker Program Management and senior technical staff; and (3) maintaining close communication with the LANTDIV NTR, Mr. Scott Park, and with FWES. He will also serve as Baker's primary focal point for all CLEAN work that is conducted at NAB Little Creek.

Baker's Project Manager for this SRI/FAUST will be Mr. Thomas Fuller. He will report directly to Mr. John W. Mentz, Baker's Navy CLEAN Program Manager. Mr. John W. Mentz will be responsible for overall QA/QC.

The FWES Project Manager (PM) will be Mr. Nitin Apte and he will lead and direct the technical and field activities. Mr. Apte will be responsible for monitoring the costs, performance schedules, and budget for this CTO and to ensure that all deliverables are properly submitted. Mr. Apte will be supported by several FWES staff engineers, geologists, environmental scientists, draftsmen, and administrative assistants, as needed.

4.1 Project Management

Overall project management activities for Team will be coordinated between Baker and FWES. Day-to-day management of administrative activities includes:

- Project management and administrative activities,
- Project-level technical oversight,
- Budget/schedule review and tracking,
- Preparation and review of invoices,
- Manpower resources planning and allocation, and
- Coordination with LANTDIV Code 18 staff.

QA/QC efforts will focus on data quality, documentation of field activities, document/deliverable clarity, overall completeness, and adherence to the Statement of Work (SOW) in addition to the general QAPP requirements.

4.2 Staffing

This section describes the project Team organization, responsibilities of key personnel, and personnel training to be included in the SRI/FAUST for NAB Little Creek Sites 12 and 13.

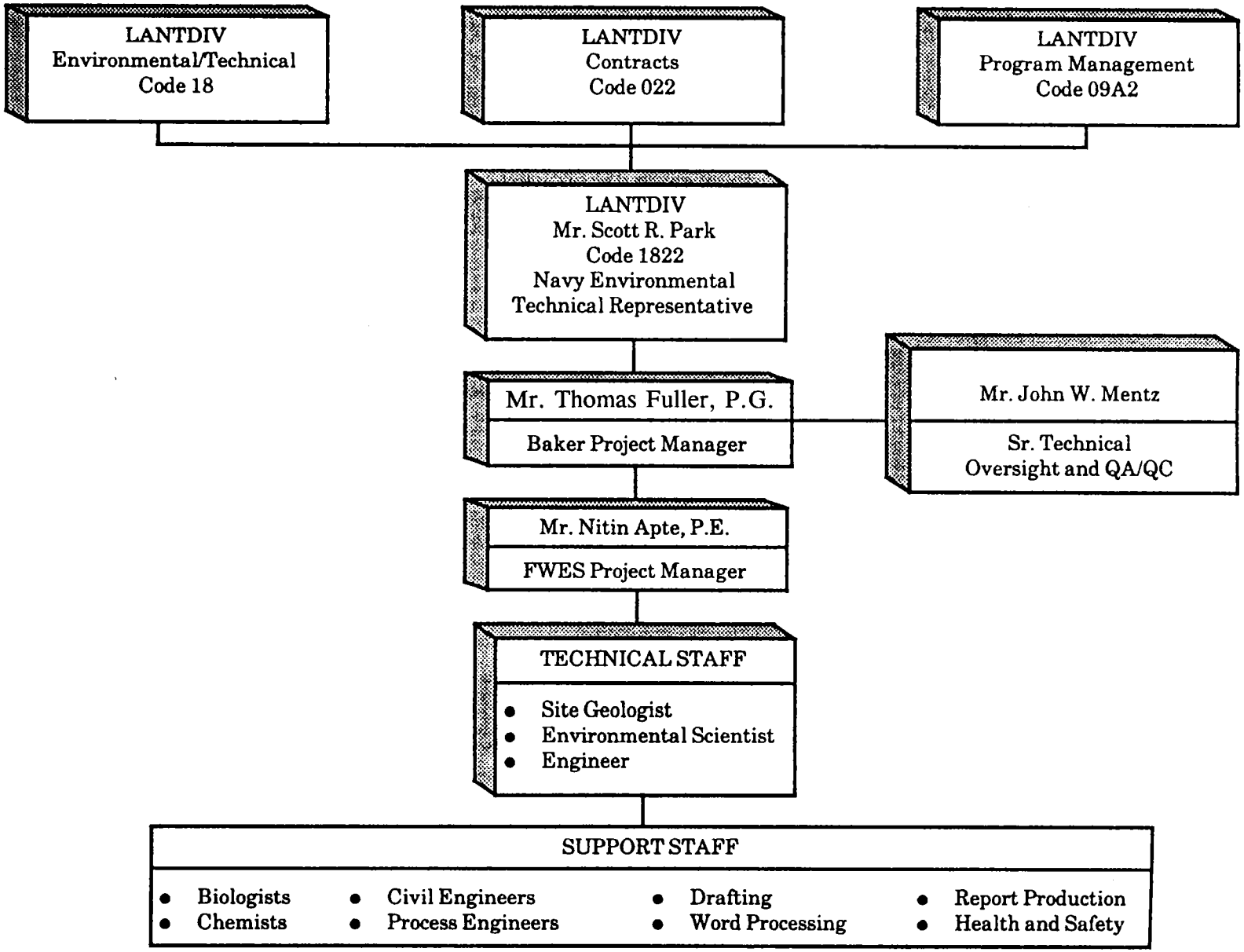
4.2.1 Organization

The proposed organization structure for this assignment is shown in **Figure 4-1**. This figure exhibits the lines of authorities, and defines the relationships among project key personnel. Details of responsibilities for project personnel are provided in Section 4.2.2.

4.2.2 Personnel

Specific responsibilities of key project personnel assigned to Little Creek are summarized below.

Figure 4–1
PROJECT ORGANIZATION



4.2.2.1 Project Manager

The Project Manager is responsible for ensuring that all activities are conducted in accordance with the Work Plan. The Project Manager will monitor the budget and schedule, and ensure the availability of necessary personnel, equipment, subcontractors, and services. He will participate in development of the SRI/FAUST effort, evaluation of findings, development of conclusions and recommendations, and report generation, and will have primary responsibility for the technical quality of all products. Foster Wheeler's Project Manager for this SRI/FAUST is Mr. Nitin Apte, P.E..

4.2.2.2 Field Operations Manager

The Field Operations Manager is responsible for coordination of all field activities. Reporting to the Project Manager, he will ensure that field activities are conducted in accordance with the Work Plan, the Quality Assurance Plan, the Health and Safety Plan, and the Field Sampling Plan. The Field Operations Manager may also serve as a supervisory geologist. Foster Wheeler's Field Operations Manager for this SRI/FAUST is Mr. Morgan Evans.

4.2.2.3 Supervisory Geologist

The Supervisory Geologist will be responsible for supervision of drilling and/or sampling activities, including installation of wells, piezometers and borings, soil/formation sampling, logging, well development, and groundwater sampling. In addition, he will be responsible for monitoring exposure levels to volatile organic contaminants throughout drilling and sampling activities. The supervisory geologist will also be responsible for sample handling and shipment to the analytical laboratory. Foster Wheeler's supervisory geologist for this SRI/FAUST will be Mr. Paul Scian.

4.2.2.4 Feasibility Study (FAUST) Engineer

The FAUST Engineer is responsible for coordination of all remedial action evaluation and planning activities. Reporting to the Project Manager, she will ensure that FAUST activities are conducted in accordance with the SOW for CTO-0247, and USEPA guidance on preparation of FAUST reports. Foster Wheeler's Feasibility Study Engineer for this FAUST will be Ms. Ari Selvakumar.

4.2.2.5 Site Health and Safety Officer

The Site Health and Safety Officer has prepared the Health and Safety Plan addendum tailored to the specific needs of this investigation. In consultation with the Project Manager and Field Operations Manager, he will ensure an adequate level of personal protection from anticipated hazards for all personnel during field investigations. He will coordinate with the Corporate Health and Safety Manager in these matters. The SHSO for this project will be Mr. Dave Newman.

4.2.2.6 Quality Assurance Specialist

The Quality Assurance Specialist (QAS) is responsible for ensuring that all QA objectives for the project are met. Mr. Henry Njũgũna, an Environmental Scientist, will serve as the Project QAS.

4.3 Quality Assurance and Data Management

The site-specific quality assurance requirements will be performed in accordance with the Quality Assurance Project Plan (QAPP) for the project. The QAPP provides guidance on the following subjects:

- QA and personnel responsibility; and
- QA objectives for measurement of data.

Data management aspects of the program pertain to controlling and filing documents. FWES has developed a program filing system guideline to ensure that the integrity of the documents is safeguarded. This guideline will be implemented to control and file all documents associated with the project. The system includes document receipt control procedures, a file review and inspection system, and security measures.

4.4 Project Schedule

The Project Schedule in **Figure 4-2** shows the tasks and activities for the project wherein key milestones have been identified. This schedule assumes Task activities commenced on February 1, 1995. The schedule for the field investigation is dependent on the following assumptions:

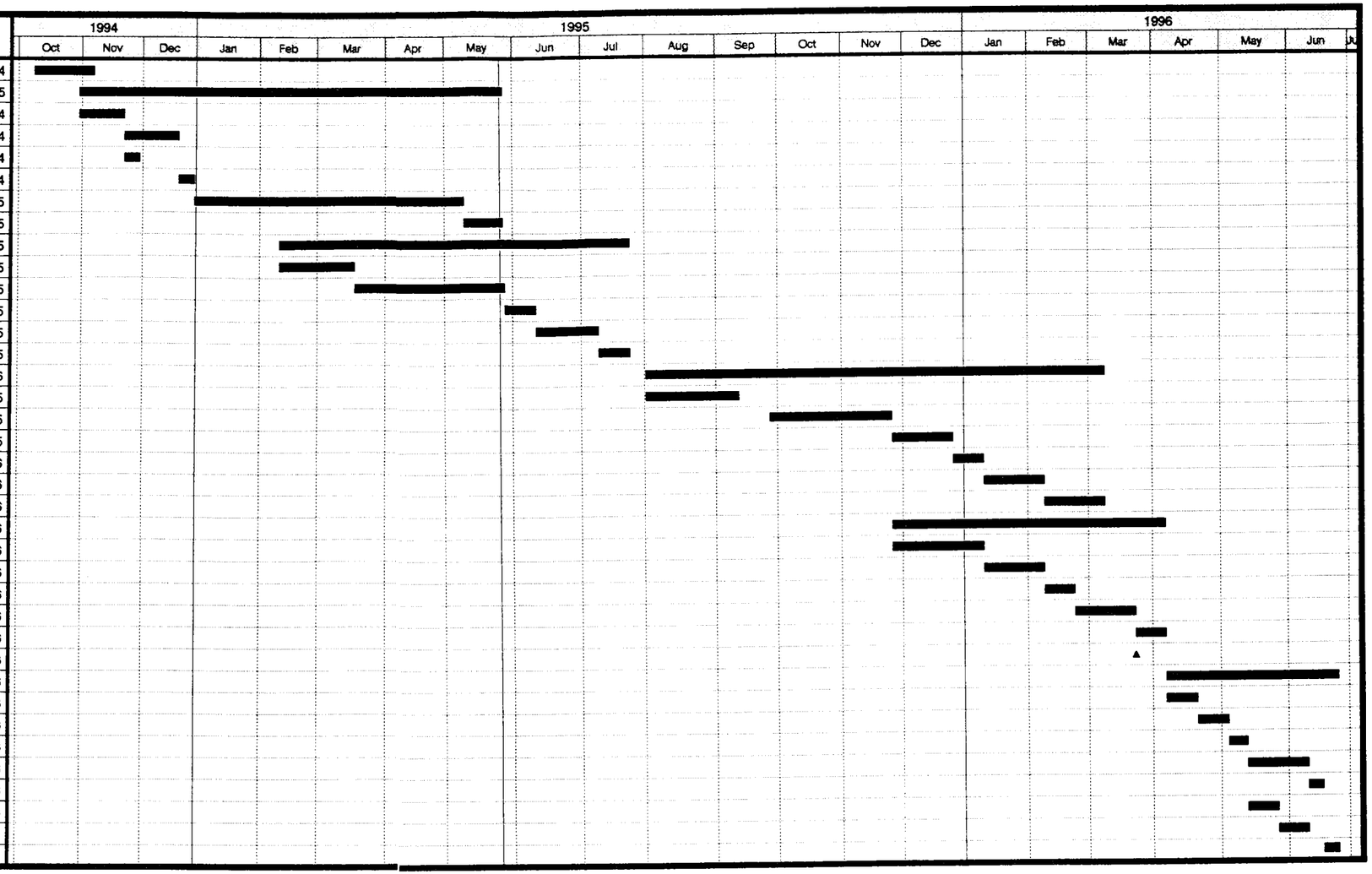
- Access to the sites affected by the SRI/FAUST field activities will be approximately 10 calendar days after Plan approval.
- The proposed schedule assumes unlimited access, 5 days a week, to Sites 12 and 13 for field operations. Every effort will be made to work within the access limitations present at Sites 12 and 13.
- After final sample delivery, the laboratory turnaround time shall be about 28 calendar days for the delivery of complete analytical results.
- The proposed schedule does not anticipate downtime during field operations due to inclement weather.
- The proposed schedule does not anticipate downtime resulting from difficulties encountered during subsurface drilling operations.
- The proposed schedule does not anticipate downtime resulting from equipment malfunction during drilling or pump tests.
- FWES personnel will attempt to fill hand-auger holes with the cuttings; however, excess cuttings from auguring activities will be secured on site, after waste characterization sampling, for disposal by the Activity.
- Decontamination water will be placed in 5-gallon buckets which will be placed, after waste characterization sampling, in a central staging area at each site for disposal by the Activity.

The schedule also assumes that the health and safety personnel protective requirements are Level D with contingency to upgrade to Level C protection.

Figure 4–2

SITE MANAGEMENT SCHEDULE: Sites 12 and 13
NAB LITTLE CREEK, VIRGINIA BEACH, VIRGINIA.

Task Name	Dur Wks	Start Date	End Date
FINALIZE RI REPORT	4	Oct 10, 1994	Nov 7, 1994
SITE MANAGEMENT PLAN	28	Oct 31, 1994	May 26, 1995
Draft SMP	3	Oct 31, 1994	Nov 21, 1994
LANTDIV/NABLC Review	3. 5	Nov 21, 1994	Dec 16, 1994
Site Visit	1	Nov 21, 1994	Nov 30, 1994
Draft Final SMP	1	Dec 16, 1994	Dec 23, 1994
RAB Review of SMP	18	Dec 23, 1994	May 9, 1995
Final SMP	2. 5	May 9, 1995	May 26, 1995
PROJECT PLANS	23	Feb 9, 1995	Jul 25, 1995
Draft Project Plan	5	Feb 9, 1995	Mar 17, 1995
LANTDIV/NABLC Review	10	Mar 17, 1995	May 26, 1995
Draft Final Project Plans	2	May 26, 1995	Jun 12, 1995
State/EPA Review	4	Jun 12, 1995	Jul 11, 1995
Final Project Plans	2	Jul 11, 1995	Jul 25, 1995
SUPPLEMENTAL RI	30	Aug 1, 1995	Mar 8, 1996
Field Work	6	Aug 1, 1995	Sep 13, 1995
Draft Supplemental RI Report	8	Sep 27, 1995	Nov 27, 1995
LANTDIV/ NABLC Review	4	Nov 27, 1995	Dec 26, 1995
Draft Final Supplemental RI	2	Dec 26, 1995	Jan 10, 1996
State/ EPA Review	4	Jan 10, 1996	Feb 8, 1996
Final Supplemental RI	4	Feb 8, 1996	Mar 8, 1996
DETAILED FEASIBILITY STUDY	18	Nov 27, 1995	Apr 5, 1996
Draft FS Report	6	Nov 27, 1995	Jan 10, 1996
LANTDIV/NABLC Review	4	Jan 10, 1996	Feb 8, 1996
Draft Final FS Report	2	Feb 8, 1996	Feb 23, 1996
State/EPA Review	4	Feb 23, 1996	Mar 22, 1996
Final FS Report	2	Mar 22, 1996	Apr 5, 1996
RAB MEETING	0	Mar 22, 1996	Mar 22, 1996
DECISION DOCUMENTS	11. 2	Apr 5, 1996	Jun 25, 1996
Draft PRAP	2	Apr 5, 1996	Apr 19, 1996
LANTDIV/NABLC Review	2	Apr 19, 1996	May 3, 1996
Draft Final PRAP	1. 2	May 3, 1996	May 13, 1996
Public Comments	4	May 13, 1996	Jun 11, 1996
Final PRAP & Resp. Summary	1	Jun 11, 1996	Jun 18, 1996
Draft ROD	2	May 13, 1996	May 28, 1996
LANTDIV/NABLC Review	2	May 28, 1996	Jun 11, 1996
Final ROD	1	Jun 18, 1996	Jun 25, 1996



NOTE:
As of May 25, 1995

Actual

Milestone

ADDENDUM TO HEALTH AND SAFETY PLAN (HASP)

Site 12 - Exchange Laundry Waste Disposal Area
Site 13 - Public Works PCP Dip-Tank and Wash Rack

ADDENDUM TO HEALTH AND SAFETY PLAN (HASP)

Site 12 - Exchange Laundry Waste Disposal Area
Site 13 - Public Works PCP Dip-Tank and Wash Rack

The following is an addendum to the Health and Safety Plan (HASP) issued by FWES in April 1993 as part of the CTO-0042 RI/FS project conducted at the Naval Amphibious Base - Little Creek. The HASP has already outlined the relevant health and safety procedures in detail for sampling at Site 12 and Site 13. The information detailed in this addendum is specific for the sampling activities proposed for this SRI/FS at Site 12. The information is updated to reflect anticipated conditions in August, 1995, where appropriate.

A copy of the original HASP will be available on-site throughout the duration of the field activities.

ATTACHMENT NO. 1
SITE NO. 12 & 13
CONTRACT: N62470-89-D-4814
TASK ORDER: 0247

1.0 SITE DESCRIPTION

Proposed Mobilization Date: 08/01/95 Location: Naval Amphibious Base, Little Creek, VA

Background:

Site 12 - During the period from 1973 to 1978, perchlorethylene (PCE), soaps, sizing, and dyes were disposed of in the storm drain on the site.

Site 13 - During the period from the early 1960's to 1974, pentachlorophenol (PCP) was used at the site.

Hazards:

(1) Potentially Contaminated Soil
(2) Potentially Contaminated Sediment
(3) Potentially Contaminated Surface Water
(4) Potentially Contaminated Groundwater
(5) Physical Hazards associated with work in the field (i.e., tripping or falling).
(6) Physical Hazards associated with work involving drilling rigs (i.e. moving machinery).
(7) Physical Hazards associated with work taking place in bodies of water (i.e., slipping, strong current).

Former or Current Use, and Area Affected:

Site 12 - Exchange laundry waste storage area. Approximately 1,300 gallons of soap, sizing, sludges discharged into storm drain and canal. Area affected to be determined. Active base commissary located adjacent to drainage canal.

Site 13 - PCP Dip Tank contained approximately 300 to 400 gallons of PCP.

Surrounding Population:

Densely populated, military and commercial establishments adjacent and on-site.

Topography:

Generally level with no obstructions.

Anticipated Weather Conditions:

60° - 90°F

2.0 SITE OBJECTIVES

* (See Section 3.0 of Work Plan/Sampling and Analysis Plan)

The objective of the entry into the contaminated area is to characterize the extent of groundwater, surface soil, subsurface soil, surface water, and sediment contamination (if any) at Sites 12 & 13. The exact tasks to be performed are identified in more detail as provided in the WP/SAP. Proposed investigative activities consist of subsurface soil, groundwater, and sediment sampling and surveying. Aquifer testing will also be conducted. A more detailed explanation of the sampling is provided in Section 3.0 of the WP/SAP.

3.0 SITE ORGANIZATION AND COORDINATION

* (See Section 5.0 of WP/SAP)

The following personnel are designated to carry out the stated job functions for both on and off-site activities. (Note: One person may carry out more than one job function.)

BAKER ACTIVITY COORDINATOR Tom Fuller (412) 269-6000
PROJECT MANAGER Nitin Apte (201) 535-2359
PROJECT HEALTH AND SAFETY OFFICER Gerard Sudell (201) 535-2528
FIELD TEAM LEADER Morgan Evans
SITE HEALTH AND SAFETY OFFICER Dave Newman
FIELD TEAM MEMBERS Morgan Evans, Michael Schmidt, Dennis Place, Paul Scian, Dave Newman

NAVFACENGCOM REPRESENTATIVES

LANTDIV: Scott Park, NTR (804)322-4788

ACTIVITY/BASE REPRESENTATIVES

Activity Coordinator: Rich Stryker (804)363-4571
On-Scene Coordinator: Willie Barnes (804)464-8566
Hazardous Material Team: Tom Baker (804)464-7363

FEDERAL/STATE/LOCAL REPRESENTATIVES

Virginia State Water Control Board: Aron Tisdale (804) 552-1840
Steve Wright (804) 552-1840

Virginia Department of Environmental Quality: Dinesh Vithani (804) 762-4204

United States Environmental Protection Agency: Robert Stroud (215) 597-8183

CONTRACTOR(S)

Surveyor: to be determined by Baker

All personnel arriving or departing the site will be documented in the field log. All activities on site must be cleared through the Field Team Leader (FTL). The FTL will direct all on-site personnel; however the Baker Activity Coordinator is ultimately responsible for activities of all personnel not affiliated with Foster Wheeler or the Navy.

4.0 OSHA TRAINING HISTORY OF PROJECT PERSONNEL

(See Section 1.4 of HASP)

Personnel	Anticipated Site Activities	Training Status	Current
Nitin Apte	• Project Manager	• 40-hr. training completed: • 8-hr. refresher completed: • Supervisory training: • Medical surveillance participant:	yes yes yes
Morgan Evans	• Field Team Leader	• 40-hr. training completed: • Supervisory training: • 8-hr. refresher completed: • Medical surveillance participant:	yes yes yes yes
Dave Newman	• Site Health and Safety Officer	• 40-hr. training completed: • Supervisory training: • 8-hr. refresher completed: • Medical surveillance participant:	yes yes yes yes
Dennis Place	• Field Team Member	• 40-hr. training completed: • Supervisory training: • 8-hr. refresher completed: • Medical surveillance participant:	yes yes yes yes
Paul Scian	• Field Team Member	• 40-hr. training completed: • Supervisory training: • 8-hr. refresher completed: • Medical surveillance participant:	yes yes yes yes
Michael Schmidt	• Field Team Member	• 40-hr. training completed: • Supervisory training: • 8-hr. refresher completed: • Medical surveillance participant:	yes yes yes yes

5.0 EMERGENCY PHONE NUMBERS

* (See Section 8.0 of HASP)

A specific chain of command for contact, contact procedures, an explanation of Navy On-Scene Coordinator/Commander Procedures, a listing of the specific Department of Navy points of contact for emergency medical response, and an explanation of the base phone system will be provided in the Final Draft HASP.

List of emergency phone numbers:

Facility	Phone Numbers On-Base	Phone Number Local
Security	(804)-363-4444	911
Fire	(804)-363-4444	911
Ambulance	(804)-363-4444	(804)-363-4444
Hospital	(804)-398-7283 (Medical Clinic)	(804)-363-6137 (Sentara Bayside Hospital)
Emergency	911	911
Activity Coordinator	(804)-363-4571 Rich Stryker	Not Applicable
Navy On-Scene Coordinator	(804)-464-8566 (Willie Barnes)	Not Applicable
Hazardous Materials Team	(804)-464-7363 (Tom Baker)	Not Applicable
Agency for Toxic Substances and Disease Registry (for toxic spills)	Not Applicable	(404)-639-0615
Certified Regional Poison Control Center	Not Applicable	(800)-552-6337 (804)-786-9123

A First Aid Kit and Emergency Eyewash bottle will be maintained in the field vehicle.

5.1 Directions and Hospital Route

The following are direction to Sentara Bayside Hospital:

From Site 12
1. Leave site, make right. Proceed northwest on 3rd Street.
2. Turn left (southeast) onto B Street. Proceed through gate and off the base.
3. Continue straight and proceed southeast on Independence Boulevard.
4. Hospital is approximately 3 miles southeast on Independence Boulevard, on the left side.

From Site 13
1. Proceed south on B Street turning right onto Shore Drive.
2. Take Shore Drive to Independence Boulevard. Turn left.
3. Hospital is approximately 3 miles southeast on Independence Boulevard, on the left side.

6.0 HAZARD ANALYSIS Consult Appendix ___I___ of the HASP, for MSD Sheets

7.0 ENVIRONMENTAL MONITORING SITE SPECIFIC INFORMATION

* (See Section 8.3 of HASP)

Point Source	Activity
Periodic monitoring with HNu	Subsurface soil, groundwater, surface water, and sediment sampling. Aquifer testing.

8.0 PERSONAL PROTECTIVE EQUIPMENT

* (See Section 4.0 of HASP)

Levels of Protection

Based on an evaluation of potential hazards, the following levels of personal protection will be designated for the applicable work areas or tasks. Upgrading or downgrading the level of protection will be based on real time monitoring and working conditions. Changes in Level of Protection will be the responsibility of the SHSO in consultation with the Field Team Leader, and will be noted on the following chart. Provisions will be made to upgrade to Level C in the event this becomes necessary.

Site	Job Task	Level of Protection				
		B	C	D+	D	Other
12	Subsurface soil, groundwater, surface water, and sediment sampling. Aquifer testing.				√	
13	Subsurface soil, groundwater, surface water, and sediment sampling. Aquifer testing.				√	

Start-Off Level of Protection ___D___

In addition to the standard personal protective equipment used as part of Level D protection, additional equipment may be utilized during sediment sampling at Site 12 because the sampling will be conducted within a body of water. Steel toed rubber boots and/or hip waders will most likely be necessary, though which will be used will be dependent on the depth of the water in the drainage canal. Need for additional personnel health and safety equipment is not anticipated since the water in the drainage canal is not expected to be more than 2 feet deep and the flow of water has been observed to be mostly stagnant. As discussed previously, any changes in Level of Protection will be made in the field by the SHSO in consultation with the Field Team Leader.