N60478.AR.000286
NWS EARLE
5090.3a

R-51-4-3-4

UNDERGROUND STORAGE TANK REMEDIAL INVESTIGATION WORK PLAN

VARIOUS SITES
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Northern Division
Environmental Branch, Code 18
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop No. 82
Lester, Pennsylvania 19113-2090

Submitted by:
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Contract No. N62472-90-D-1298
Contract Task Order 0085

June 1994

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1.0 INTRODUCTION

The Underground Storage Tank (UST) Remedial Investigation (RI) Work Plan for Contract Task Order (CTO) No. 0085 has been prepared by Halliburton NUS Corporation (HNUS) for the Northern Division (NORTHDIV) Naval Facilities Engineering Command (NAVFAC) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62472-92-D-1298.

UST leaks have occurred at five areas of concern (AOCs) at the Main Base and the Waterfront area of Naval Weapons Station (NWS) Earle, Colts Neck, New Jersey. Four of the AOCs are located on the Main Base: Buildings C-10 and C-13 (Barrack Housing), C-17/20 (Supply Gas Station), C-27 (Barrack Housing), and S-106B (Family Housing Unit). The fifth AOC, Buildings R-6/7, is located in the Waterfront area. USTs at NWS Earle are covered under New Jersey Department of Environmental Protection and Energy (NJ DEPE) UST system registration no. 0151003; NJ DEPE UST registration questionnaires for NWS Earle USTs are in Appendix A. Limited soil and groundwater investigations have been conducted at Buildings C-10 and C-13, C-17/20, C-27, and S-106. No investigations have been conducted at Buildings R-6/7. All available background information obtained from the NWS Earle facility representative, including site records and previous investigation reports, is in Appendix B.

Soil and groundwater contamination was documented during the 1992 removal of a 5,000-gallon home heating oil (No. 2) UST at Building C-10 and a 5,000-gallon home heating oil (No. 2) UST at Building C-13. A 550-gallon UST was discovered beneath the 5,000-gallon UST at Building C-13 during removal activities. A limited soil and groundwater sampling program was conducted at Buildings C-10 and C-13 in June 1992. Samples collected adjacent to Building C-10 were analyzed for total petroleum hydrocarbons (TPHs). Samples collected adjacent to Building C-13 were analyzed for volatile organic compounds plus 15 (VOC+15) and TPHs. The results of the sampling programs are discussed in Section 2.2.5; reports documenting the excavation and sampling activities were not prepared.

Soil contamination was documented during the 1992 replacement of leaking delivery lines connected to a 10,000-gallon diesel fuel (No. 2-D) UST and a 12,000-gallon unleaded gasoline UST at Buildings C-17/20. The replacement activities were conducted under a NJ DEPE-approved closure application (TMS No. C-91-3702). An underground diesel line connecting Building C-20 to Building C-50 was reportedly removed in the 1970s because of product loss. A limited soil and groundwater sampling program was conducted at Buildings C-17/20 in January and February 1992. Soil samples collected adjacent to Buildings C-17/20 were analyzed for VOC+15, lead, and TPHs. A groundwater sample was analyzed for VOC+15, including methyl tertiary butyl ether (MTBE) and tertiary butyl alcohol (TBA), and semivolatile organic compounds plus 15 (SVOC+15). Replacement activities and the results of the 1992 sampling program are discussed

in Section 2.3.5. The Site Characterization Report (without appendices) prepared by HNUS (May 1992) for the field and sampling activities is in Appendix B.

Soil contamination was documented during the 1992 removal of a 10,000-gallon home heating oil (No. 2) UST at Building C-27. A limited soil sampling program was conducted at Building C-27 in October 1992. Soil samples collected adjacent to Building C-27 were analyzed for VOC+15 and TPHs. An oily sheen was noted on groundwater in the excavation. The results of this sampling program are discussed in Section 2.4.5; a report documenting the excavation and sampling activities was not prepared.

Soil and groundwater contamination was documented during the 1991 removal of a 1,000-gallon home heating oil (No. 2) UST at Building S-106B. A soil and groundwater sampling program was conducted at Building S-106B in November 1991. Soil samples collected adjacent to Building S-106B were analyzed for EPA Priority Pollutant List (PPL+40) and TPHs; groundwater samples from on-site piezometers were analyzed for TPHs. A groundwater sample was not collected from the monitoring well because measurable free product was encountered; a sample of free product was collected for hydrocarbon fingerprint analysis. The results of this sampling program are discussed in Section 2.5.5. The Discharge Investigation and Corrective Action Report (without appendices) prepared by Kaselaan & D'Angelo Associates, Inc. (K&D) (June 1992) for the field and sampling activities is in Appendix B.

Soil contamination was encountered during the 1990 installation of vapor recovery piping at Buildings R-6/7. The contamination was attributed to a dripping compromised joint between a fiberglass pipe from a 12,000-gallon unleaded gasoline UST and an iron pipe leading to gasoline pumps. The piping was repaired, and contaminated soil in the construction path was removed. No sampling has been conducted to date at Buildings R-6/7. The Site Characterization and Plan of Action Report (without appendices) prepared by K&D (October 1991, revised July 1992) for this event is in Appendix B.

1.1 PROJECT OBJECTIVES AND DELIVERABLES

The objective of this UST RI project is to investigate the potential sources of contamination at the five AOCs at NWS Earle. For each AOC, the overall purpose of the investigative program is to

- Delineate the horizontal and vertical extent of contamination in all media. Delineation samples will be biased to identify any contaminant migration pathways.

- Determine the general subsurface characteristics, including the depth to groundwater.

- Identify migration pathways and actual or potential receptors of contaminants on or through air, soil, bedrock, sediment, surface water, groundwater, and structures.

- Collect all data necessary to evaluate remedial action alternatives, including treatability, bench scale, and pilot scale studies.

- Collect and evaluate all data necessary to evaluate the ecological impact of the contaminants.

- Collect all data necessary to develop permit limitations that may be required for any remedial action alternative under evaluation for any discharge to an environmental medium.

- Characterize all natural resource damages caused by potential contaminants.

- Identify containment and/or stabilization activities to prevent the off-site migration of contaminants and the on-site exposure to contaminants while remedial alternatives are being evaluated.

To accomplish the objective of this project, field activities will be conducted in two phases: Phase I and Phase II. Sampling objectives for Phase I are to delineate the extent of soil and groundwater contamination and confirm the presence or absence of contamination at concentrations above applicable clean-up standards in NJ DEPE Site Remediation Program Clean-Up Standards for Contaminated Sites Proposed New Rules: N.J.A.C. 7:26D. If contamination above applicable proposed clean-up standards is confirmed, Phase II operations will be implemented. Sampling objectives of Phase II operations include determining direction of groundwater flow and aquifer characteristics, etc.

Project deliverables for CTO 0085 will include the submission of a draft report summarizing Phase I RI activities, a draft report summarizing Phase I and II RI activities, and a final RI report. The RI report will be in accordance with NJ DEPE Site Remediation Program Technical Requirements for Site Remediation Proposed New Rules: N.J.A.C. 7:26E-4.9 Remedial Investigation Report. The RI report will include

- A summary of historical information pursuant to N.J.A.C. 7:26E-4.8(b)3.

- A summary of information on the physical setting pursuant to N.J.A.C. 7:26E-4.8(b)4 including stratigraphic cross sections.

- A technical overview pursuant to N.J.A.C. 7:26E-3.10(b)3 and findings and recommendations pursuant to N.J.A.C. 7:26E-3.10(b)4.

- A summary of the results of any treatability, bench scale, or pilot studies conducted pursuant to N.J.A.C. 7:26E-4.1(a)4.

- A summary of the results of any data collected to develop permit limitations pursuant to N.J.A.C. 7:26E-4.8(b)8.

- A summary of the results of any ecological assessments pursuant to N.J.A.C. 7:26D-5.

- Results of all analyses pursuant to N.J.A.C. 7:26E-2.1 including a summary table of analytical methods and quality assurance indicators pursuant to N.J.A.C. 7:26E-2.2 and a Sample Results Summary Table of all analyses pursuant to N.J.A.C. 7:26E-3.13(c)3.

- Site and AOC maps pursuant to N.J.A.C. 7:26E-4.8(b)3.

Supporting documentation, attached as appendices to the RI report, will include copies of soil boring logs, well completion reports, sample log sheets, and laboratory analytical data packages. Sample maps will be provided that will include the locations of all geoprobe sites, soil borings, monitoring wells, and sampling points.

1.2 ACTIVITIES SCHEDULE

The proposed schedule of significant events including Phase I and Phase II field activities, as measured from HNUS' receipt of written authorization to proceed, is outlined below:

Milestone Event	Weeks From Authorization to Proceed
HNUS receives written authorization to proceed from Navy	0
HNUS procures subcontracts for Phase I	0 to 3 weeks
Phase I field activities by HNUS	3 to 8 weeks
Phase I data receipt by HNUS	8 to 11 weeks
Phase I data validation completed by HNUS	11 to 16 weeks
HNUS submits draft Phase I RI report to Navy (including Phase II recommendations)	21 weeks
HNUS receives Navy and NJ DEPE review comments for Phase I	26 weeks

HNUS procures subcontracts for Phase II . . . . . 26 to 29 weeks

Phase II field activities by HNUS . . . . . 29 to 34 weeks

Phase II data receipt by HNUS . . . . . 34 to 38 weeks

Phase II data validation completed by HNUS . . . . . 38 to 43 weeks

HNUS submits draft RI report (Phases I and II) to Navy . . . . . 48 weeks

HNUS receives Navy and NJ DEPE review comments . . . . . 53 weeks

HNUS submits final RI report to Navy . . . . . 57 weeks

The field activities timeline is presented in Figure 1-1. Specific dates will be added to the proposed schedule of significant events upon written receipt of authorization to proceed, and a copy of the amended schedule will be submitted to NJ DEPE.

1.3 PRINCIPAL INVESTIGATORS AND RESPONSIBILITIES

HNUS will be responsible for the management and conduct of the field investigation activities presented in this Work Plan. The following key personnel will be involved with RI activities for this CTO

- Navy Remedial Project Manager (RPM)
- Navy Legal Contact
- NWS Earle Facilities Representative
- CLEAN Program Manager
- CLEAN Program Quality Assurance (QA) Manager
- CLEAN Program Health and Safety (H&S) Manager
- HNUS Project Manager (PM)
- HNUS Project QA Advisor
- HNUS Project H&S Officer
- Subcontractor Geoprobe System Coordinator
- Subcontractor Drilling Coordinator
- Subcontractor Surveying Coordinator
- Subcontractor Laboratory Analytical Coordinator

The organizational chart for this project is presented in Figure 1-2.

FIGURE 1-1 FIELD ACTIVITIES TIMELINE FOR CTO 85

ID	Name	Duration
1	CTO 85 - UST RI Workplan, NWS Earle, NJ	291d
2	Written Authorization to Proceed	1d
3	Phase I Subcontract Procurement	3w
4	Phase I Field Activities	5w
5	Phase I Data Receipt	3w
6	Phase I Data Validation	5w
7	Submission of Rough Draft Phase I Rpt	1d
8	Receipt of Navy and NJ DEPE Review C	1d
9	Phase II Subcontractor Procurement	3w
10	Phase II Field Activities	5w
11	Phase II Data Receipt	4w
12	Phase II Data Validation	5w
13	Submission of Draft Phases I & II Rpt	1d
14	Receipt of Navy and NJ DEPE Review Co	1d
15	Submission of Final RI Report	1d

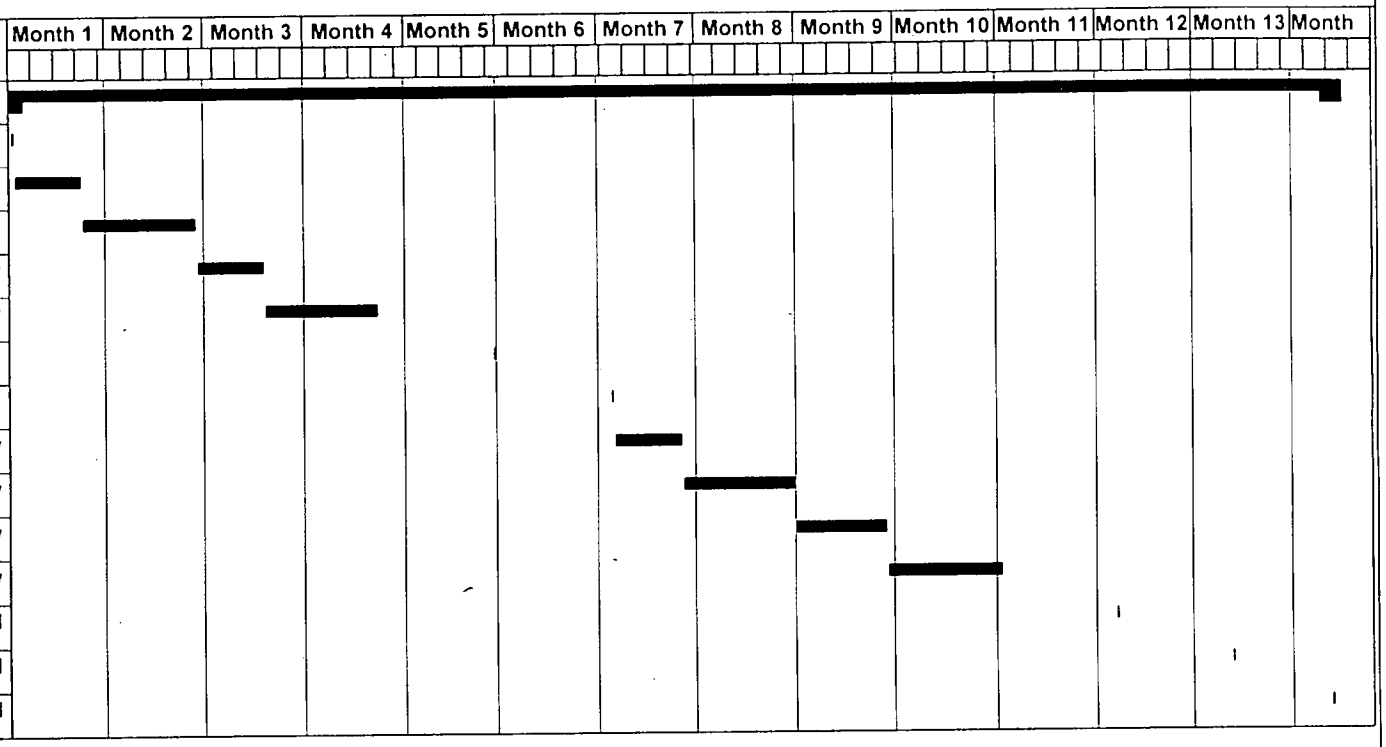
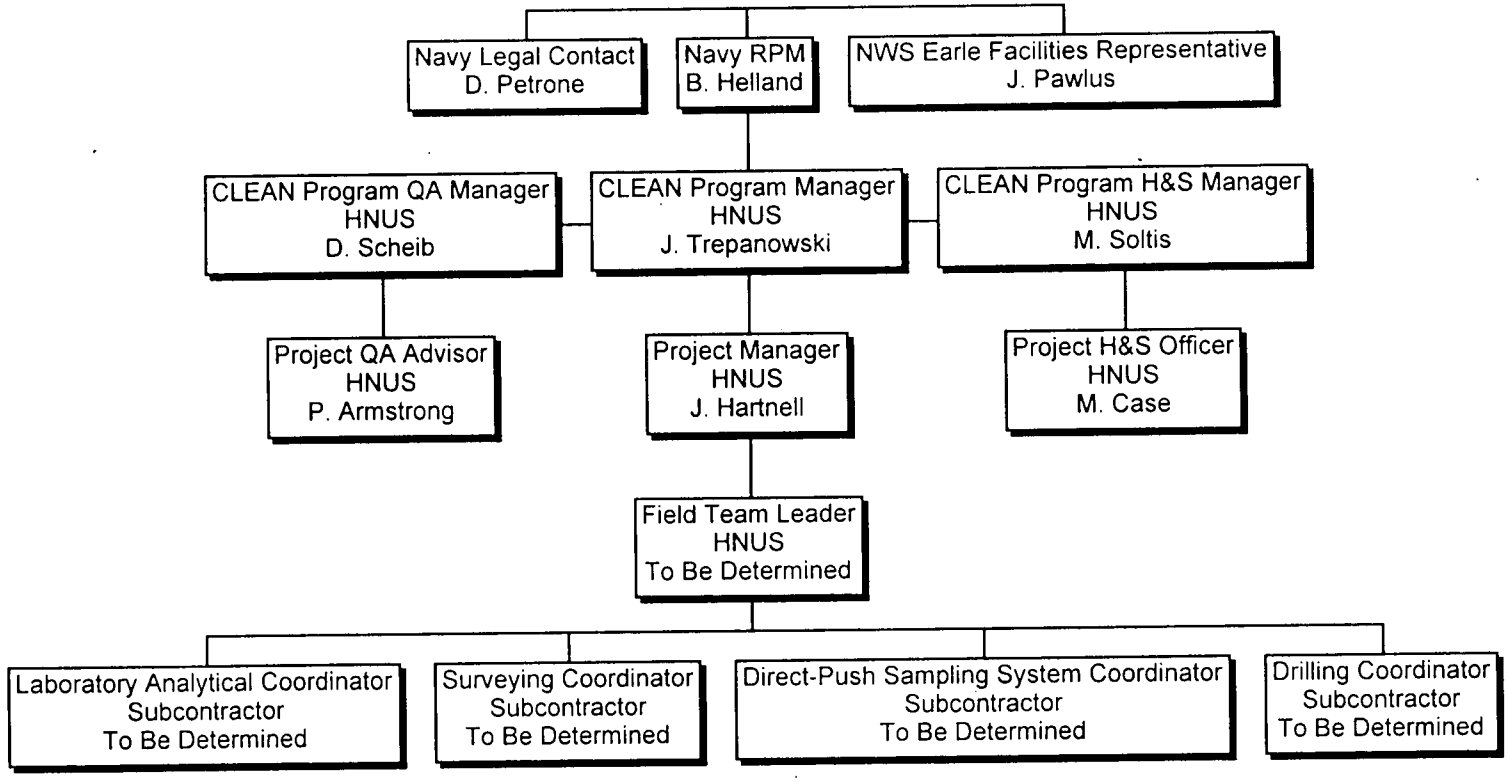


FIGURE 1-2
PROJECT ORGANIZATIONAL CHART
CTO 85 - UNDERGROUND STORAGE TANK REMEDIAL INVESTIGATION WORK PLAN
FOR VARIOUS SITES,
NWS EARLE, NEW JERSEY



The Navy RPM for CTO No. 0085 is Brian Helland, NORTHDIV NAVFAC; he can be contacted at (610) 595-0567. As RPM, Mr. Helland is responsible for the following:

- Provide site information and history
- Provide logistical assistance
- Review results and recommendations and provide management and technical oversight

The Navy Legal Contact is David Petrone, NORTHDIV NAVFAC; he can be contacted at (610) 595-0606.

The NWS Earle Facility Representative is John Pawlus, NWS Earle; he can be contacted at (908) 866-2674. As Facility Representative, Mr. Pawlus is responsible for the following:

- Provide site information and history
- Provide logistical assistance
- Review results and recommendations and provide technical oversight

The CLEAN Program Manager is John Trepanowski, of HNUS; he can be contacted at (610) 971-0900. As Program Manager, Mr. Trepanowski is responsible for the following:

- Ensure that contract requirements are met.
- Provide necessary resources to the project team to meet requirements of the RI.
- Maintain consistency in procedures and work products with other CTOs.
- Establish and maintain communication among the Navy RPM, CLEAN Program Contracting Officer, CLEAN Program QA Manager, CLEAN Program H&S Manager, and HNUS PM.

The CLEAN Program QA Manager is Debra Scheib, of HNUS; she can be contacted at (412) 921-8876. As QA Manager, Ms. Scheib is responsible for the following:

- Review laboratory QA plans, work plans, audit reports, and site data.

- Identify nonconformance situations to management and provide guidance in the correction of nonconformances.

- Ensure deliverables meet the requirements of NJ DEPE QA/quality control (QC) Program and the Navy QA/QC Program.

- Make recommendations to the Program Manager and the PM regarding corrective action.

- Supervise the responsibilities of the Site QA Advisor.

The CLEAN Program H&S Manager is Matthew Soltis, of HNUS; he can be contacted at (412) 921-8912. As H&S Manager, Mr. Soltis is responsible for the following:

- Ensure that the site-specific Health and Safety Plan (HASP) is in accordance with federal and state regulations and contract specifications.

- Provide technical safety and industrial hygiene oversight for all field work performed under the CLEAN contract.

- Provide clearance to the Navy for all personnel on the site in accordance with federal and state regulations and contract specifications.

- Perform audits to evaluate program effectiveness.

- Provide assistance and guidance to the Project H&S Officer.

- Maintain communication with the Program Manager, PM, and the Project H&S Officer.

The PM is Jill Hartnell, of HNUS; she can be contacted at (610) 971-0900 by telephone and (610) 971-9715 by telecopy. As PM, Ms. Hartnell is responsible for the following:

- Complete the project in a timely manner and maintain the project's scope, budget, and schedule.

- Coordinate and implement all tasks indicated in the approved site-specific work plan and quality assurance project plan (QAPP).

- Supervise the document control process.

- Approve deliverables and associated documents before transmittal.

- Implement programs and protocols related to the project.

- Establish and maintain communication among technical staff, Navy RPM, CLEAN Program Manager, Program QA Coordinator, Program H&S Managers, and regulatory agencies.

Ms. Hartnell has been certified by NJ DEPE as a subsurface evaluator, UST certification no. 0001755, and will also be serving as the project geologist for this CTO.

The Project QA Advisor is Patricia Armstrong, of HNUS; she can be contacted as (610) 971-0900. As Project QA Advisor, Ms. Armstrong is responsible for the following:

- Ensure that protocols described in the QAPP are met.

- Provide guidance or assistance in the resolution of QA/QC problems.

- Review and evaluate quality-related changes to the work plan and QAPP. Discuss and submit changes to the Program QA Manager for approval.

- Ensure that nonconformances are identified and appropriate corrective actions are taken; provide assistance to the PM with regard to corrective action and, if necessary, solicit involvement with the CLEAN Program Manager.

- Communicate regularly with the PM, Program QA Manager, and the subcontract laboratory Analytical Coordinator to ensure the progress of the QA tasks for the RI.

- Act as the main contact for project QA matters and provide guidance about appropriate procedures to the PM and support personnel.

The Project H&S Officer is Marcia Case, of HNUS; she can be contacted at (610) 971-0900. As Project H&S Officer, Ms. Case is responsible for the following:

- Prepare the RI HASP.

- Establish and maintain communication among the Site Safety Officer (SSO), PM, and the CLEAN Program H&S Manager.

- Verify that site personnel adhere to the site safety requirements.

- Provide guidance about appropriate corrective action procedures to PM and support personnel.

- Perform other responsibilities as specified in the site-specific HASP.

Subcontracts for the Geoprobe System, drilling services, surveying, and laboratory analytical services will be procured and awarded by CLEAN Program Subcontracting Officers before commencement of field activities. The subcontract Geoprobe System Coordinator will ensure that all Geoprobe System activities are in accordance with NJ DEPE permits and regulations and HNUS requirements. The subcontract Drilling Coordinator will ensure that all drilling activities are in compliance with NJ DEPE permits and regulations and HNUS requirements. The subcontract Surveying Coordinator will ensure that all surveying activities are in compliance with NJ DEPE permits and regulations and HNUS requirements. The subcontract Laboratory Analytical Coordinator will ensure that the laboratory implements the requirements of the NJ DEPE and the QAPP. The Laboratory Analytical Coordinator is responsible for reviewing the laboratory data before release. The names and telephone numbers for the various subcontract coordinators will be transmitted to the appropriate NJ DEPE personnel before the start of field work.

2.0 BACKGROUND INFORMATION

2.1 PHYSICAL SETTING

NWS Earle is located in Monmouth County, New Jersey (Figure 2-1). The station is divided into three physically separate areas: the Main Base, Waterfront area, and Chappel Hill area.

The Main Base and Waterfront area were established in June 1943 for national defense purposes. Before the establishment of the naval weapons station, the land was used for farming/agricultural purposes. The Main Base encompasses 10,428 acres; the Waterfront and Chappel Hill areas, combined, encompass 706 acres. Historical aerial photographs are not available for NWS Earle.

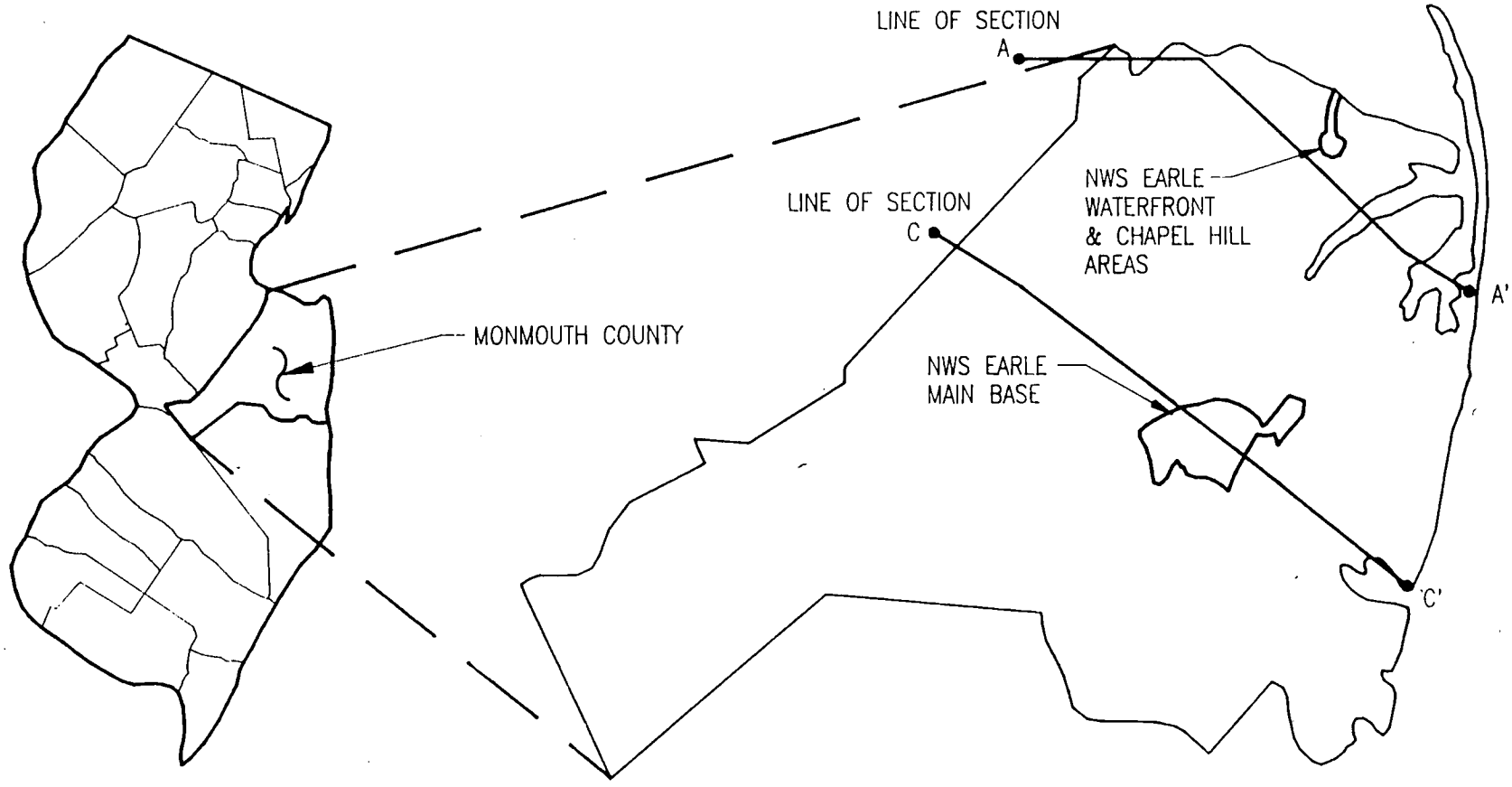
2.1.1 Physical Geography and Topography

The Main Base is situated on the outer plain of the emergent portion of the Atlantic Coastal Plain Physiographic Province, approximately six miles inland from the Atlantic Ocean. Portions of the Main Base fall on the following United States Geological Survey (U.S.G.S.) quadrangle, 7.5 minute series topographic maps: Marlboro, New Jersey; Long Branch, New Jersey; Farmingdale, New Jersey; and Asbury Park, New Jersey. The elevation across the Main Base ranges from 100 to 300 feet above mean sea level (AMSL). Buildings C-10 and 13, C-17/20, C-27, and S-106B are located on the Main Base (Figure 2-2). The Main-Base AOCs can be found at the following latitudes and longitudes on the U.S.G.S. Marlboro, New Jersey quadrangle, 7.5 minute series topographic map (see Appendix C):

Latitude and Longitude of Main Base AOCs

Building	North Latitude (Degrees, Minutes, Seconds)	West Longitude (Degrees, Minutes, Seconds)
C-10	40 16 09	74 09 32
C-13	40 16 02	74 09 30
C-17/20	40 16 05	74 09 21
C-27	40 16 12	74 09 45
S-106B	40 15 45	74 09 38

The Waterfront area is on the southern coast of Sandy Hook Bay, an inlet on the Atlantic Ocean, and occupies a long strip of land parallel to the ocean. A pier extends two miles offshore into the bay. Much of the area is swamp or tidal marsh with areas of man-made land. The elevation across the Waterfront area averages approximately 10 feet AMSL. Buildings R-6/7 are located in the Waterfront area (Figure 2-3)



NOT TO SCALE

FIGURE 2-1

SITE LOCATION MAP

CTO 85 – UNDERGROUND STORAGE TANK REMEDIAL INVESTIGATION AT VARIOUS SITES

NWS EARLE, COLTS NECK, NEW JERSEY

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and can be found at 40° 25' 10" north latitude and 74° 04' 16" west longitude on U.S.G.S. Sandy Hook, New Jersey-New York quadrangle, 7.5 minute series topographic map. This topographic map is in Appendix C.

2.1.2 Climate

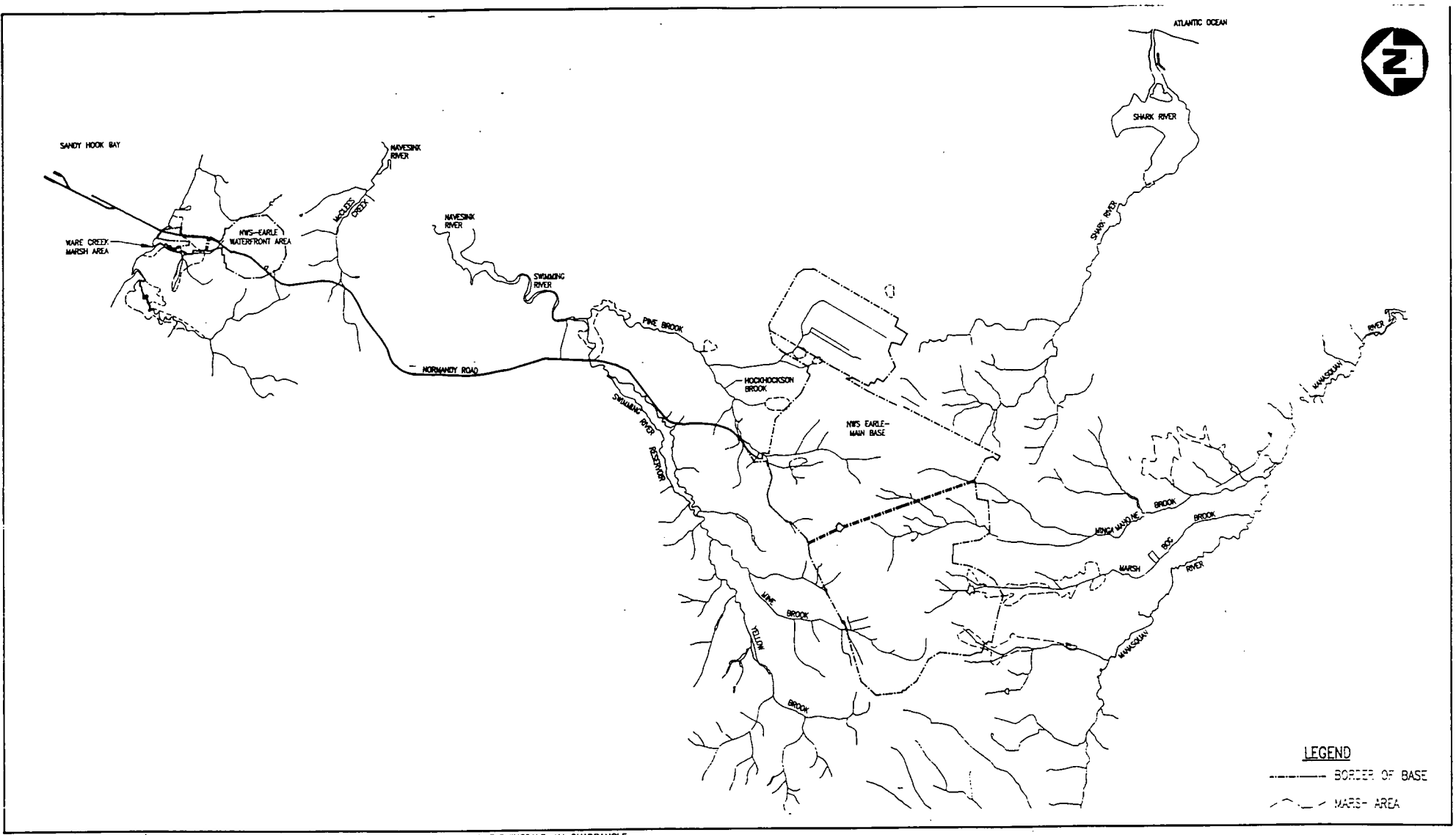
The Main Base and Waterfront area are characterized by a predominantly continental climate. The dominant wind direction during the winter months is from the northwest. Shore winds may reach the Main Base during the spring and summer months. The mean annual temperature in Freehold is 52.7°F. Average temperature extremes in Freehold range from 22°F to 39°F in January and 63°F to 85°F in July. The average annual precipitation of 45 inches is generally evenly distributed throughout the year. The growing season in this area ranges from 140 to 160 days.

2.1.3 Population and Land Use

An estimated 2,500 people reside and/or work at NWS Earle. Land use at the Main Base includes residential, buildings/offices and warehouses, recreational, undeveloped wooded areas, and undeveloped open areas. Land use at the Waterfront area includes residential, buildings/offices, recreational, undeveloped wooded areas, undeveloped open areas, and wetlands. Approximately 20 percent of the Waterfront area is considered marshland.

2.1.4 Surface Water and Wetlands

Rivers and brooks in the Main Base ultimately discharge to the Atlantic Ocean. The headwaters and drainage of Swimming, Manasquan, and Shark Rivers originate on the Main Base (Figure 2-4). The northern half of the Main Base is in the Swimming River drainage basin. The Swimming River discharges into the Navesink River and then into Sandy Hook Bay. Tributaries of the Swimming River include Mine Brook and Pine Brook. Three of the AOCs on the Main Base (Buildings C-10 and C-13, C-17/20, and C-27) are located within 1/2 mile of the headwaters of a tributary of Hockhockson Brook (Figure 2-5). A drainage ditch near Building S-106B drains into Hockhockson Brook. Hockhockson Brook is a tributary of Pine Brook. A copy of the National Wetlands Inventory for the U.S.G.S. Marlboro, New Jersey Quadrangle, 7.5 minute series topographic map is in Appendix C. The southwestern portion of the Main Base drains via Marsh Bog Brook or Mingamahone Brook to the Manasquan River. The southeastern portion of the base drains to the Shark River.



SOURCE: (7.5 MINUTE SERIES) U.S.G.S. MARLBORO, NJ QUADRANGLE, ASHBURY PARK, NJ QUADRANGLE, FARMINGDALE, NJ QUADRANGLE, SANDY HOOK, NJ-NY QUADRANGLE, AND LONG BRANCH, NJ QUADRANGLE.

FIGURE 2-4

WATER SHED
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

0 8,000 16,000
SCALE IN FEET

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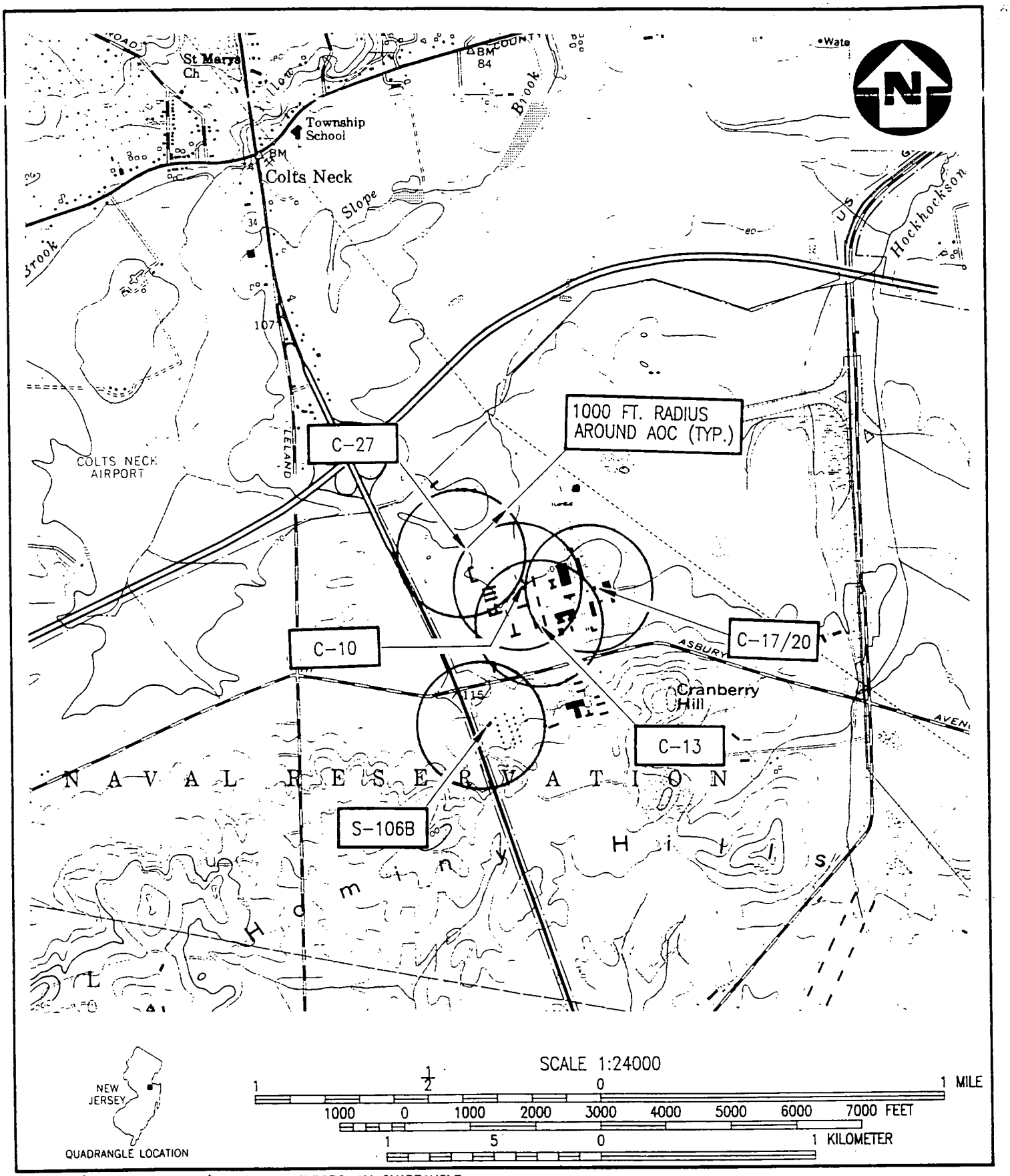

SOURCE: (7.5 MINUTE SERIES) U.S.G.S. MARLBORO, NJ QUADRANGLE

FIGURE: 2-5

MAIN BASE AOCs
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY
(SCALE 1:24000)

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The AOC at the Waterfront area (Buildings R-6/7) is located within 1/2 mile of Ware Creek and the marshlands that surround Ware Creek (Figure 2-6). A copy of the National Wetlands Inventory for the U.S.G.S. Sandy Hook, New Jersey - New York quadrangle, 7.5 minute series topographic map is in Appendix C. Rivers and streams draining the Waterfront area, including Ware Creek, ultimately discharge to Sandy Hook Bay. Surface water in the Waterfront area may be tidally influenced.

Runoff in either area follows the topographic gradient to storm sewers or occurs as overland flow that discharges to local surface water bodies.

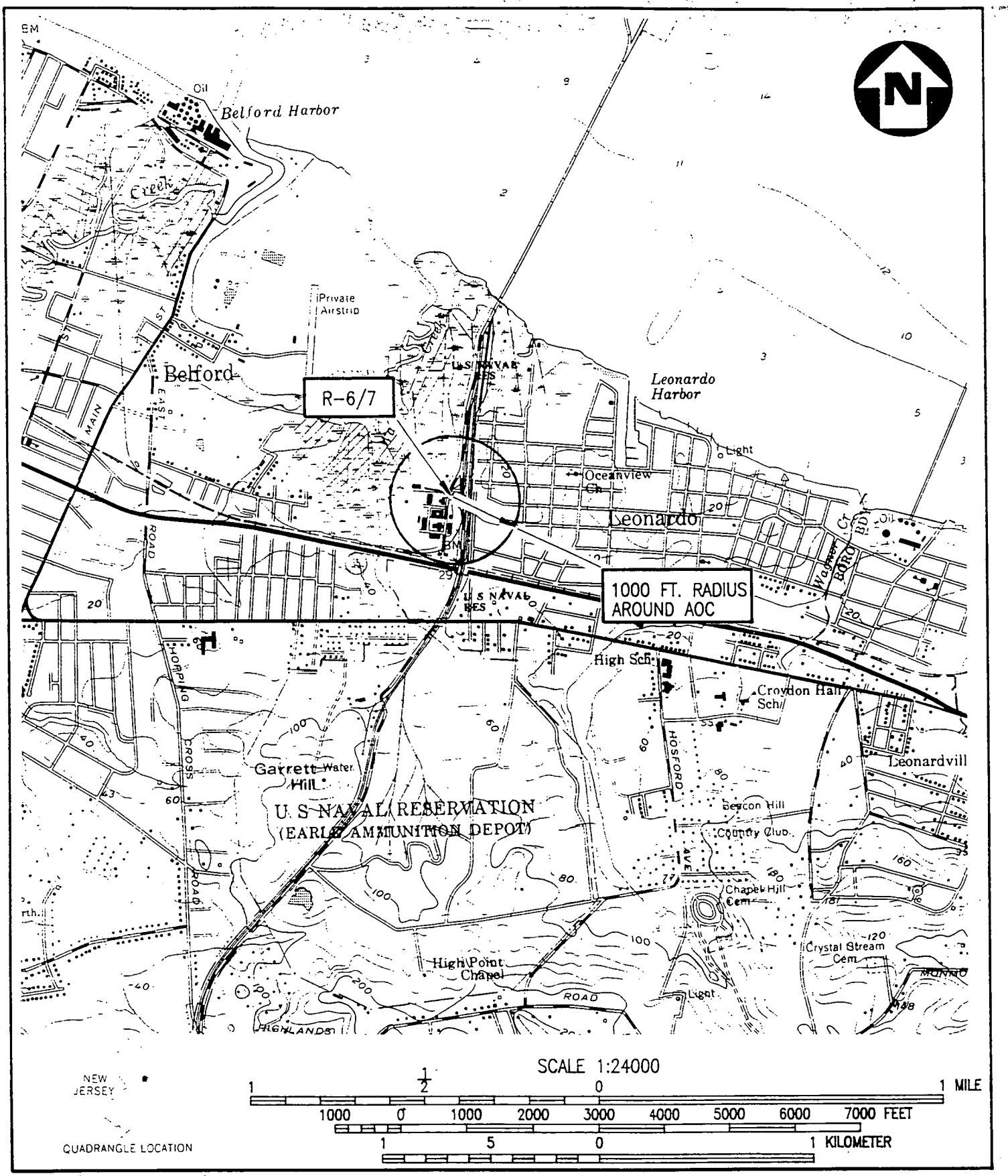
2.1.5 Soils

Soils underlying the AOCs located on the Main Base are mapped as Udorthents, smoothed (Figure 2-7). Soils underlying the AOC at the Waterfront area are mapped as Udorthents-Urban land complex, zero to three percent slopes (Figure 2-8). Udorthents consists of areas of excavation and/or fill where little of the original soil profile remains. The fill used ranges from loamy material to concrete rubble. Urban land consists of areas covered by impermeable structures such as roads, buildings, etc. On-site investigation is needed to characterize the soil present beneath each AOC.

Tidal marsh soils and beach sands have been mapped in the Waterfront area. Tidal marsh consists of poorly drained, soft, organic-rich silts, sands, and clays. Tidal marsh soils typically are flooded twice daily by tides. Natural conditions in the Waterfront area have been altered by man-made filled areas reclaimed from the marsh. Several sanitary landfills (currently closed) are present in the area.

2.1.6 Regional Geology

NWS Earle is situated in the Atlantic Coastal Plain Physiographic Province. A wedge of unconsolidated Cretaceous and Cenozoic age sands, clays, and marls overlies Precambrian and lower Paleozoic age crystalline bedrock in the Coastal Plain. The unconsolidated sediments strike generally northeast-southwest and dip slightly to the southeast at 10 to 60 feet per mile. The sediments thicken seaward from zero at the Fall Line to greater than 6,500 feet near Cape May. The thickness of sediments in the NWS Earle area is estimated at 900 feet. The sediments crop out in a banded pattern that runs roughly parallel to the shoreline. The geologic units identified in the Coastal Plain of New Jersey are in Table 2-1.



SOURCE: (7.5 MINUTE SERIES) U.S.G.S. SANDY HOOK, NJ QUADRANGLE

FIGURE: 2-6

WATERFRONT AREA AOC
CTO 85 – UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY
(SCALE 1:24000)

HALLIBURTON NUS
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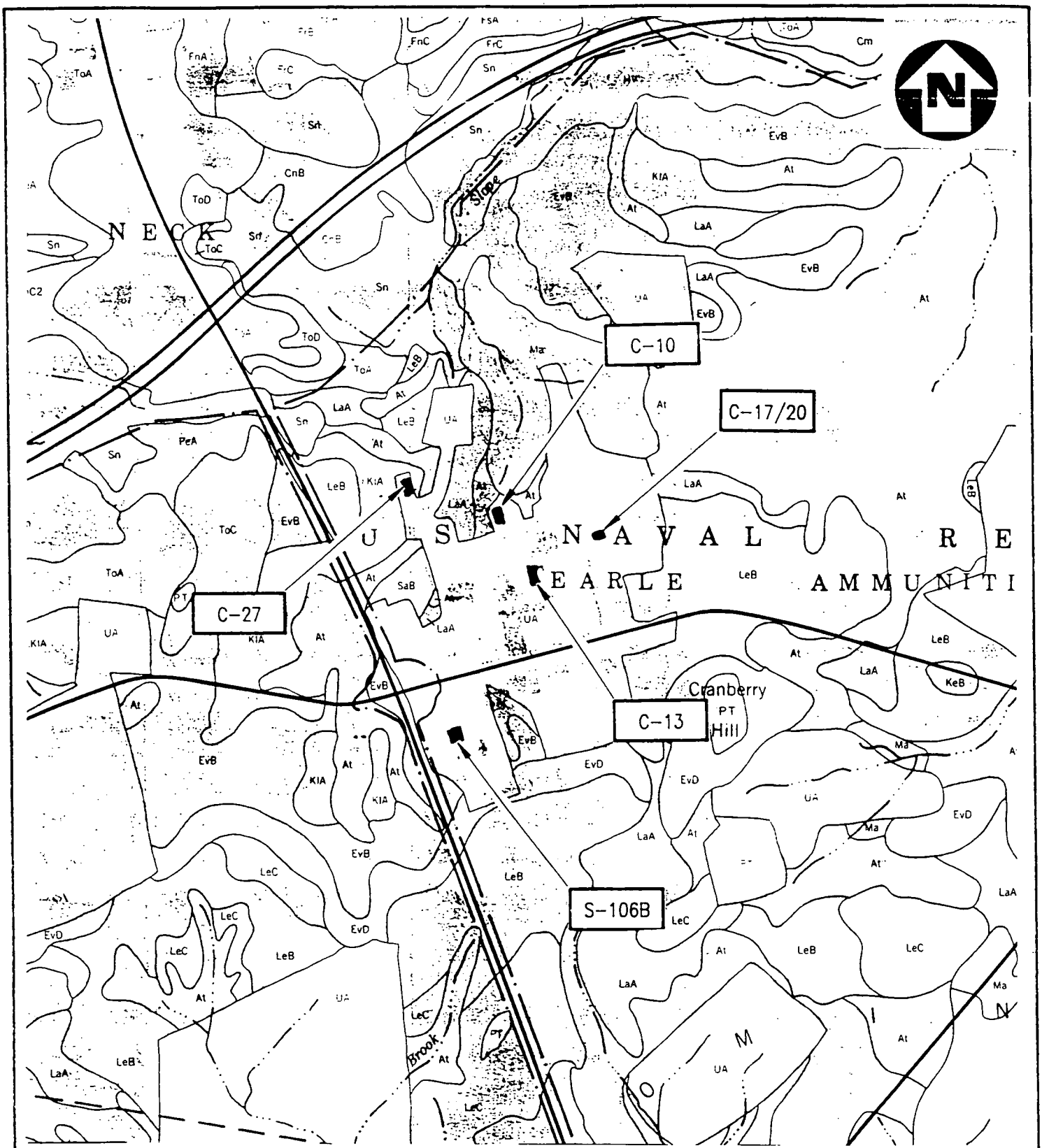
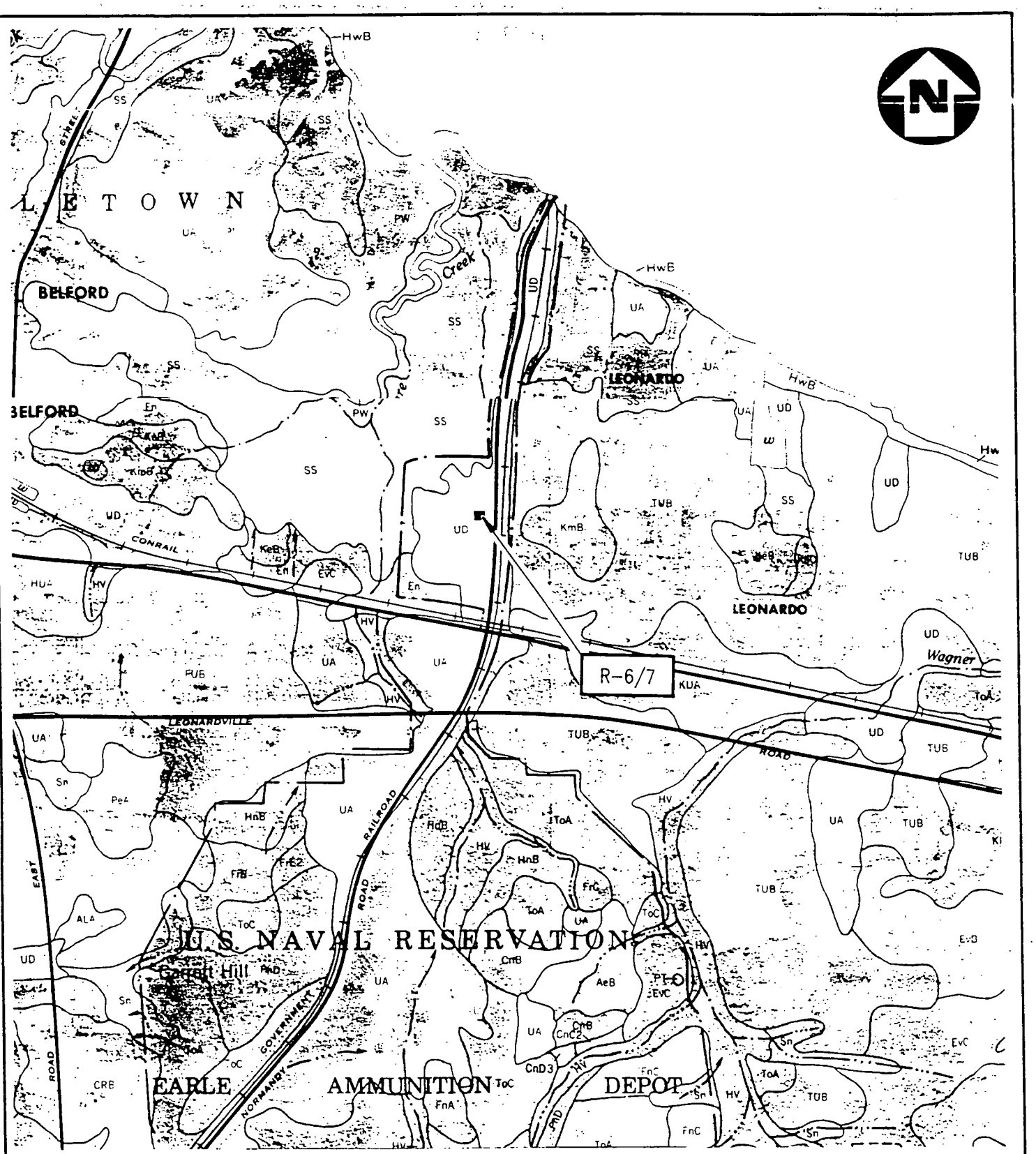


SOURCE: U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE. SOIL SURVEY OF MONMOUTH COUNTY, NEW JERSEY, APRIL 1989.

FIGURE: 2-7

SOILS MAP FOR MAIN BASE AOCs
CTO 85 – UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY
(SCALE 1:15840)

HALLIBURTON NUS
Environmental Corporation



LEGEND

UD Udorthents – Urban land complex, 0 to 3 percent slopes

SOURCE: U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE. SOIL SURVEY OF MONMOUTH COUNTY, NEW JERSEY, APRIL 1989.

FIGURE: 2-8

SOILS MAP FOR WATERFRONT AREA AOC
CTO 85 – UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY
(SCALE 1:15840)

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Table 2-1

New Jersey Coastal Plain Geologic and Hydrogeologic Units
CTO 85 – UST RI at Various Sites
NWS Earle, Colts Neck, New Jersey

SYSTEM	SERIES	GEOLOGIC UNIT	LITHOLOGY	HYDROGEOLOGIC UNIT	HYDROLOGIC CHARACTERISTICS
Quaternary	Holocene	Alluvial deposits	Sand, silt, and black mud.	Undifferentiated	Surficial material, often hydraulically connected to underlying aquifers. Locally units may act as confining beds. Thicker sands are capable of yielding large quantities of water.
		Beach sand and gravel	Sand, quartz, light-colored, medium- to coarse-grained, pebbly.		
	Pleistocene	Cape May Formation	Sand, quartz, light-colored, heterogeneous, clayey, pebbly.		
Tertiary	Miocene	Pensauken Formation		Kirkwood–Cohansey aquifer system	A major aquifer system. Groundwater occurs generally under water-table conditions. In Cape May County, the Cohansey Sand is under artesian conditions.
		Bridgeton Formation			
		Beacon Hill Gravel	Gravel, quartz, light-colored, sandy.		
		Cohansey Sand	Sand, quartz, light-colored, medium- to coarse-grained, pebbly; local clay beds.		
		Kirkwood Formation	Sand, quartz, gray and tan, very fine- to medium-grained, micaceous, and dark-colored diatomaceous clay.	confining bed	Thick diatomaceous clay bed occurs along coast and for a short distance inland. A thin water-bearing sand occurs within the middle of this unit.
				Rio Grande water-bearing zone	
				confining bed	
				Atlantic City 800-foot sand	A major aquifer along the coast.
				Composite confining beds	Alloway Clay member or equivalent.
	Eocene	Piney Point Formation	Sand, quartz and glauconite, fine- to coarse-grained.	Piney Point aquifer	Yields moderate quantities of water locally.
		Shark River Formation	Clay, silty and sandy, glauconitic, green, gray and brown, fine-grained quartz sand.		Poorly permeable sediments.
		Manasquan Formation			
	Paleocene	Vincentown Formation	Sand, quartz, gray and green, fine- to coarse-grained, glauconitic, and brown clayey, very fossiliferous, glauconite and quartz calcarenite.	Vincentown aquifer	Yields small to moderate quantities of water in and near its outcrop area.
		Hornerstown Sand	Sand, clayey, glauconitic, dark green, fine- to coarse-grained.		Poorly permeable sediments.
Cretaceous	Upper Cretaceous	Tinton Sand	Sand, quartz, and glauconite, brown and gray, fine- to coarse-grained, clayey, micaceous.	Red Bank Sand	Yields small quantities of water in and near its outcrop area.
		Red Bank Sand			
		Navesink Formation	Sand, clayey, silty, glauconitic, green and black, medium- to coarse-grained.		Poorly permeable sediments.
		Mount Laurel Sand	Sand, quartz, brown and gray, fine- to coarse-grained, slightly glauconitic.	Wenonah–Mount Laurel aquifer	A major aquifer.
		Wenonah Formation	Sand, very fine- to fine-grained, gray and brown, silty, slightly glauconitic.		
		Marshalltown Formation	Clay, silty, dark greenish gray, glauconitic quartz sand.	Marshalltown–Wenonah confining bed	A leaky confining bed.
		Englishtown Formation	Sand, quartz, tan and gray, fine- to medium-grained; local clay beds.	Englishtown aquifer system	A major aquifer. Two sand units in Monmouth and Ocean Counties.
		Woodbury Clay	Clay, gray and black, micaceous silt.	Merchantville–Woodbury confining bed	A major confining bed. Locally, the Merchantville Formation may contain a thin water-bearing sand.
		Merchantville Formation	Clay, glauconitic, micaceous, gray and black; locally very fine-grained quartz and glauconitic sand.		
		Magothy Formation	Sand, quartz, light gray, fine- to coarse-grained; local beds of dark gray lignitic clay.	Potomac–Raritan–Magothy aquifer system: upper aquifer	A major aquifer system. In the northern Coastal Plain, the upper aquifer is equivalent to the Old Bridge aquifer and the middle aquifer is the equivalent of the Farrington aquifer. In the Delaware River Valley, three aquifers are recognized. In the deeper subsurface, units below the upper aquifer are undifferentiated.
		Raritan Formation	Sand, quartz, light gray, fine- to coarse-grained, pebbly, arkosic, red, white, and variegated clay.	confining bed; middle aquifer	
	Lower Cretaceous	Potomac Group	Alternating clay, silt, sand, and gravel.	confining bed; lower aquifer	
Pre-Cretaceous		Bedrock	Precambrian and lower Paleozoic crystalline rocks, metamorphic schist and gneiss; locally Triassic basalt, sandstone and shale.	Bedrock confining bed	No wells obtain water from these consolidated rocks, except along the Fall Line.

Source: Zapecza, Otto S. Hydrogeologic Framework of the New Jersey Coastal Plain. USGS Open-File Report 84-730, Regional Aquifer-System Analysis. 1984.

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The youngest unit mapped in the area is the Miocene Cohansey Sand. A portion of the outcrop area of the Cohansey Sand may underlie the southernmost portion of the Main Base. The Cohansey Sand consists of medium- to coarse-grained, pebbly quartz sand with local clay beds. Permeability in the sands of the Cohansey Sand is good.

The Miocene Kirkwood Formation stratigraphically underlies the Cohansey Sand. The outcrop area of the Kirkwood Formation underlies the middle and southern portions of the Main Base. The Kirkwood Formation consists of very fine- to medium-grained, gray and tan, micaceous quartz sand and dark-colored diatomaceous clay. Permeability in the sands of the Kirkwood Formation is good.

The Paleocene Vincentown Formation stratigraphically underlies the Kirkwood Formation in this portion of the Coastal Plain. The Vincentown Formation, in and adjacent to its area of outcrop, consists of two lithofacies, a fine- to coarse-grained, brown and gray quartz sand and a brown, very fossiliferous, glauconitic, clayey quartz calcarenite. The outcrop area of the quartz sand facies of the Vincentown Formation underlies the northern portion of the Main Base. In general, the quartz sand facies crops out from Ocean to eastern Monmouth Counties and the quartz calcarenite facies crops out from Burlington to Salem Counties. Permeability of the quartz sand facies and the quartz calcarenite facies ranges from moderate to good. Both facies grade rapidly down dip from their respective outcrop areas into finer grained silts and clays.

The Paleocene Hornerstown Sand stratigraphically underlies the Vincentown Formation. The Hornerstown Sand consists of fine- to coarse-grained, dark green, glauconitic, clayey sand. Permeability in the Hornerstown Sand is poor.

Upper Cretaceous units in the area include, in descending order, the Tinton Sand, Red Bank Sand, Navesink Formation, Mount Laurel Sand, Wenonah Formation, Marshalltown Formation, Englishtown Formation, Woodbury Clay, Merchantville Formation, Magothy Formation, and Raritan Formation. The Tinton Sand stratigraphically underlies the Hornerstown Sand and, with the Red Bank Sand, consists of fine- to coarse-grained, brown and gray, micaceous, glauconitic, clayey quartz sand. The Navesink Formation consists of medium- to coarse-grained, green and black, glauconitic, silty clayey sand. The Mount Laurel Sand consists of fine- to coarse-grained, brown and gray, slightly glauconitic quartz sand. The Wenonah Formation consists of very fine- to fine-grained, gray and brown, slightly glauconitic sand. The Marshalltown Formation consists of dark greenish-gray, glauconitic, silty clay and glauconitic quartz sand.

The outcrop area of the Englishtown Formation underlies the Waterfront area. The Englishtown Formation consists of fine- to medium-grained, tan and gray quartz sand with local clay beds.

The Woodbury Clay consists of gray and black clay and micaceous silt. The Merchantville Formation consists of gray and black, glauconitic, micaceous clay with locally very fine-grained quartz and glauconitic sand. The Magothy Formation consists of fine- to coarse-grained, light gray quartz sand with local dark gray, lignitic coal beds. The Raritan Formation consists of fine- to coarse-grained, light gray, pebbly sand and red, white, and variegated clay.

Permeabilities in the Mount Laurel Sand, Wenonah Formation, Englishtown Formation, Magothy Formation, and Raritan Formation are good. Permeability in the Red Bank Sand ranges from moderate to good. Permeabilities in the Tinton Sand, Navesink Formation, and Marshalltown Formation are poor. Permeabilities in the Woodbury Clay and Merchantville Formation are generally very poor.

The Lower Cretaceous Potomac Group, undivided, stratigraphically underlies the Raritan Formation. The combined outcrop area of the Magothy and Raritan Formations and the Potomac Group is located approximately 14 miles northwest of the Main Base. The Potomac Group consists of alternating sequences of clay, silt, sand, and gravel. Permeability in the sands and gravels of the Potomac Group is good.

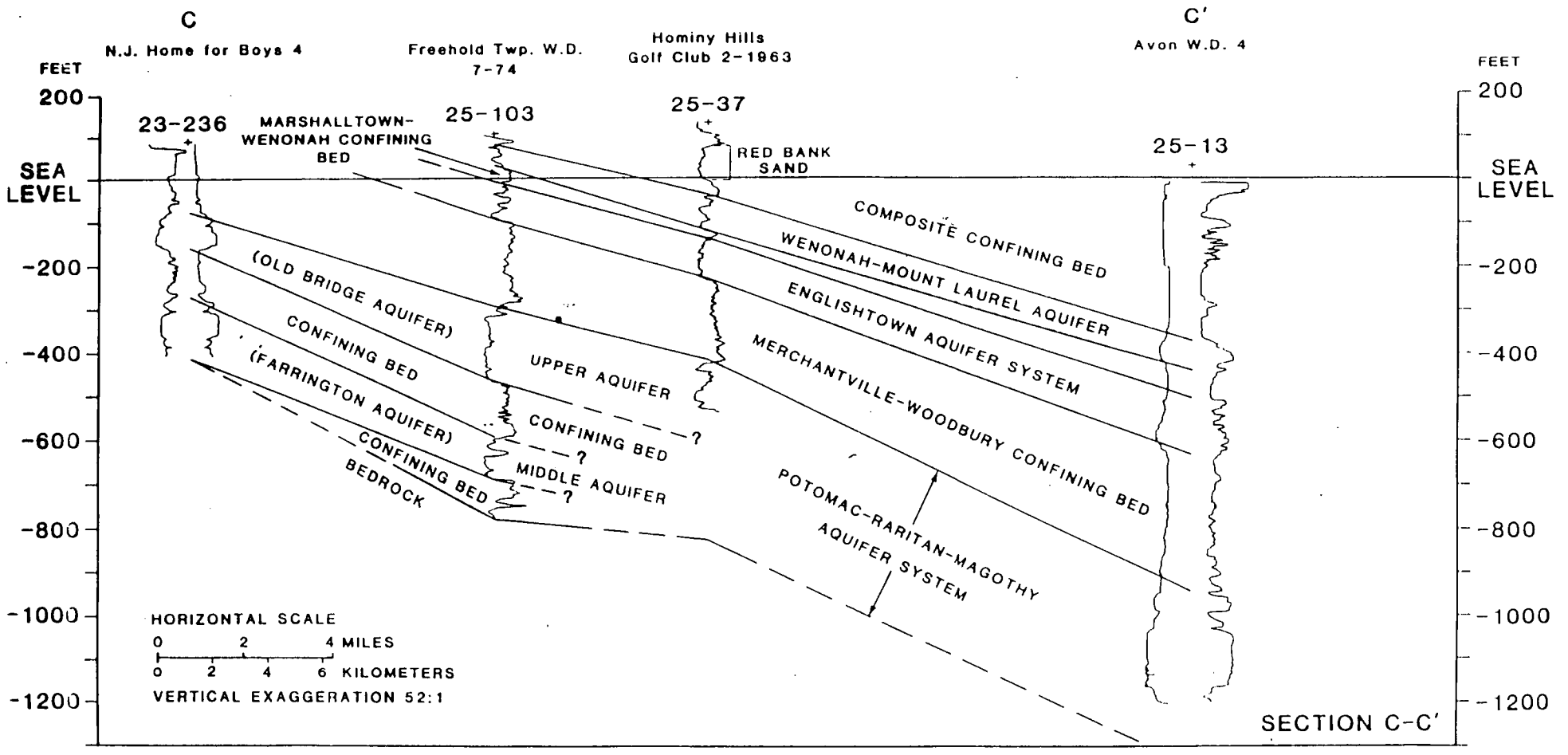
2.1.7 Local Geology

The Main Base is underlain by outcrops of the Kirkwood Formation and quartz sand facies of the Vincentown Formation. As previously mentioned, the Kirkwood Formation consists of very fine- to medium-grained, gray and tan, micaceous quartz sand and dark-colored diatomaceous clay. The quartz sand facies of the Vincentown Formation is a fine- to coarse-grained, brown and gray, glauconitic quartz sand.

The Waterfront area is underlain by outcrops of the Englishtown Formation. The Englishtown Formation, as already mentioned, consists of fine- to medium-grained, tan and gray quartz sand with local clay beds.

2.1.8 Regional Hydrogeology

The hydrogeologic units identified in the Coastal Plain of New Jersey are in Table 2-1. A generalized hydrogeologic cross-section for the Main Base is in Figure 2-9; a generalized hydrogeologic cross-section for the Waterfront area is in Figure 2-10.

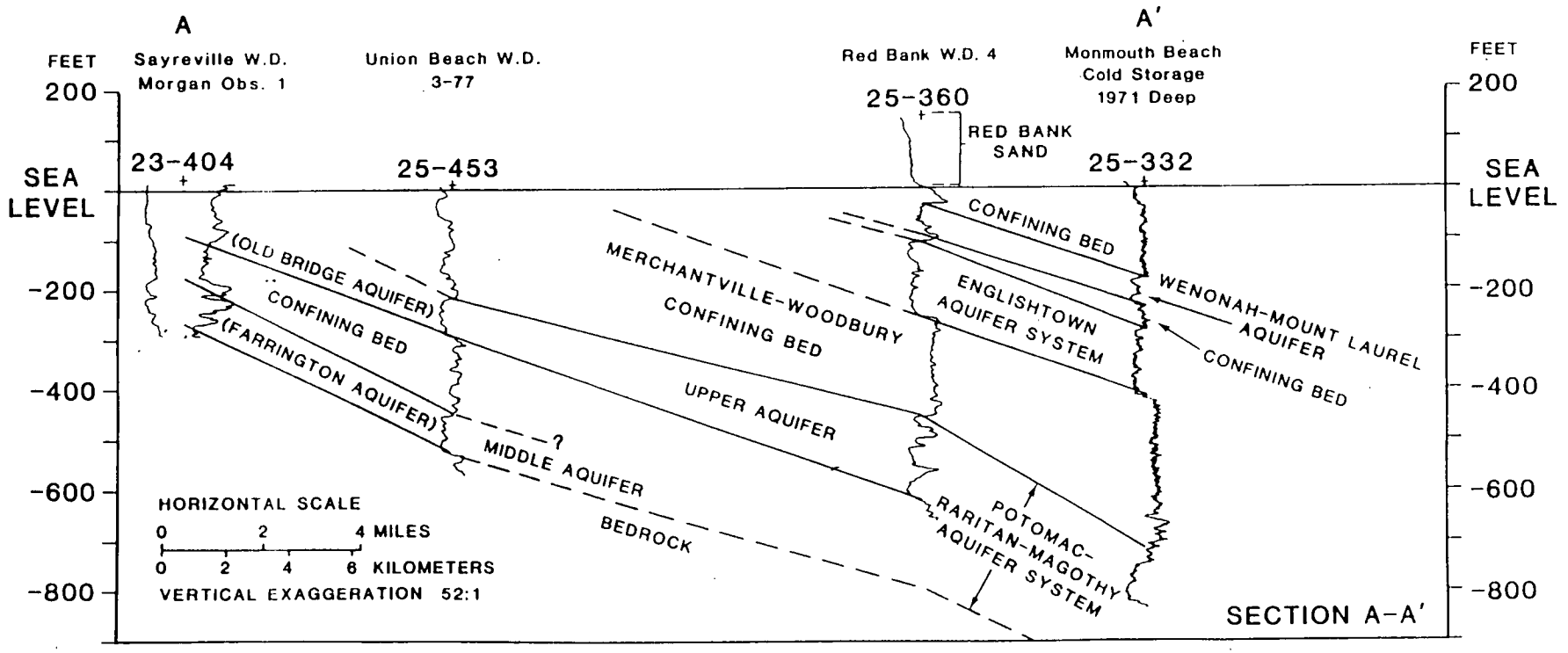


SOURCE: U.S.G.S. OPEN-FILE REPORT 84-730. HYDROGEOLOGIC FRAMEWORK OF THE NEW JERSEY COSTAL PLAIN.

FIGURE 2-9

GENERALIZED HYDROGEOLOGIC CROSS-SECTION FOR THE MAIN BASE
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

HALLIBURTON NUS
Environmental Corporation



SOURCE: U.S.G.S. OPEN-FILE REPORT 84-730. HYDROGEOLOGIC FRAMEWORK OF THE NEW JERSEY COSTAL PLAIN.

FIGURE 2-10

GENERALIZED HYDROGEOLOGIC CROSS-SECTION FOR THE WATERFRONT AREA
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

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Sediments of the Coastal Plain area of New Jersey are an important source of potable water for the region. In general, the deeper aquifers are used for public water supplies and the shallower aquifers are used for domestic supplies. NJ DEPE Water Technical Programs Groundwater Quality Standards Proposed Repeal and New Rules: N.J.A.C. 7:9-6 established groundwater classifications areas in New Jersey (Appendix D). The Main Base and Waterfront area are located in the area designated as Class II-A Ground Water Supporting Potable Water Supply. Class II-A includes those areas where groundwater is an existing source of potable water with conventional water supply treatment or a potential source of potable water.

Fifteen regional hydrogeologic units or aquifer systems have been defined in the Coastal Plain area of New Jersey by O.A. Zapecza (1984). Of these, five regional hydrogeologic units have been identified in the vicinity of the Main Base: Kirkwood-Cohansey aquifer system, Vincentown aquifer, Wenonah-Mount Laurel aquifer, Englishtown aquifer system, and Potomac-Raritan-Magothy aquifer system. Two of the 15 hydrogeological units have been identified in the Waterfront area: Englishtown aquifer system and the Wenonah-Mount Laurel aquifer.

The Kirkwood-Cohansey aquifer system is developed in the quartz sand units of the Kirkwood Formation and Cohansey Sand. Groundwater in this aquifer system is generally under water-table conditions. The Kirkwood-Cohansey aquifer system is underlain by confining beds of the Kirkwood Formation.

The Vincentown aquifer is developed in the sand and calcarenite facies of the Vincentown Formation. The northern portion of the Main Base is located in the outcrop and recharge area of the Vincentown Formation. The Vincentown Formation functions as a semi-confining to confining bed three to 10 miles downdip of its outcrop area. Groundwater in the Vincentown aquifer is generally under confined conditions. The Vincentown aquifer is underlain by composite confining beds of the Hornerstown, Tinton, and Red Bank Sands and the Navesink Formation.

The Wenonah-Mount Laurel aquifer is developed in the sand units of the Wenonah Formation and Mount Laurel Sand. Groundwater in this aquifer is generally under confined conditions. The Wenonah-Mount Laurel aquifer is underlain by composite confining beds of the Marshalltown and Wenonah Formations.

The Englishtown aquifer system is developed in the sand units of the Englishtown Formation. The Waterfront area is located in the outcrop and recharge area of the Englishtown Formation. Groundwater in this aquifer system is generally under confined conditions. The Englishtown aquifer system is underlain by composite confining beds of the Woodbury Clay and Merchantville Formation.

The Potomac-Raritan-Magothy aquifer system can be subdivided into upper, middle, and lower aquifers. The upper aquifer is developed in the sand units of the Magothy Formation. Confining beds of the Raritan Formation separate the upper aquifer from the middle aquifer. The middle aquifer is developed in the sand units of the Raritan Formation. Confining beds of the Potomac Group separate the middle and lower aquifers. The lower aquifer is developed in the sand units of the Potomac Group. Groundwater in this aquifer system is generally under confined conditions.

2.1.9 Local Hydrogeology

As previously mentioned, the Main Base is located on the outcrop and recharge area of the Vincentown Formation. No wells have been identified as producing from the Vincentown aquifer or any other aquifer within one mile of Buildings C-10 and C-13, C-17/20, S-106B, or C-27. Groundwater flow beneath the Main Base is expected to be generally to the east and southeast following local topography. Depth to the shallow water-table aquifer beneath the Main Base is estimated to range from five to 30 feet below grade.

As previously mentioned, the Waterfront area is located on the outcrop and recharge area of the Englishtown Formation. Groundwater flow beneath the Waterfront area is expected to be west toward the marshland and north toward Sandy Hook Bay. Depth to the shallow water-table aquifer beneath the Waterfront area is estimated to range from zero to 9.5 feet below grade.

2.1.10 Well Search

A computer radius program search for major withdrawal points within five miles and a microfilm well record search for wells within 1/2 mile of all AOCs will be requested from NJ DEPE Bureau of Water Allocation Well Permits Section during the RI. A computer radius program search and microfilm well record search were performed for Buildings C-17/20 and S-106B by NJ DEPE in March 1992 at the requests of HNUS and K&D, respectively. A microfilm well record search was performed for Buildings R-6/7 by NJ DEPE in March 1991 at the request of K&D. Copies of the searches are in Appendix E.

2.2 BUILDINGS C-10 AND C-13

2.2.1 Location

Building C-10 is located on the Main Base northwest of the intersection of Burma and Coral Roads (Figure 2-2) and can be found at 40° 16' 09" north latitude and 74° 09' 32" west longitude on the U.S.G.S.

Marlboro, New Jersey quadrangle, 7.5 minute series topographic map. Building C-13 is located on the Main Base southeast of the intersection of Burma and Coral Roads (Figure 2-2) and can be found at 40° 16' 02" north latitude and 74° 09' 30" west longitude on the U.S.G.S. Marlboro, New Jersey quadrangle, 7.5 minute series topographic map. Both buildings are used for barrack housing.

2.2.2 Description

The 5,000-gallon UST (Tank I.D. No. C10/1) that served Building C-10 before it was removed in 1992 contained home heating oil (No. 2). The tank and associated piping were constructed of single-wall painted/asphalt steel. Construction details for the tank system are summarized in Table 2-2. The tank was located west of Building C-10 in the northeastern section of an asphalt parking lot (Figure 2-11).

The 5,000-gallon UST (Tank I.D. No. C13/1) that served Building C-13 before it was removed in 1992 contained home heating oil (No. 2). The tank and associated piping were constructed of single-wall painted/asphalt steel. Construction details for the tank system are summarized in Table 2-2. The tank was located southeast of Building C-13 in the northern portion of a small asphalt parking area (Figure 2-12).

2.2.3 Physical Setting

The topography at the buildings is essentially flat (Figure 2-5). A topographic map of the areas surrounding the building contoured at two-foot intervals is not available. The elevation at Building C-10, based upon the U.S.G.S. Marlboro, New Jersey quadrangle, 7.5 minute series topographic map, is about 100 feet AMSL. The wooded area west of Building C-10 is approximately two feet lower in elevation than the excavated area at Building C-10. The elevation at Building C-13, based upon the U.S.G.S. Marlboro, New Jersey quadrangle, 7.5 minute series topographic map, is about 105 feet AMSL.

Subsurface utilities located near Building C-10 are shown in Figure 2-11. Subsurface utilities that could serve as potential contaminant conduits include fresh-water and storm sewer lines. Storm drains are located along Burma Road, northeast and southeast of the tank excavation area at Building C-10.

Subsurface utilities located near Building C-13 are shown in Figure 2-12. Subsurface utilities that could serve as potential contaminant conduits include fresh-water and storm sewer lines. A storm drain is located southwest of the tank excavation area at Building C-13. Both buildings have basements.

TABLE 2-2
TANK CONSTRUCTION DETAILS - MAIN BASE AOCs
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

	Buildings C-10 and C-13		Buildings C-17/20			
	C10/1	C13/1	C201	C202	C203	C204
Tank Status	removed in 1992	removed in 1992	in use	in use	in use	in use
Installation Year	1959	1958	1976	1985	1985	1985
Tank Age (years)	33 (when removed)	34 (when removed)	17	8	8	8
Tank Size (gallons)	5,000	5,000	10,000	12,000	12,000	12,000
Tank Contents	home heating oil (No. 2)	home heating oil (No. 2)	unleaded gasoline	unleaded gasoline	unleaded gasoline	unleaded gasoline
Tank Construction	single-wall painted/asphalt steel	single-wall painted/asphalt steel	single-wall fiberglas-reinforced plastic	single-wall fiberglas-clad steel	single-wall fiberglas-clad steel	single-wall fiberglas-clad steel
Piping Construction	single-wall painted/asphalt steel	single-wall painted/asphalt steel	single-wall bare steel	single-wall fiberglas-reinforced plastic*	single-wall fiberglas-reinforced plastic	single-wall fiberglas-reinforced plastic
Internal Tank and Piping Lining	none	none	none	none	none	none
Secondary Containment	none	none	none	- - -	- - -	- - -
Cathodic Protection	none	none	- - -	- - -	- - -	- - -
Monitoring/Detection Method	stock/inventory control (manual)	stock/inventory control (manual)	stock/inventory control (manual)	event-activated stock/inventory control (electronic)	event-activated stock/inventory control (electronic)	event-activated stock/inventory control (electronic)

Information taken from NJ DEPE UST Registration Questionnaires, dated 1986.

* Piping was replaced in 1992 with double-wall fiberglass-reinforced plastic piping.

TABLE 2-2
MAIN BASE AOCs
NWS EARLE
PAGE TWO

	Building C-17/20 (continued)			Building C-27	Building S-106
	C205	C206	C207	C27/1	0020
Tank Status	in use	unknown	in use	removed in 1992	removed in 1991
Installation Year	1979	1944	1944	unknown	1952
Tank Age (Years)	14	49	59	unknown	39 (when removed)
Tank Size (Gallons)	12,000	12,500	12,500	5,000	1,000
Tank Contents	medium diesel fuel (No. 2-D)	spill containment and overflow	spill containment and overflow	home heating oil (No. 2)	home heating oil (No. 2)
Tank Construction	single-wall fiberglass-clad steel	single-wall concrete	single-wall concrete	single-wall painted/asphalt steel	single-wall coated steel
Piping Construction	single-wall fiberglass-reinforced plastic*	single-wall bare steel	single-wall bare steel	single-wall painted/asphalt steel	single-wall coated steel
Internal Tank and Piping Lining	none	- - -	- - -	none	none
Secondary Containment	- - -	- - -	- - -	none	none
Cathodic Protection	- - -	- - -	- - -	none	none
Monitoring/Detection Method	- - -	- - -	- - -	stock/inventory control (manual)	none

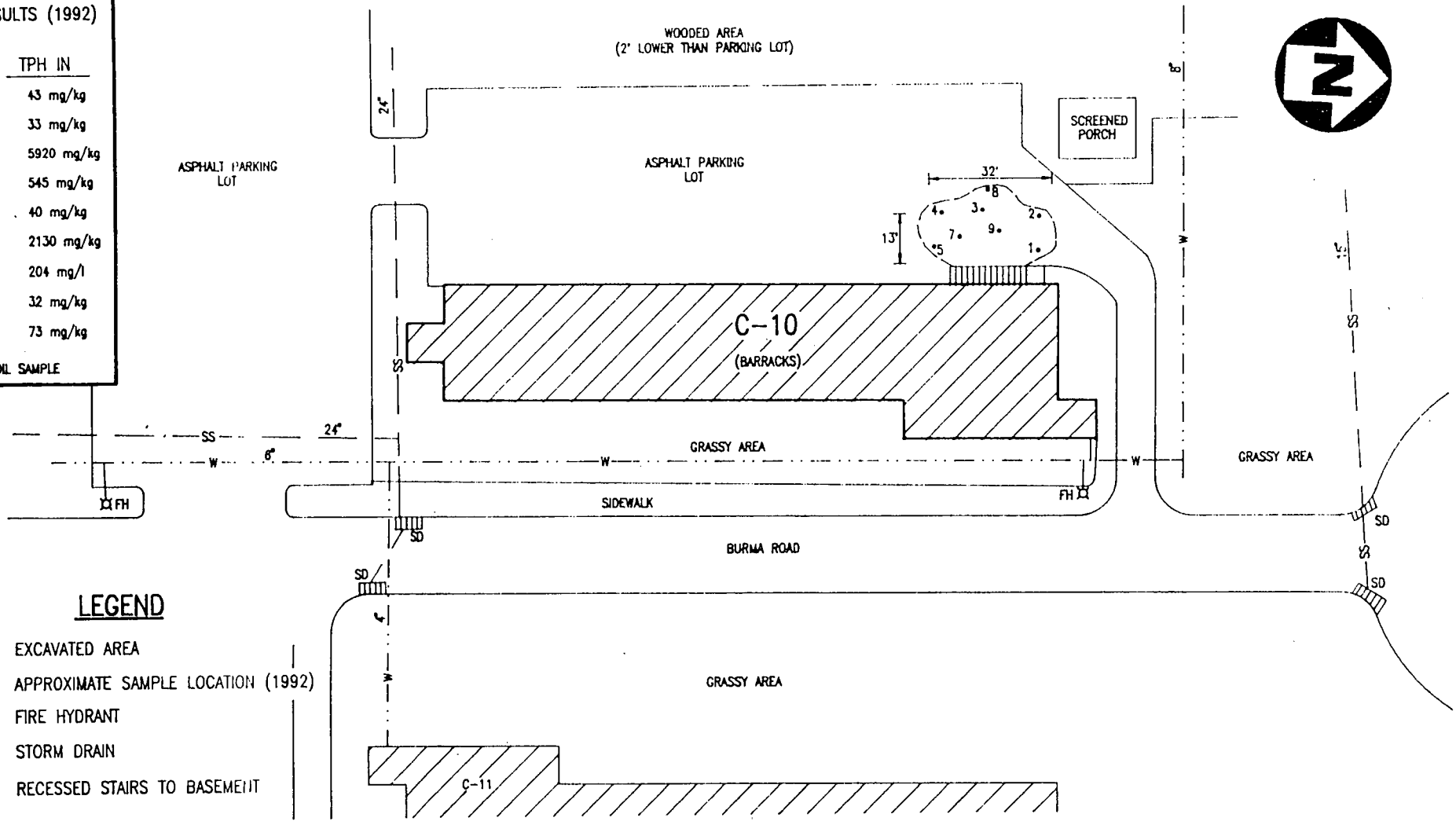
Information taken from NJ DEPE UST Registration Questionnaires, dated 1986.

* Piping was replaced in 1992 with double-wall fiberglass-reinforced plastic piping.

ANALYTICAL RESULTS (1992)

SAMPLE ID No.	TPH IN
C-10-1	43 mg/kg
C-10-2	33 mg/kg
C-10-3	5920 mg/kg
C-10-4	545 mg/kg
C-10-5	40 mg/kg
C-10-6 *	2130 mg/kg
C-10-7	204 mg/l
C-10-8	32 mg/kg
C-10-9	73 mg/kg

* STOCK PILE SOIL SAMPLE



LEGEND

- EXCAVATED AREA
- 1• APPROXIMATE SAMPLE LOCATION (1992)
- FH FIRE HYDRANT
- SD STORM DRAIN
- RECESSED STAIRS TO BASEMENT
- BUILDING

SCALE

0 20 40 60 100

SCALE IN FEET

FIGURE 2-11

BUILDING C-10 – DETAIL MAP
CTO 85 – UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

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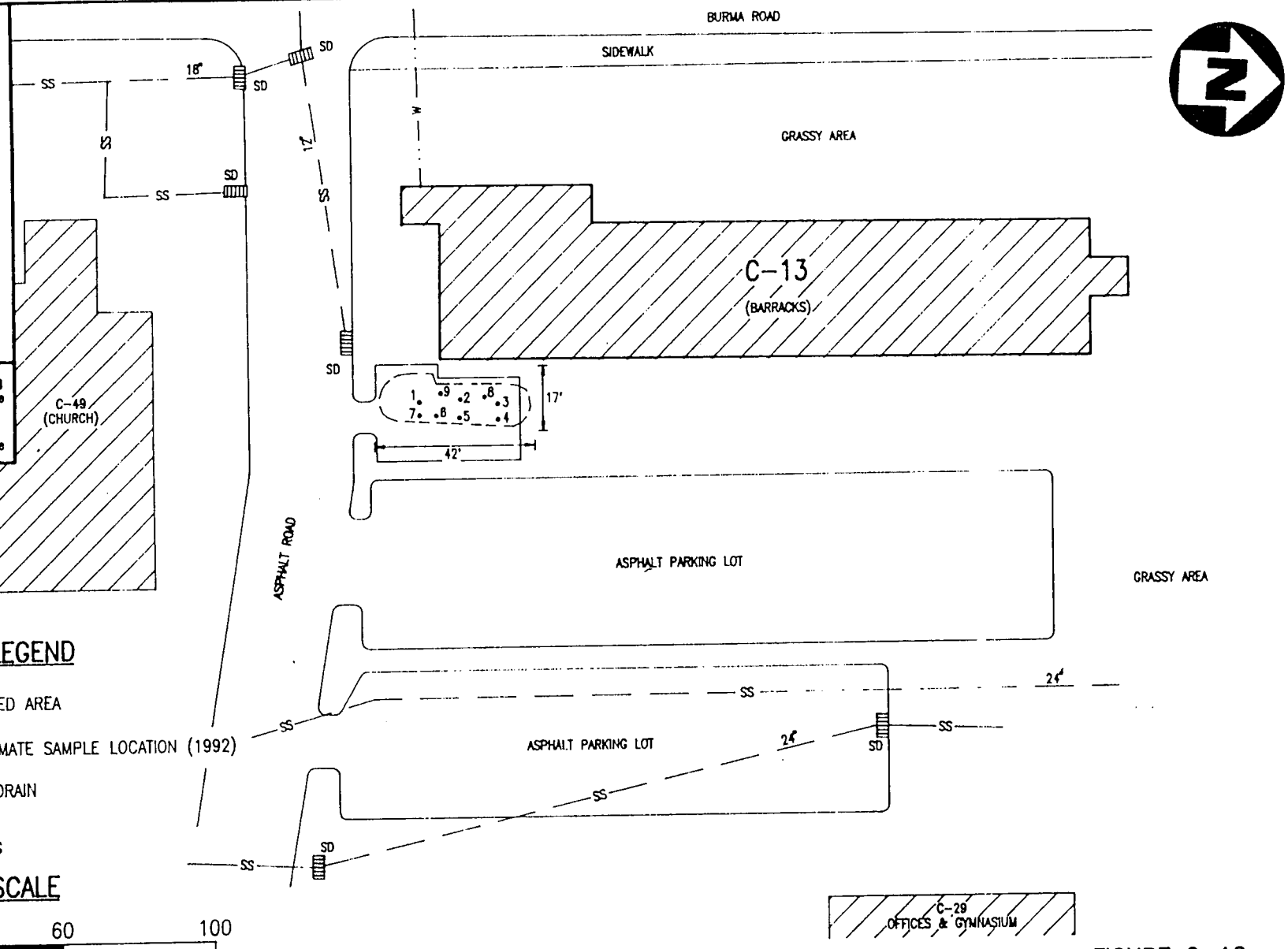
ANALYTICAL RESULTS (1992)

SAMPLE ID No.	TPH IN mg/kg
C-13-1	54
C-13-2	2,280
C-13-3	14,000
C-13-4	2,270
C-13-5	3,830
C-13-6	18
C-13-7	73
C-13-8	2,060
C-13-9	5,490
C-13-8	0.280 mg/kg ethyl benzene
C-13-9	2.5 mg/kg ethyl benzene



LEGEND

- EXCAVATED AREA
- 1• APPROXIMATE SAMPLE LOCATION (1992)
- SD STORM DRAIN
- BUILDING

SCALE

0 20 40 60 100

SCALE IN FEET

FIGURE 2-12

BUILDING C-13 - DETAIL MAP
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

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Land use within 1,000 feet of Building C-10 includes residential, buildings/offices, warehouses, undeveloped wooded areas, and undeveloped open areas (Figure 2-2). Approximately 30 percent of the total land within 1,000 feet of Building C-10 is covered by buildings and other impermeable surface covers. Land use within 1,000 feet of Building C-13 includes residential, buildings/offices, recreational facilities, warehouses, recreational areas, and undeveloped open areas (Figure 2-2). Approximately 35 percent of the total land within 1,000 feet of Building C-13 is covered by buildings and other impermeable surface covers.

The headwaters of a tributary of Hockhockson Brook is located 600 feet north of Building C-10 and 1,100 feet north of Building C-13 (Figure 2-5). Hockhockson Brook drains into the Swimming River via Pine Brook. The Swimming River discharges into the Navesink River and then into Sandy Hook Bay.

The soil beneath both buildings may range from loamy material to concrete rubble and has been mapped as Udorthents, smoothed (Figure 2-7). On-site investigation is needed to determine the soil characteristics.

Both buildings are located on the outcrop and recharge area of the glauconitic quartz sand facies of the Vincentown Formation. Groundwater monitoring wells are needed to determine the local groundwater flow direction. The depth to groundwater beneath Building C-10, based upon the depth to water encountered in the tank excavation area, is about eight feet below grade. The depth to groundwater below Building C-13, based upon the depth to water encountered in the tank excavation area, is about 10 feet below grade.

2.2.4 History

The 5,000-gallon USTs at Buildings C-10 and C-13 were installed in 1959 and 1958, respectively. Historical site plans, as-built diagrams, and operating and maintenance records, including integrity tests, are not available for the USTs at Buildings C-10 and C-13. The USTs at Buildings C-10 and C-13 were removed in 1992. The excavated areas were subsequently filled in with clean fill material and covered with asphalt. Samples collected during 1992 tank removal activities at Buildings C-10 and C-13 detected TPHs in the soil, indicating that a leak had occurred in either the tank or piping system and/or a spill had occurred around the fill ports. The incident discharge number for Building C-10 is 92-6-1-1513-27.

2.2.5 Previous Investigations

An estimated 3,750 cubic feet of soil (13 feet by 32 feet and nine feet deep) was excavated during 1992 tank removal activities at Building C-10. Eight soil samples (C-10-1 through C-10-6, C-10-8, and C-10-9) and one groundwater sample (C-10-7) were collected for TPH analysis from the tank excavation (Figure

2-11). The soil samples were collected from just above the top of water table; water was encountered in the excavation at eight feet below grade. Samples C-10-1 through C-10-8 were collected on June 1, 1992. Samples C-10-1 through C-10-7 were received by W.A.T.E.R. Works Laboratory, Incorporated on June 1, 1992; sample C-10-8 was received on June 2, 1992. Sample C-10-9 was collected on June 2, 1992 and received by W.A.T.E.R. on June 3, 1992. The maximum concentration of TPH detected in the soil samples was 5,920 mg/kg (C-10-3). This does not exceed the soil clean-up standard for all organic contaminants, including TPH, of 10,000 mg/kg proposed in N.J.A.C. 7:26D (Appendix D); however, the extent of non-TPH organic contamination present in the soil is not known. A concentration of 204 mg/l of TPH was detected in the groundwater sample. This exceeds the groundwater clean-up standard for all organic contaminants, including TPH, of 10 mg/l proposed in N.J.A.C. 7:26D. Analytical results are shown on Figure 2-11. A report documenting the excavation and sampling activities was not prepared.

An estimated 6,450 cubic feet of soil (17 feet by 42 feet and average nine feet deep) was excavated during 1992 tank removal activities at Building C-13. The depth of the excavation ranged from five to 11 feet; water was not encountered in the excavation. Nine soil samples (C-13-1 through C-13-9) were collected for TPH analysis from the tank excavation (Figure 2-12); samples C-13-8 and C-13-9 were also analyzed for VOC+15 and xylene. Samples C-13-1 through C-13-5 were collected on June 2, 1992 and received by W.A.T.E.R. on June 2, 1992. Samples C-13-6 through C-13-9 were collected on June 3, 1992 and received by W.A.T.E.R. on June 3, 1992. The maximum concentration of TPH detected was 14,000 mg/kg (C-13-3). This exceeds the soil clean-up standard for all organic contaminants, including TPH, of 10,000 mg/kg proposed in N.J.A.C. 7:26D. Analytical results are summarized on Figure 2-12. A report documenting the excavation and sampling activities was not prepared.

Based upon the analytical results from sampling at Buildings C-10 and C-13, soil and groundwater at Building C-10 and soil the Building C-13 are contaminated at levels above the proposed subsurface soil standards. Additional investigation and remediation are required at Building C-10 to delineate the extent of soil and groundwater contamination. Additional investigation and remediation are required at Building C-13 to determine if groundwater contamination are present and to delineate the extent of soil contamination and groundwater contamination, if any.

2.3 BUILDINGS C-17/20

2.3.1 Location

Buildings C-17/20 are located on the Main Base, on Saipan Road just north of the intersection of Saipan and Coral Roads (Figure 2-2) and can be found at 40° 16' 05" north latitude and 74° 09' 21" west longitude on the U.S.G.S. Marlboro, New Jersey quadrangle, 7.5 minute series topographic map. Buildings C-17/20

serve as the supply gas station for the Main Base. Building C-17 is the office for the pump island and Building C-20 is the pump house. Building C-20 is enclosed by a metal security fence.

2.3.2 Description

Of the seven USTs (Tank I.D. Nos. C201 through C207) registered at Buildings C-17/20, four (Tank ID Nos. C202, C203, C204, and C205) are currently in service. UST C201 is a 10,000-gallon single-wall fiberglass-reinforced plastic tank with single-wall bare steel piping. USTs C202 through C205 are 12,000-gallon single-wall fiberglass-clad steel tanks with single-wall fiberglass-reinforced plastic piping. In 1992, the piping associated with USTs C202 and C205 was removed and replaced with double-wall fiberglass-reinforced plastic piping. USTs C201, C202, and C203 contain unleaded gasoline, C204 contains home heating oil (No. 2), and C205 contains diesel fuel (No. 2-D). USTs C206 and C207 are 12,500-gallon single-wall concrete spill containment and overflow tanks with single-wall bare steel piping. Construction details for the USTs at Buildings C-17/20 are summarized in Table 2-2. The tanks are located in the vicinity of Building C-20 (Figure 2-13).

2.3.3 Physical Setting

The topography at the buildings is essentially flat (Figure 2-5). A topographic map of the areas surrounding the buildings contoured at two-foot intervals is not available. The elevation at Buildings C-17/20, based upon the U.S.G.S. Marlboro, New Jersey quadrangle, 7.5 minute series topographic map, is about 110 AMSL.

Subsurface utilities near Buildings C-17/20 are shown in Figure 2-13. Subsurface utilities that could serve as potential contaminant conduits include fresh-water, storm sewer, sanitary sewer, and gas lines. Buildings C-17/20 have slab foundations.

Land use within 1,000 feet of Buildings C-17/20 includes residential, buildings/offices, warehouse, recreational facilities and areas, rail yards, undeveloped wooded areas, and undeveloped open areas (Figure 2-2). Approximately 30 percent of the total land area within 1,000 feet of Buildings C-17/20 is covered by buildings and other impermeable surface covers.

The headwaters of a tributary of Hockhockson Brook are located 1,900 feet northwest of Buildings C-17/20 (Figure 2-5). Hockhockson Brook drains into the Swimming River via Pine Brook. The Swimming River discharges into the Navesink River and then into Sandy Hook Bay.

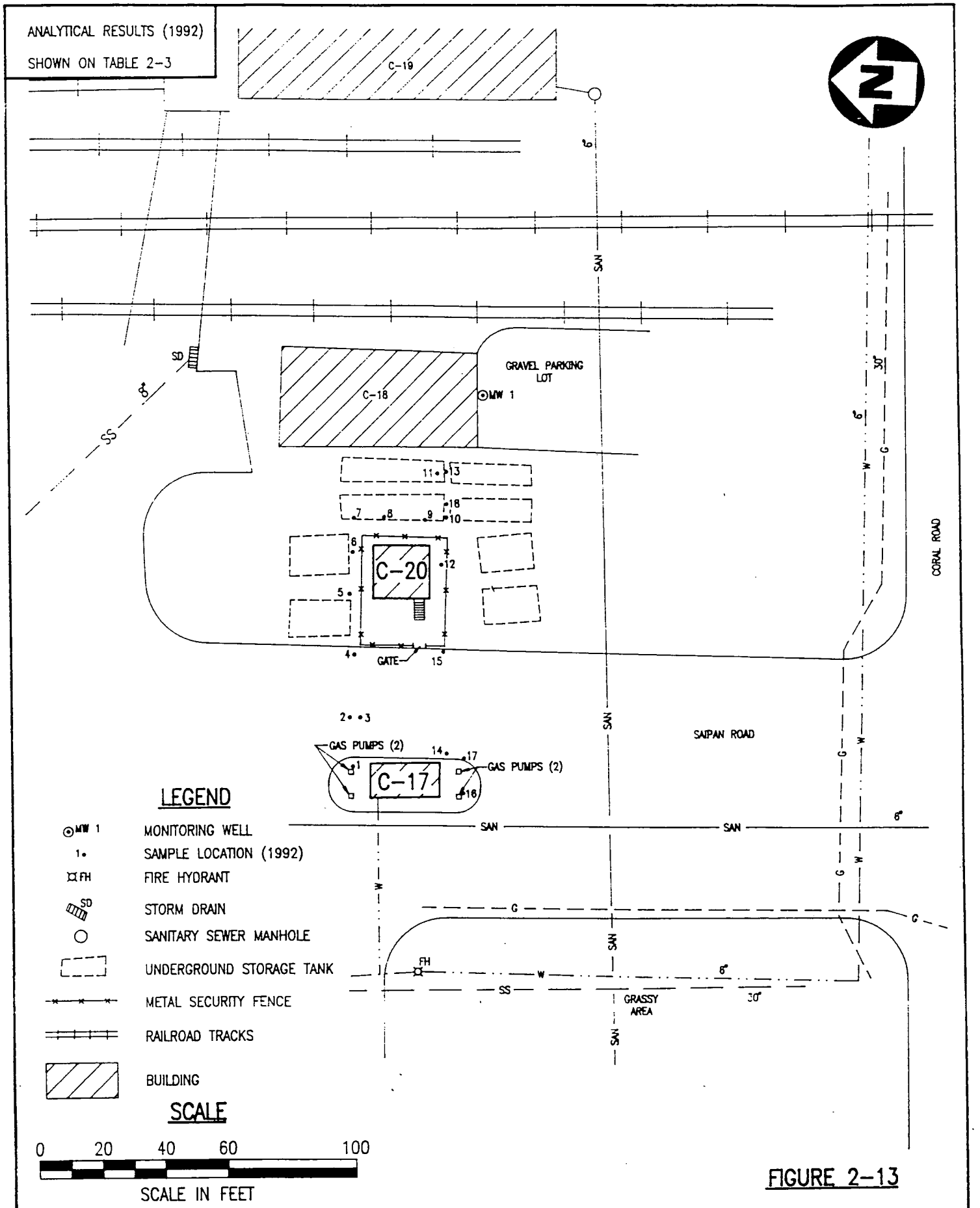


FIGURE 2-13

BUILDINGS C-17/C-20 - DETAIL MAP
CTO 85-UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

HALLIBURTON NUS
Environmental Corporation

The soil beneath Buildings C-17/20, based upon on-site investigation, ranges from loamy material to concrete rubble and has been mapped as Udorthents, smoothed (Figure 2-7).

Buildings C-17/20 are located on the outcrop and recharge area of the glauconitic quartz sand facies of the Vincentown Formation. Groundwater monitoring wells are needed to determine the local groundwater flow direction information. The depth to groundwater beneath Buildings C-17/20, based upon a nearby monitoring well, is about 10 feet below grade.

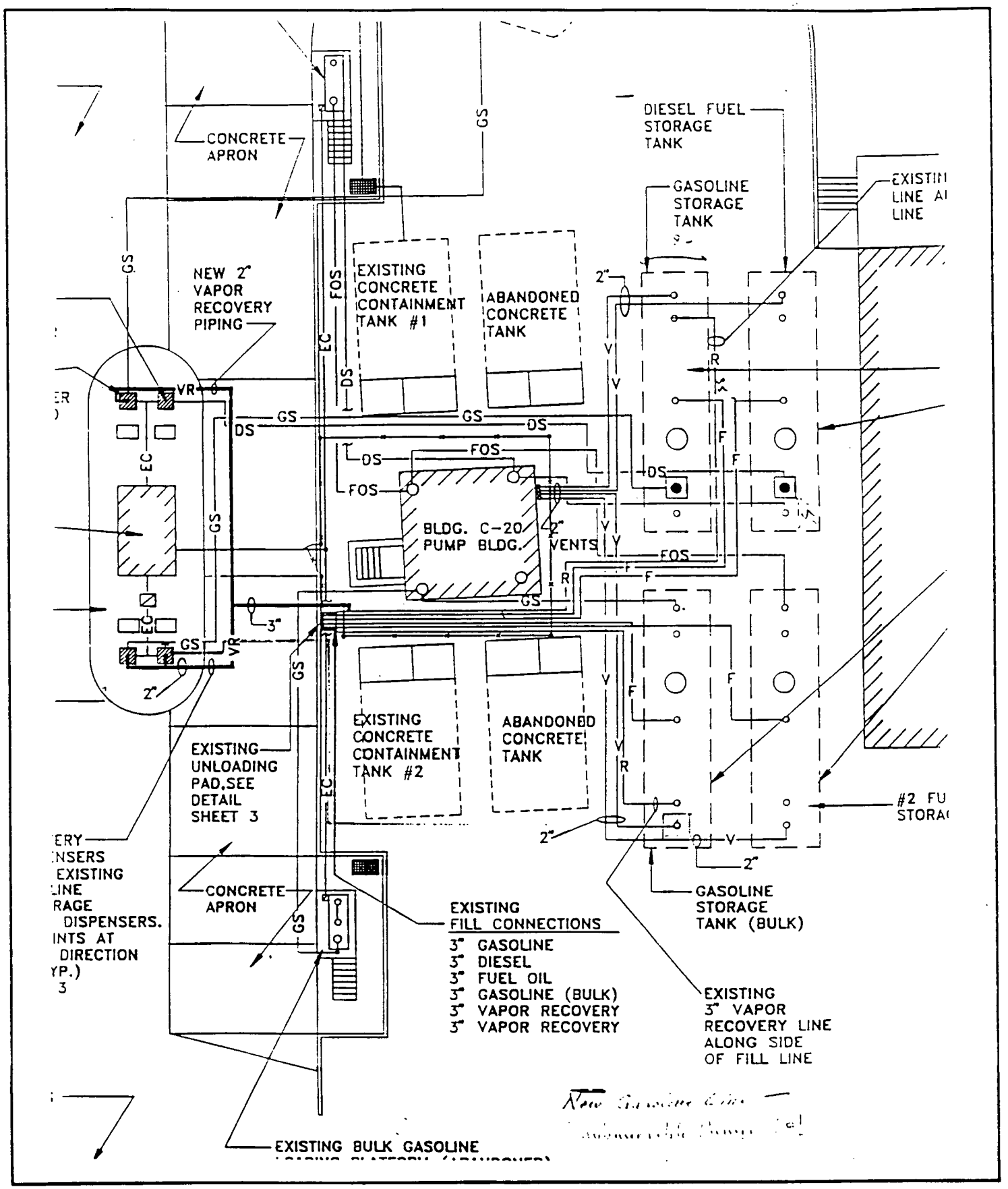
2.3.4 History

USTs C206 and C207 were installed in 1944, C201 was installed in 1975, C205 was installed in 1979, and C202, C203, and C204 were installed in 1985. An as-built diagram for Buildings C-17/20 is in Figure 2-14; based upon field observations, this as-built diagram is inaccurate. Operating and maintenance records, including integrity tests, are not available for the USTs at Buildings C-17/20. The fuel lines connecting USTs C202 and C205 to their respective dispensers failed tightness tests on May 14, 1991. The incident was reported to NJ DEPE and was assigned Case No. 91-5-15-0941-14. A closure permit application and proposed sampling plan were filed with NJ DEPE by the Navy to cover the removal of 200 feet of gasoline piping; the closure application was approved, and TMS No. C-91-2703 was assigned. In 1992, the Navy removed both lines and replaced them with double-wall fiberglass-reinforced plastic piping. Large holes were noted in portions of the piping removed during 1992 pipe removal and replacement activities. Samples collected during 1992 pipe removal and replacement activities at Buildings C-17/20 detected benzene, toluene, ethyl benzene, and xylene (BTEX), lead, and various VOCs in the soil and methylene chloride and chloroform in the groundwater. The contamination detected in the soil confirms that, at a minimum, leakage has occurred from the piping system.

USTs at Building C-20 were tested in May 1993 and found to be tight. However, the piping associated with the diesel tank (C205) was found to be broken. Additional diesel contamination is therefore expected at Buildings C-17/20.

2.3.5 Previous Investigations

An estimated 40 cubic yards of soil was excavated during 1992 pipe removal and replacement activities. Twenty soil samples (E-S-1 through E-S-18, E-S-7D, and E-S-15D) were collected and analyzed for VOC+15, lead, and TPH (Figure 2-13). The soil samples were collected at depths ranging from two to 3.5 feet. Samples E-S-1 through E-S-9, E-S-7D, and E-S-12 were collected on January 31, 1992 and received by Ceimic Corporation on February 1, 1992. Samples E-S-10, E-S-11, E-S-13 through E-S-18,



SOURCE: NAWAC DRAWING No. 2146804

AS-BUILT DIAGRAM FOR BUILDINGS C-17/20
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

FIGURE: 2-14

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and E-S-15D were collected on February 3, 1992 and received by Ceimic Corporation on February 4, 1992. One groundwater sample (MW-1) was collected on March 2, 1992 for VOC+15 including MTBE and TBA, and SVOC+15 analysis from a monitoring well installed as part of the 1992 replacement activities. Sample MW-1 was received by Ceimic Corporation on March 3, 1992. The concentrations of VOC, TPH, and lead detected in 1991 samples are summarized on Table 2-3. A comparison of the maximum concentration of contaminant detected in the soil samples with respective subsurface soil clean-up standard proposed in N.J.A.C. 7:26D is shown on Table 2-4.

The maximum concentrations of tetrachloroethene, benzene, xylene (total), 1,1,1-trichloroethane, and 2-methyl-2-pentanone detected exceed the respective soil clean-up standards proposed in N.J.A.C. 7:26D. A concentration of 388 ug/l of methylene chloride and 4 ug/l of chloroform was detected in the groundwater sample. These do not exceed the groundwater clean-up standard for all organic contaminants, including TPH, of 10 mg/l (10,000 ug/l) proposed in N.J.A.C. 7:26D. The Site Characterization Report prepared by HNUS for the 1992 field and sampling activities is in Appendix B.

Based upon field observations and the analytical results from sampling at Buildings C-17/20, the soil is contaminated at levels above the proposed subsurface soil standards. Additional investigation and remediation are required at Buildings C-17/20 to determine if groundwater contamination is present and to delineate the extent of soil contamination and groundwater contamination, if any.

2.4 BUILDING C-27

2.4.1 Location

Building C-27 is located on the Main Base, east of Gela Road (Figure 2-2) and can be found at 40° 16' 12" north latitude and 74° 09' 45" west longitude on the U.S.G.S. Marlboro, New Jersey quadrangle, 7.5 minute series topographic map. Building C-27 functions as barracks housing.

2.4.2 Description

The 5,000-gallon UST (Tank I.D. No. C27/1) that served Building C-27 before it was removed in 1992 contained home heating oil (No. 2). The tank and associated piping were constructed of single-wall painted/asphalt steel. Tank construction details are summarized in Table 2-2. The tank was located southeast of the boiler room for Building C-27 (Figure 2-15).

Table 2-3
VOCs, TPH, and Lead Detected in 1992 Samples from Building C17/20
CTO 85 – UST RI at Various Sites
NWS Earle, Colts Neck, New Jersey

	E-S-01	E-S-02	E-S-03	E-S-04	E-S-05	E-S-06	E-S-07
Volatile Organic Compound in ug/kg							
methylene chloride	560 J	390 J		1800		530 J	
acetone			6 J				
trichlorethene	220 J	180 J		180 J			
tetrachloroethene	310 J	140 J					
toluene	2600	11000	10 J			120 J	5 J
ethyl benzene	45000	8700	17	2800			4 J
xylene (total)	33000 E	69000 E	94	4700		120 J	13
1,1,1-trichloroethane	1200 J	7600		7200		490 J	5 J
benzene		1500	9 J				5 J
4-methyl-2-pentanone		64000 E					
bromodichloromethane							3 J
cis-1,3-dichloropropene							6 J
bromoform							3 J
1,1,2,2-tetrachloroethane							5 J
C7H14 isomer	9500 J			4000 J			
aliphatic hydrocarbon	40200 J	50800 J	46 J	15200 J	130 J		
trimethylcyclohexane isomer	35700 J	13000 J		17800 J			
C9H20 isomer	3400 J						
C3-benzene isomer	43300 J	91200 J	219 J	5000 J			29 J
unknown	49600 J	63100 J	232 J	56000 J	620 J	12200 J	49 J
C9H18 isomer		20000 J		4300 J			
C4-benzene isomer			63 J				
TPH in mg/kg	91000	30000	3000	7200	2000	9800	
Lead in mg/kg	2.8	2.7	3.3	4.4	4.1	3.4	2.1

	E-S-07D	E-S-08	E-S-09	E-S-10	E-S-11	E-S-12	E-S-13
Volatile Organic Compound in ug/kg							
methylene chloride				620 J	620 J	2500 J	4 J
acetone		72					10 J
toluene				710 J	590 J	960 J	
ethyl benzene					600 J		
xylene (total)	34		9 J	81000 E	4700	15000 E	
1,1,1-trichloroethane				800 J	720 J	14000	
benzene	4 J						
C7H14 isomer					2300 J		
aliphatic hydrocarbon				23800 J	19700 J	9500 J	
C9H20 isomer				3100 J	3700 J		
C3-benzene isomer	40 J		210 J	118000 J	5300 J	221000 J	
unknown		7 J	25 J	12000 J	4400 J	105500 J	
C8H14 isomer				1200 J			
C10H20 isomer				1600 J			
C8H18 isomer					1500 J		
TPH in mg/kg			65	670	5400	1200	
Lead in mg/kg	2	3.3	3.2	2.2	3	1.8	1.3

Table 2-3 Continued

	E-S-14	E-S-15	E-S-15D	E-S-16	E-S-17	E-S-18
Volatile Organic Compound in ug/kg						
methylene chloride		630 B		440 B		
trichlorethene				90 J		
tetrachloroethene				100 J		
toluene	23000	3500	18000		110000	
ethyl benzene	15000	790 J	4600 J		31000	
xylene (total)	350000 E	130000 E	510000 E	4100	250000 E	
1,1,1-trichloroethane	3300 J	1400 J		1300	2600 J	
benzene					8700	1 B
1,1,2,2-tetrachloroethane				170 J		
C7H14 isomer	13000 J					
aliphatic hydrocarbon	152000 J	194000 J	83000 J	17670 J	129000 J	
C9H20 isomer				1000 J	15000 J	
C3-benzene isomer	236000 J	154000 J	482000 J	26700 J	193000 J	
unknown	80400 J			10800 J	82000 J	
C8H18 isomer				3800 J		
2 methyl pentane					30000 J	
TPH in mg/kg	3600	570	380	670	4100	38
Lead in mg/kg	6.1	2.8	9.3	76.7	195	2.2

	MW-01	MW-01D
Volatile Organic Compound in ug/kg		
methylene chloride	38 B	
chloroform	4	4
bis(2-ethyl hexyl)pthalate	6 J	
unknown	9 J	18 J
aliphatic hydrocarbon	63 J	137 J

B – Contaminant Detected in Blank.
J – Estimated Value
E – Concentration Exceeded Calibration Range of Instrument

TABLE 2-4
COMPARISON OF MAXIMUM CONCENTRATION OF CONTAMINANT DETECTED IN SOIL SAMPLES WITH N.J.A.C.:26D CLEAN-UP STANDARDS
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant	Sample Concentration in mg/kg	N.J.A.C.7:26E Proposed Subsurface Soil Standards in mg/kg
methylene chloride	2.5	none listed
acetone	0.72	50
trichloroethene	0.22	1
tetrachloroethene	3.1	1
toluene	110.0	500
ethyl benzene	31.0	100
xylene (total)	510.0	10
1,1,1-trichloroethane	14.0	50
benzene	8.7	1
4-methyl-2-pentanone	64.0	50
bromodichloromethane	0.003	1
cis-1,3-dichloropropene	0.006	none listed
carbon tetrachloride	0.17	1
1,1,2,2-tetrachloroethane	0.005	1
BTEX	532.6	--
TPH	30.0	--
lead	0.195	none listed

ANALYTICAL RESULTS (1992)

SAMPLE ID No.	TPH IN mg/kg
1(01A)	8,400
1(02A)	3,500
2(03A)	<16
2(04A)	3,700
3(05A)	32
3(06A)	540
4(07A)	12,000
5(08A)	100%
7(09A)	21,000
8(10A)	160
9(11A)	13,000

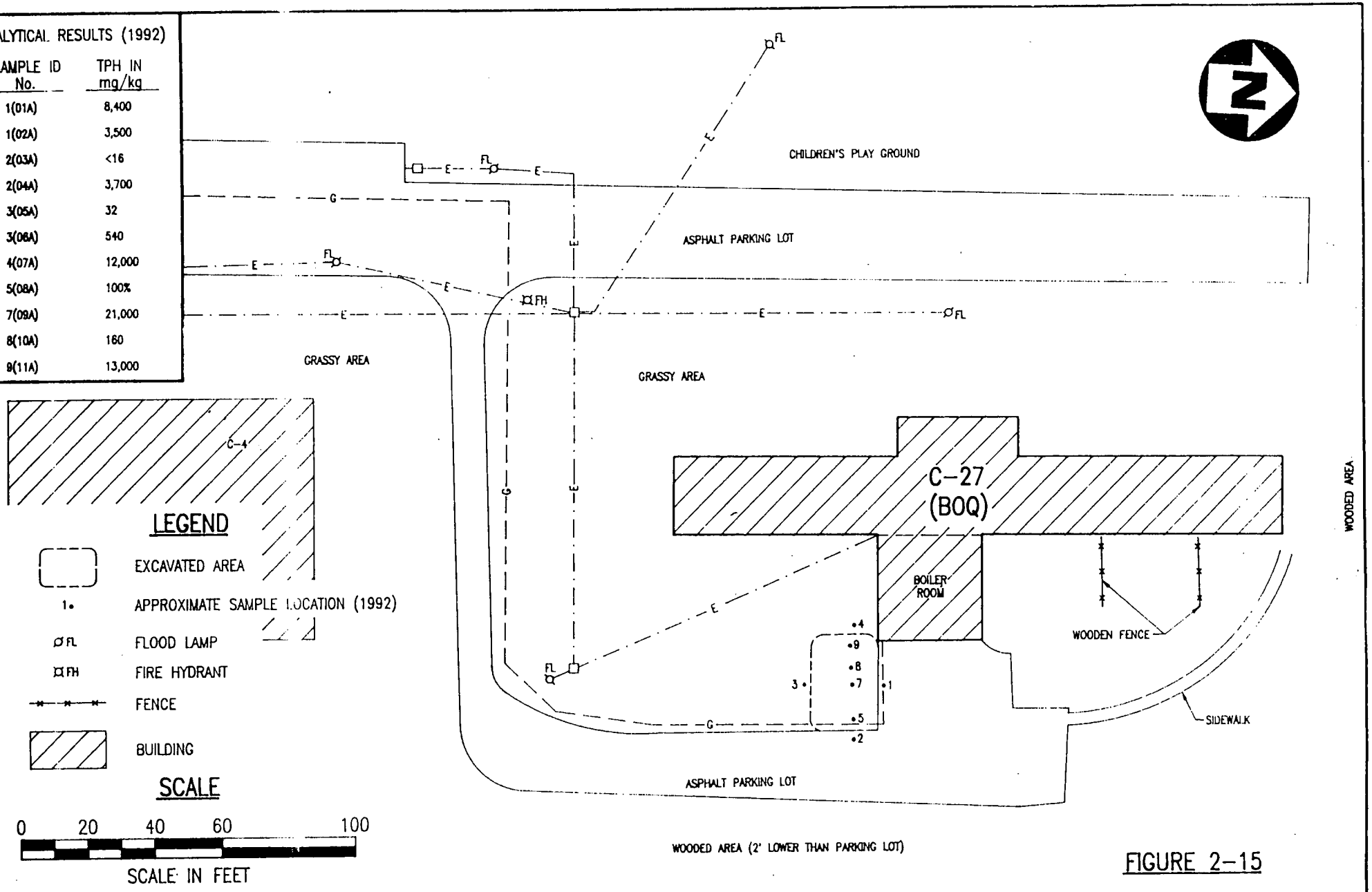

FIGURE 2-15

BUILDING C-27 – DETAIL MAP
CTO 85 – UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

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2.4.3 Physical Setting

The topography at Building C-27 is essentially flat (Figure 2-5). A topographic map of the areas surrounding the building contoured at two-foot intervals is not available. The elevation at Building C-27, based upon the U.S.G.S. Marlboro, New Jersey quadrangle, 7.5 minute series topographic map, is about 100 feet AMSL.

Subsurface utilities near Building C-27 are shown in Figure 2-15. Subsurface utilities that could serve as potential contaminant conduits include electrical and gas lines. Building C-27 has a basement.

Land use within 1,000 feet of Building C-27 includes residential, buildings/offices, recreational facilities, warehouses, recreational areas, undeveloped wooded areas, and undeveloped open areas (Figure 2-2). Approximately 30 percent of the total land within 1,000 feet of Building C-27 is covered by buildings and other impermeable surface covers.

The headwaters of a tributary of Hockhockson Brook is located 700 feet east of Building C-27 (Figure 2-5). Hockhockson Brook drains into the Swimming River via Pine Brook. The Swimming River discharges into the Navesink River and then into Sandy Hook Bay.

The soil beneath Building C-27 may range from loamy material to concrete rubble and has been mapped as Udorthents, smoothed (Figure 2-7). On-site investigation is needed to determine the soil characteristics.

Building C-27 is located on the outcrop and recharge area of the glauconitic quartz sand facies of the Vincentown Formation. Groundwater monitoring wells are needed to determine the local groundwater flow direction. The depth to groundwater beneath Building C-27, based upon the depth to water encountered in the tank excavation area, is about 10 feet below grade.

2.4.4 History

The installation date of the 5,000-gallon UST at Building C-27 is unknown. Historical site plans, as-built diagrams, and operating and maintenance records, including integrity tests, are not available for the UST at Building C-27. The UST at Building C-27 was removed in 1992; the excavated area was subsequently filled in with clean fill material and covered with asphalt. Samples collected during 1992 tank removal activities at Building C-27 detected TPH in the soil and groundwater, indicating that a leak had occurred in either the tank or piping system and/or a spill had occurred around the fill ports. The incident discharge number for Building C-27 is 92-10-8-0841-01.

2.4.5 Previous Investigations

An estimated 6,000 cubic feet of soil (20 feet by 30 feet and 10 feet deep) was excavated during 1992 tank removal activities at Building C-27. Seven soil samples (C-27-1 through C-27-4, C-27-8, and C-27-9) and one groundwater sample (C-27-5A) were collected for TPH analysis from the tank excavation (Figure 2-15). The soil samples were collected from the bottom of the excavation. The date of sample collection, the date of sample receipt at the laboratory, and the name of the laboratory that performed the analysis are not available. The maximum concentration of TPH detected in the soil samples is 21,000 mg/kg (C-27-7). This exceeds the soil clean-up standard for all organic contaminants, including TPH, of 10,000 mg/kg proposed in N.J.A.C. 7:26D. A concentration of 32 mg/l was detected in the groundwater sample. This exceeds the groundwater clean-up standard for all organic contaminants, including TPH, of 10 mg/l proposed in N.J.A.C. 7:26D. Analytical results are summarized on Figure 2-15. A report documenting the excavation and sampling activities was not prepared.

Based upon field observations and the analytical results from sampling at Building C-27, soil and groundwater at Building C-27 are contaminated at levels above the proposed subsurface soil standards. Additional investigation and remediation are required at Building C-27 to delineate the extent of soil and groundwater contamination.

2.5 BUILDING S-106B

2.5.1 Location

Building S-106B is located on the Main Base, south of Esperance Road and NJ Highway 34 (Figure 2-2) and can be found at 40° 15' 45" north latitude and 74° 09' 38" west longitude on the U.S.G.S. Marlboro, New Jersey quadrangle, 7.5 minute series topographic map. Building S-106B was used for family housing.

2.5.2 Description

The 1,000-gallon UST (Tank I.D. No. 0020) that served Building S-106B before it was removed in 1991 contained home heating oil (No. 2). The tank and associated piping were constructed of single-wall coated steel. Construction details for the tank system are summarized in Table 2-2. The tank was located at the northern end of the northeastern side of Building S-106B (Figure 2-16).

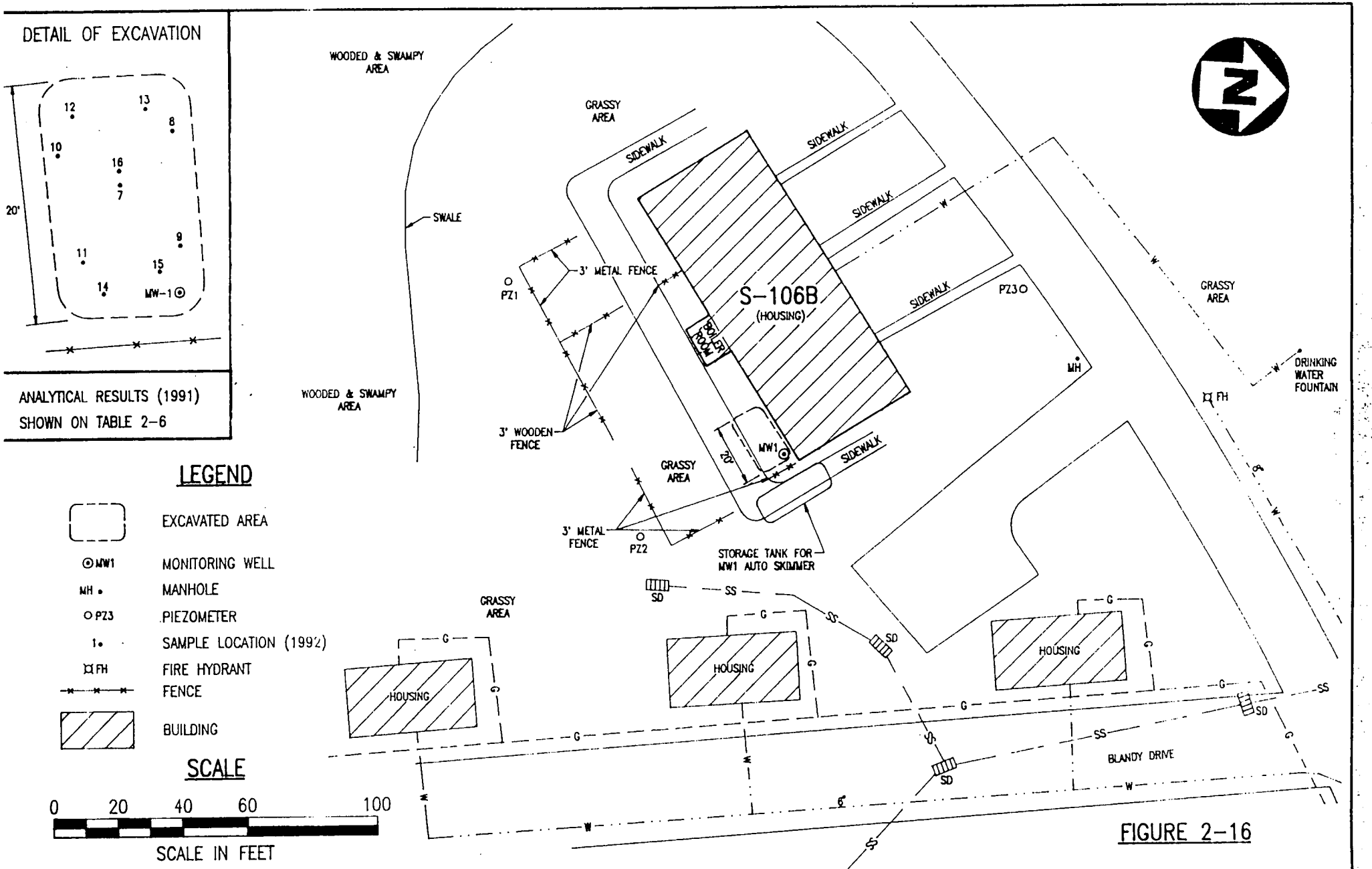

FIGURE 2-16

BUILDING S-106B - DETAIL MAP
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

HALLIBURTON NUS
Environmental Corporation

2.5.3 Physical Setting

Building S-106B is located along the southern edge of a small, east-west-trending hill (Figure 2-5). A topographic map of the area surrounding the building contoured at two-foot intervals is not available. The elevation at Building S-106B, based upon the U.S.G.S. Marlboro, New Jersey quadrangle, 7.5 minute series topographic map, is about 130 AMSL. A concrete swale is located east and south of the building.

Subsurface utilities near Building S-106B are shown in Figure 2-16. Subsurface utilities that could serve as potential contaminant conduits include fresh-water, storm sewer, and gas lines. Building S-106B has a slab foundation.

Land use within 1,000 feet of Building S-106B includes residential, recreational facilities and areas, buildings/offices, undeveloped open areas, and undeveloped wooded areas (Figure 2-2). Approximately 20 percent of the total land within 1,000 feet of Building S-106B is covered by buildings and other impermeable surface covers.

A drainage ditch located near Building S-106B drains into Hockhockson Brook. Hockhockson Brook drains into the Swimming River via Pine Brook. The Swimming River discharges into the Navesink River and then into Sandy Hook Bay.

The soil beneath Building S-106B has been mapped as Udorthents, smoothed (Figure 2-7). One monitoring well and three piezometers were installed on the site as part of the 1991 tank removal activities (Figure 2-16). Soil boring logs from the monitoring well and piezometers encountered 24 feet of light green, fine- to medium- and medium- to coarse-grained sand.

Building S-106B is located on the outcrop and recharge area of the Kirkwood Formation. The direction of groundwater flow based upon the on-site monitoring well and piezometers is east-northeast. The depth to groundwater beneath Building S-106B ranges from 25 to 28 feet below grade.

2.5.4 History

The 1,000-gallon UST at Building S-106B was installed in 1952. Historical site plans, as-built diagrams, and operating and maintenance records are not available for the UST at Building S-106B. The UST at Building S-106B failed a tightness test in May 1990 and was leaking so fast that a rate could not be measured. The incident was reported to the NJ DEPE Spill Hotline and was assigned Case No. 90-05-09-1324. The tank was cleaned and removed in November/Decemb r 1991. The excavated area was

subsequently filled in with clean fill material and covered with asphalt. Three piezometers (PZ-1 through PZ-3) and one monitoring well (MW-1) were installed as part of the 1991 tank removal activities. Thirty-six inches of free product were measured on February 27, 1992 in the on-site monitoring well (MW-1) using an oil-water interphase probe. The presence of a substantial amount of free product in the on-site monitoring well confirms that contamination exists beneath the area.

2.5.5 Previous Investigations

An estimated 392 tons of grossly contaminated soil were excavated during 1991 tank removal activities. Nine subsurface soil samples collected during the installation of the piezometers and six subsurface soil samples collected during the monitoring well installation were analyzed for TPH. The samples obtained from the piezometer installation were collected on October 28, 1992 and were shipped to GTEL Environmental Laboratory, Incorporated. The samples obtained from the monitoring well installation were collected on January 22, 1992 and were received by GTEL on January 30, 1992. No TPH was detected in the subsurface soil samples collected from the piezometer installations. A concentration of 8,000 mg/kg of TPH was detected in one of the subsurface soil samples collected from the monitoring installation. This is below the soil clean-up standard for all organic contaminants, including TPH, of 10,000 mg/kg proposed in N.J.A.C. 7:26D. Nine subsurface soil samples (8 through 16) collected from the excavation and three stockpile soil samples (17, 19, and 21) were obtained on November 25, 1991. These samples were analyzed for TPH (Figure 2-16); one of the samples (16) was also analyzed for PPL+40. The subsurface soil samples obtained from the excavation were received by W.A.T.E.R. on November 25, 1991. The maximum concentration of TPH detected in soil samples was 12,062 mg/kg (17). This exceeds the soil clean-up standard for all organic contaminants, including TPH, of 10,000 mg/kg proposed in N.J.A.C. 7:26D. A comparison of the VOCs and SVOCs contaminants and metals detected in sample 16 with respective clean-up standards proposed in N.J.A.C. 7:26D is in Table 2-5.

Pesticides, polychlorinated biphenyls (PCBs), and cyanide were not detected in sample 16; a concentration of 18.3 mg/kg of total phenols was detected.

A surface water sample (WS-01) was collected from the concrete swale located south-southeast of Building S-106B for PPL VOC+15 and SVOC+15. Sample WS-01 was analyzed by GTEL. Minor concentrations of di-n-octyl phthalate (3.2J ug/l) and bis(2-ethylhexyl) phthalate (5.1JB ug/l) were detected in sample WS-01.

A sample of the free product was collected for a hydrocarbon fingerprint analysis on February 26, 1992. The analyses, performed by GTEL, confirmed the product to b in the boiling range of diesel or No. 2 fuel. The concentration of TPH detected in 1991 samples, excluding 16, is summarized in Table 2-6. The Navy

TABLE 2-5
A COMPARISON OF VOCS AND SVOCS CONTAMINANTS AND METALS DETECTED IN SAMPLE 16 (BUILDING S-106B) WITH N.J.A.C. 7:26D
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant	Sample Concentration in mg/kg	N.J.A.C. 7:26D Proposed Subsurface Soil Standards in mg/kg
VOCs and SVOCs		
chloroform	0.34	1.
1,1,1-trichloroethane	0.38	50.
trichloroethane	0.48	1.
tetrachloroethane	0.46	1.
ethyl benzene	0.84	100.
xylenes (total)	9.1	10.
2-methylnaphthalene	22.0	none listed
fluorene	7.1	100.
phenanthrene	13.0	none listed
anthracene	1.1	500.
pyrene	1.7	500.
METALS		
arsenic	19.15	none listed
beryllium	1.2	none listed
chromium	198.7	none listed
lead	6.17	none listed
selenium	1.99	none listed
zinc	9.74	none listed

Table 2–6
TPH Detected in 1991 Samples from Building S–106B
CTO–85 UST RI at Various Sites
NWS Earle, Colts Neck, New Jersey

	MW1(18–20')	8	9	10	11
TPH in mg/kg	8000	11659	10750	74	41

	12	13	14	15	16
TPH in mg/kg	2474	8002	3058	11982	10596

	17	19	21
TPH in mg/kg	12062	4001	50

Note: Samples 17, 19, and 21 collected from stockpiled soil.

installed an automatic skimmer in MW-1 in March 1992; the skimmer is infrequently in service. The Discharge Investigation and Corrective Action Report prepared by K&D (June 19, 1992) for this event is in Appendix B.

Based upon field observations and the analytical results from sampling at Building S-106B, soil and groundwater at Building S-106B are contaminated at levels above the proposed subsurface soil standards. Additional investigation and remediation are required at Building S-106B to delineate the extent of soil and groundwater contamination.

2.6 BUILDINGS R-6/7

2.6.1 Location

Buildings R-6/7 are located in a secured portion of the Waterfront area, west of Normandy Road (Figure 2-3) and can be found at 40° 25' 10" north latitude and 74° 04' 16" west longitude on the U.S.G.S. Sandy Hook, New Jersey-New York quadrangle, 7.5 minute series topographic map.

Buildings R-6/7 serve as the supply gas station for the Waterfront area. Building R-6 is the office for the pump island and Building R-7 is the pump house. Building R-7 is enclosed by a metal security fence.

2.6.2 Description

Of the four USTs (Tank I.D. No. R701 through R704) registered at Building R-7, three (Tank ID Nos. R701 through R703) are currently in service. USTs R701, R702, and R703 are 12,000-gallon single-wall fiberglass-clad steel tanks with single-wall fiberglass-reinforced plastic piping. UST R701 contains unleaded gasoline, R702 contains medium diesel fuel (No. 2-D), and R703 contains home heating oil (No. 2). UST R704 is a 12,500-gallon single-wall concrete spill containment and overflow tank with bare steel piping. Construction details for the tank systems are summarized in Table 2-7. The tanks are located in the vicinity of Building R-7 (Figure 2-17).

2.6.3 Physical Setting

The topography at the buildings is essentially flat (Figure 2-6). A topographic map of the areas surrounding the buildings contoured at two-foot intervals is not available. The elevation at Buildings R-6/7, based upon the U.S.G.S. Sandy Hook, New Jersey-New York quadrangle, 7.5 minute series topographic map, is about 10 feet AMSL.

TABLE 2-7
TANK CONSTRUCTION DETAILS
WATERFRONT AREA AOC
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

	Buildings R-6/7			
	Tank ID No. R7/01	Tank ID No. R7/02	Tank ID No. R7/03	Tank ID No. R7/02
Tank Status	in use	in use	in use	unknown
Installation Year	1984	1984	1984	1944
Tank Age (Years)	9	9	9	49
Tank Size (Gallons)	12,000	12,000	12,000	12,500
Tank Contents	unleaded gasoline	medium diesel fuel (No. 2-D)	home heating oil (No. 2)	spill
Tank Construction	single-wall fiberglas-clad steel	single-wall fiberglas-clad steel	single-wall fiberglas-clad steel	single-wall concrete
Piping Construction	single-wall fiberglass-reinforced plastic	single-wall fiberglass-reinforced plastic	single-wall fiberglass-reinforced plastic	Bare steel
Internal Tank and Piping Lining	none	none	none	none
Secondary Containment	none	none	none	none
Cathodic Protection	none	none	none	none
Monitoring/Detection System Tank and Piping	none	none	none	none

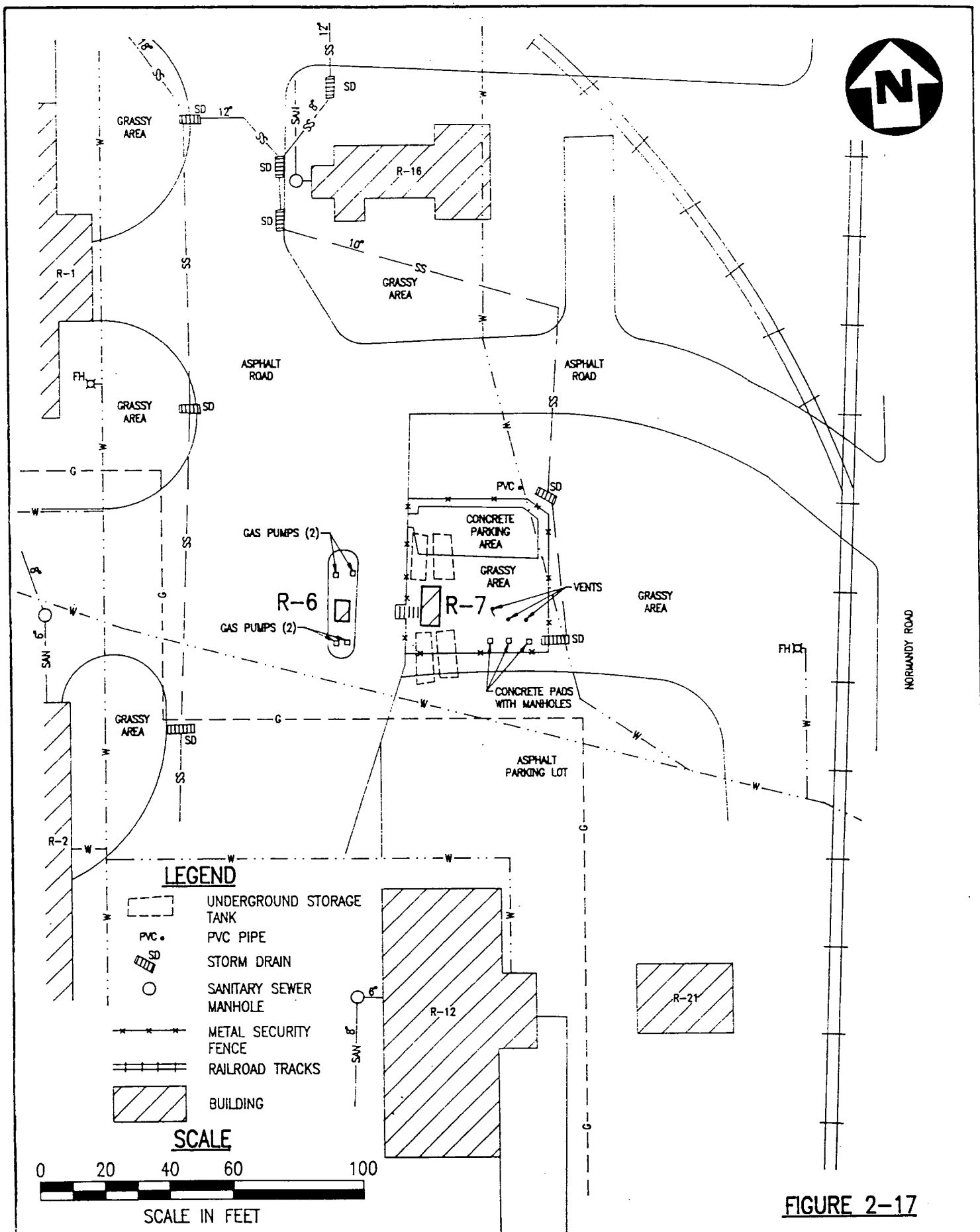

FIGURE 2-17

BUILDING R-6/R-7 DETAIL MAP
CTO 85-UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

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Soil contamination was encountered during the 1990 installation of vapor recovery piping at Buildings R-6/7. The contamination was attributed to a dripping compromised joint between a fiberglass pipe from a 12,000-gallon gasoline UST and an iron pipe leading to gasoline pumps. The piping was repaired, and contaminated soil in the construction path was removed. The Site Characterization and Plan of Action Report prepared by K&D (October 1991, revised July 1992) for this event is in Appendix B.

No sampling has been conducted to date at Buildings R-6/7. Historical soil and/or groundwater contamination may be present beneath Buildings R-6/7 because of the age and history of the UST systems. Investigation is required at Buildings R-6/7 to determine if soil and groundwater contamination is present at concentrations above soil and groundwater clean-up standards proposed in N.J.A.C. 7:26D. Remediation will be necessary if contamination is detected at concentrations greater than proposed clean-up standards.

Subsurface utilities near Buildings R-6/7 are shown in Figure 2-17. Subsurface utilities that may serve as contaminant conduits include fresh-water, storm sewer, and gas lines. Storm drains are located immediately adjacent to the northeast and southeast sections of the security fence of Building R-7.

Land use within 1,000 feet of Buildings R-6/7 includes residential, buildings/offices, warehouse, recreational areas, rail yards, undeveloped wooded areas, undeveloped open areas, and wetlands (Figure 2-3). Approximately 50 percent of the total land area within 1,000 feet of Buildings R-6/7 is covered by buildings and other impermeable surface covers, and 30 percent is covered by marshes.

Marshes associated with Ware Creek have been mapped 600 feet northwest of Buildings R-6/7 (Figure 2-6). Ware Creek, located 1,000 feet west of the buildings, discharges to Sandy Hook Bay about 3,800 feet north-northwest of the buildings. The soil beneath Buildings R-6/7 may range from loamy material to concrete rubble and has been mapped as the Udorthents-Urban land complex, zero to three percent slopes (Figure 2-8). On-site investigation is needed to determine the soil characteristics. Two 22-foot deep soil borings were installed on the site as part of the 1984 tank installation activities. The borings encountered 16 to 17 feet of brown, fine- to medium-grained sand with traces of silt and gravel on top of a gray clay.

Buildings R-6/7 are located on the outcrop and recharge area of the Englishtown Formation. Groundwater monitoring wells are needed to determine the local groundwater flow direction. The depth to groundwater beneath Buildings R-6/7, based upon 1984 tank installation activities, is approximately eight feet below grade. The top of the water table may be tidally influenced in this area.

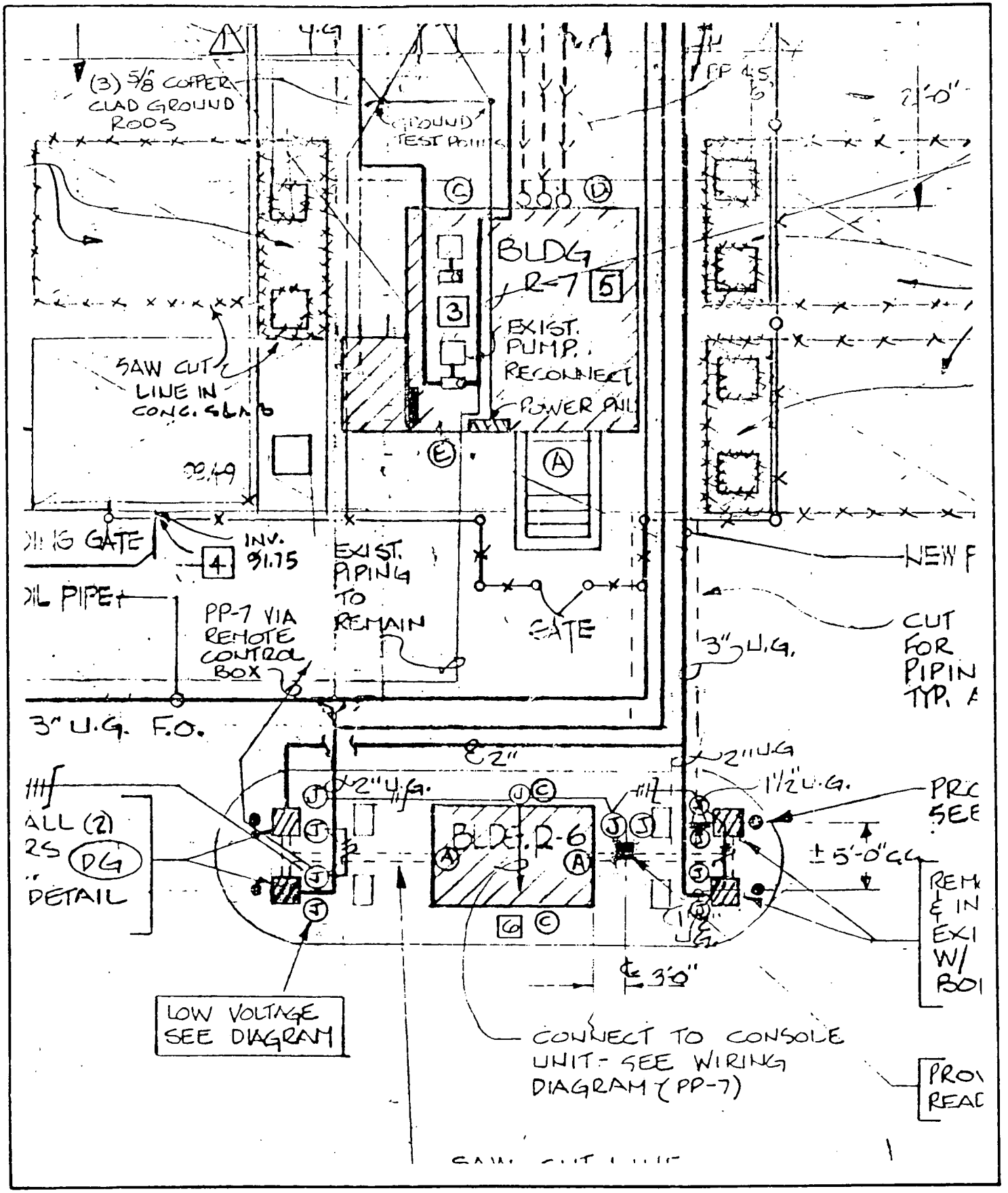
2.6.4 History

UST R704 was installed in 1944 and the three remaining USTs were installed in 1984. An as-built diagram for Buildings R-6/7 is in Figure 2-18; the accuracy of this diagram is not known. Historical site plans and operating and maintenance records, including integrity tests, are not available for the USTs at Buildings R-6/7. To date, no sampling has been done at Buildings R-6/7. The incident discharge number for Buildings R-6/7 is 90-09-10-1044.

According to the K&D report (October 1991, revised July 1992), four concrete gasoline and diesel fuel tanks existed at the Waterfront gas stations before 1984. Three of the four tanks were abandoned in place by removing the top of the tank, emptying it, and filling the tank with clean sand. Much of the piping associated with these tanks has been abandoned in place. No soil or groundwater sampling was conducted at that time. The remaining concrete tank (R704) is currently used for spill containment and overflow.

2.6.5 Previous Investigations

The amount of soil excavated during 1984 tank installation activities is not known. Two soil borings were installed on site as part of the tank installation. The borings reached total depths of 22 feet and penetrated 16 to 17 feet of fine- to medium-grained sand with a trace of gravel and silt on top of a gray clay.



SOURCE: NAVAFAC DRAWING No. 2058246

AS-BUILT DIAGRAM FOR BUILDINGS R-6/7
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

FIGURE: 2-18

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3.0 FIELD SAMPLING ANALYTICAL PLAN

3.1 APPLICABLE REGULATIONS AND GUIDELINES

Applicable regulations and procedures pertaining to site remedial investigations and clean-up standards reviewed for this project include

- NJ DEPE Site Remediation Program Technical Requirements for Site Remediation Proposed New Rules: N.J.A.C. 7:26E.
- NJ DEPE Site Remediation Program Cleanup Standards for Contaminated Sites Proposed New Rules: N.J.A.C. 7:26D.
- NJ DEPE Water Technical Programs Ground Water Quality Standards Proposed Repeal and New Rules: N.J.A.C. 7:9-6.

Copies of these documents are in Appendix D.

3.2 SAMPLING OBJECTIVES

HNUS was tasked to perform a remedial investigation in accordance with N.J.A.C. 7:26E. To accomplish the objectives of this project in a timely and cost-effective manner, field activities will be conducted in two phases, Phase I and Phase II. Sampling objectives for Phase I field operations are to delineate the lateral extent of soil and groundwater contamination and confirm the presence or absence of contamination at concentrations above applicable soil and groundwater clean-up standards proposed in N.J.A.C. 7:26D. If contamination in soil and/or groundwater is confirmed at concentrations above applicable proposed clean-up standards, sampling objectives for Phase II field operations include determining the direction of groundwater flow and aquifer characteristics, conducting well searches, and determining if nearby wells, surface water bodies, and wetlands are affected. Upon completion of the field investigative program, sufficient information will have been gathered to allow for the preparation of an RI report.

3.3 PHASE I FIELD INVESTIGATIVE TASK DESCRIPTION

The purpose of Phase I field operations is to delineate the extent of contamination above applicable soil and groundwater clean-up standards proposed in N.J.A.C. 7:26D in accordance with 7:26E-4.3 and 4.4 Remedial Investigation of Soil and Groundwater. Phase I investigative methods and rationale are in the following table.

Phase I Investigative Methods and Rationale

Investigative Method	Rationale
Geoprobe System	Delineate the vertical and horizontal extent of soil and groundwater contamination in accordance with N.J.A.C. 7:26E-4.3 and 4.4 Remedial Investigation of Soil and Groundwater.
Soil Borings	Delineate the vertical and horizontal extent of contamination that is above applicable soil clean-up standards proposed in N.J.A.C. 7:26D, if any, and establish a contaminant gradient in accordance with N.J.A.C. 7:26E-4.3 Remedial Investigation of Soil.
Permanent Groundwater Monitoring Wells	Determine the depth to groundwater and establish if contamination above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D is present.

To accomplish Phase I objectives, environmental sampling of soil gas, subsurface soil, and groundwater will be conducted during Phase I field operations. The following field activities will be conducted during Phase I field operations at Buildings C-10, C-13, C-17/20, C-27, S-106B, and R-6/7 unless otherwise specified:

- Collection of discrete subsurface soil and groundwater samples for 24-hour quick turnaround laboratory chemical analysis using a Geoprobe System at Buildings C-10/13, C-27, and S-106B. Conduct a soil gas survey using a Geoprobe System at Buildings C-17/20 and R-6/7. Soil gas samples will be analyzed in the field using an OVA in the GC mode.

- Installation of four soil borings and the collection of subsurface soil samples for field screening and discrete subsurface soil samples for standard turnaround laboratory chemical analysis. Descriptive boring logs will be prepared for the four borings.

- Surveying of the Geoprobe sites and the soil borings to a common local datum.

- Installation of one permanent groundwater monitoring well at Buildings C-10, C-13, C-17/20, and C-27 and two permanent groundwater monitoring wells at Buildings R-6/7 and the collection of subsurface soil samples for field screening.

- Collection of single-event static-water-level measurements from the permanent groundwater monitoring well(s).

- Collection of one round of groundwater samples for standard turnaround laboratory chemical analysis from the permanent groundwater monitoring well. If contamination is detected at concentrations above applicable clean-up standards proposed in N.J.A.C. 7:26D, two additional rounds of groundwater samples will be collected for standard turnaround laboratory chemical analysis. Groundwater samples will not be collected from those monitoring wells with free product.

- Surveying of the permanent groundwater monitoring well(s) to an established datum.

- Collection of one sample per drum of split-spoon samples/cuttings per site, one sample of stockpiled soil per site, and one sample per drum of development/decontamination water per site for standard turnaround laboratory chemical analysis.

The type, number, and rationale for Phase I sampling are summarized in Tables 3-1 through 3-6 for Buildings C-10, C-13, C-17/20, C-27, S-106B, and R-6/7; proposed sampling locations are shown on Figures 3-1 through 3-6, respectively. Phase I field activities are presented by task in the following paragraphs. All Phase I field activities will be conducted in accordance with procedures referenced in the NJ DEPE Field Sampling Procedures Manual (FSPM) in effect at the date of sampling and in accordance with the health and safety procedures established in the Site Health and Safety Plan (HASP, Appendix F).

3.3.1 Geoprobe System

Subsurface soil samples and groundwater samples will be collected using a Geoprobe System (as described in Section 4.4) at all the buildings in order to determine the extent of heating-oil-fuel- or diesel-fuel-derived contamination attributable to USTs located at the buildings. A soil gas survey will be conducted at Geoprobe sites at Buildings C-17/20 and R-6/7 to determine the extent of gasoline-derived contamination.

Subsurface soil samples will be collected for 24-hour quick turnaround laboratory chemical analysis from approximately five feet below grade at the Geoprobe sites at Buildings C-10, C-13, C-17/20, C-27, and R-6/7. At Building S-106B, subsurface soil samples will be collected for 24-hour quick turnaround laboratory chemical analysis in the field from approximately 10 feet below grade at the Geoprobe sites. The subsurface soil samples will be submitted to an NJ-DEPE-certified, Navy Energy and Environmental Support Activity (NEESA)-approved laboratory for TPH analysis (24-hour quick turnaround). Groundwater samples will be collected for 24-hour quick turnaround laboratory chemical analysis at all the Geoprobe sites and checked for free product. If free product is not present, the groundwater sample will be submitted

TABLE 3-1
PHASE I SAMPLING PLAN RATIONALE FOR BUILDING C-10
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

Sample Type	Number of Samples	Analysis	Rationale
Subsurface Soil	6 samples (1 per Geoprobe site)[1]	TPH (laboratory 24-hour quick turnaround analysis	Delineate the spatial distribution of contamination in subsurface soils.
	8 samples (2 per soil boring)	TPH (laboratory standard turnaround analysis)	Confirm the extent of contamination that is above applicable soil clean-up standards proposed in N.J.A.C. 7:26D.
Groundwater	6 samples (1 per Geoprobe site)[1]	TPH (laboratory 24-hour quick turnaround analysis)	Delineate the extent of contamination in groundwater.
	1 sample (monitoring well)	TPH, VOC+10, and SVOC+15 (laboratory standard turnaround analysis)	Determine if contamination is above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D.
	2 samples (monitoring well; samples to be collected a minimum of 30 days apart)	TPH, VOC+10, and SVOC+15 (laboratory standard turnaround analysis)	Confirm that contamination, if any, is above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D.
Drum - Cuttings	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize cuttings for disposal
Drum - Water	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize water for disposal
Stockpiled Soil	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize stockpiled soil for disposal

1 The actual number of samples collected may increase based upon 24-hour quick turnaround analysis.

TPH - Total petroleum hydrocarbons

BTEX - Benzene, toluene, ethyl benzene, and xylene

TABLE 3-2
PHASE I SAMPLING PLAN RATIONAL FOR BUILDING C-13
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

Sample Type	Number of Samples	Analysis	Rationale
Subsurface Soil	7 samples (1 per Geoprobe site)[1]	TPH (laboratory 24-hour quick turnaround analysis	Delineate the spatial distribution of contamination in subsurface soils.
	8 samples (2 per soil boring)	TPH (laboratory standard turnaround analysis)	Confirm the extent of contamination that is above applicable soil clean-up standards proposed in N.J.A.C. 7:26D.
Groundwater	7 samples (1 per Geoprobe site)[1]	TPH (laboratory 24-hour quick turnaround analysis)	Delineate the extent of contamination in groundwater.
	1 sample (monitoring well)	TPH, VOC+10, and SVOC+15 (laboratory standard turnaround analysis)	Determine if contamination is above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D.
	2 samples (monitoring well; samples to be collected a minimum of 30 days apart)	TPH, VOC+10, and SVOC+15 (laboratory standard turnaround analysis)	Confirm that contamination, if any, is above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D.
Drum - Cuttings	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize cuttings for disposal
Drum - Water	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize water for disposal
Stockpiled Soil	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize stockpiled soils for disposal

[1] The actual number of samples collected may increase based upon 24-hour quick turnaround analysis.

TPH - Total petroleum hydrocarbons

BTEX - Benzene, toluene, ethyl benzene, and xylene

TABLE 3-3
PHASE I SAMPLING PLAN RATIONAL FOR BUILDINGS C-17/20
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

Sample Type	Number of Samples	Analysis	Rationale
Soil Gas	16 samples (1 per Geoprobe site)[1]	BTEX (field analysis using OVA in GC mode)	Delineate the lateral extent of gasoline-derived contamination in soil.
Subsurface Soil	16 samples (1 per Geoprobe site)[1]	TPH (laboratory 24-hour quick turnaround analysis	Delineate the spatial distribution of contamination in subsurface soils.
	8 samples (2 per soil boring)	TPH, VOC+10, lead (laboratory standard turnaround analysis)	Confirm the extent of contamination that is above applicable soil clean-up standards proposed in N.J.A.C. 7:26D.
Groundwater	16 samples (1 per Geoprobe site)[1]	TPH (laboratory 24-hour quick turnaround analysis)	Delineate the extent of contamination in groundwater.
	2 samples (1 per monitoring well)	TPH, VOC+10, MTBE, TBA, and SVOC+15 (laboratory standard turnaround analysis)	Determine if contamination is above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D.
	4 samples (2 per monitoring well; samples to be collected a minimum of 30 days apart)	TPH, VOC+10, MTBE, TBA, and SVOC+15 (laboratory standard turnaround analysis)	Confirm that contamination, if any, is above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D.
Drum - Cuttings	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize cuttings for disposal
Drum - Water	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize water for disposal
Stockpiled Soil	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize stockpiled soil for disposal

[1] The actual number of samples collected may increase based upon 24-hour quick turnaround analysis.
TPH - Total petroleum hydrocarbons
BTEX - Benzene, toluene, ethyl benzene, and xylene
MTBE - Methyl tertiary butyl ether
TBA - Tertiary butyl alcohol

TABLE 3-4
PHASE I SAMPLING PLAN RATIONAL FOR BUILDING C-27
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

Sample Type	Number of Samples	Analysis	Rationale
Subsurface Soil	6 samples (1 per Geoprobe site)[1]	TPH (laboratory 24-hour quick turnaround analysis	Delineate the spatial distribution of contamination in subsurface soils.
	8 samples (2 per soil boring)	TPH (laboratory standard turnaround analysis)	Confirm the extent of contamination that is above applicable soil clean-up standards proposed in N.J.A.C. 7:26D.
Groundwater	6 samples (1 per Geoprobe site)[1]	TPH (laboratory 24-hour quick turnaround analysis)	Delineate the extent of contamination in groundwater.
	1 sample (monitoring well)	TPH, VOC+10, and SVOC+15 (laboratory standard turnaround analysis)	Determine if contamination is above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D.
	2 samples (monitoring well; samples to be collected a minimum of 30 days apart)	TPH, VOC+10, and SVOC+15 (laboratory standard turnaround analysis)	Confirm that contamination, if any, is above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D.
Drum - Cuttings	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize cuttings for disposal
Drum - Water	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize water for disposal
Stockpiled Soil	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize stockpiled soil for disposal

[1] The actual number of samples collected may increase based upon 24-hour quick turnaround analysis.

TPH - Total petroleum hydrocarbons

BTEX - Benzene, toluene, ethyl benzene, and xylene

TABLE 3-5
PHASE I SAMPLING PLAN RATIONAL FOR BUILDING S-106B
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

Sample Type	Number of Samples	Analysis	Rationale
Subsurface Soil	6 samples (1 per Geoprobe site)[1]	TPH (laboratory 24-hour quick turnaround analysis	Delineate the spatial distribution of contamination in subsurface soils.
	8 samples (2 per soil boring)	TPH (laboratory standard turnaround analysis)	Confirm the extent of contamination that is above applicable soil clean-up standards proposed in N.J.A.C. 7:26D.
Groundwater	6 samples (1 per Geoprobe site)[1]	TPH (laboratory 24-hour quick turnaround analysis)	Delineate the extent of contamination in groundwater.
	1 sample (monitoring well)	TPH, VOC+10, and SVOC+15 (laboratory standard turnaround analysis)	Determine if contamination is above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D.
	2 samples (monitoring well; samples to be collected a minimum of 30 days apart)	TPH, VOC+10, and SVOC+15 (laboratory standard turnaround analysis)	Confirm that contamination, if any, is above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D.
Drum - Cuttings	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize cuttings for disposal
Drum - Water	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize water for disposal
Stockpiled Soil	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize stockpiled soil for disposal

1 The actual number of samples collected may increase based upon 24-hour quick turnaround analysis.

TPH - Total petroleum hydrocarbons

BTEX - Benzene, toluene, ethyl benzene, and xylene

TABLE 3-6
PHASE I SAMPLING PLAN RATIONAL FOR BUILDINGS R-6/7
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

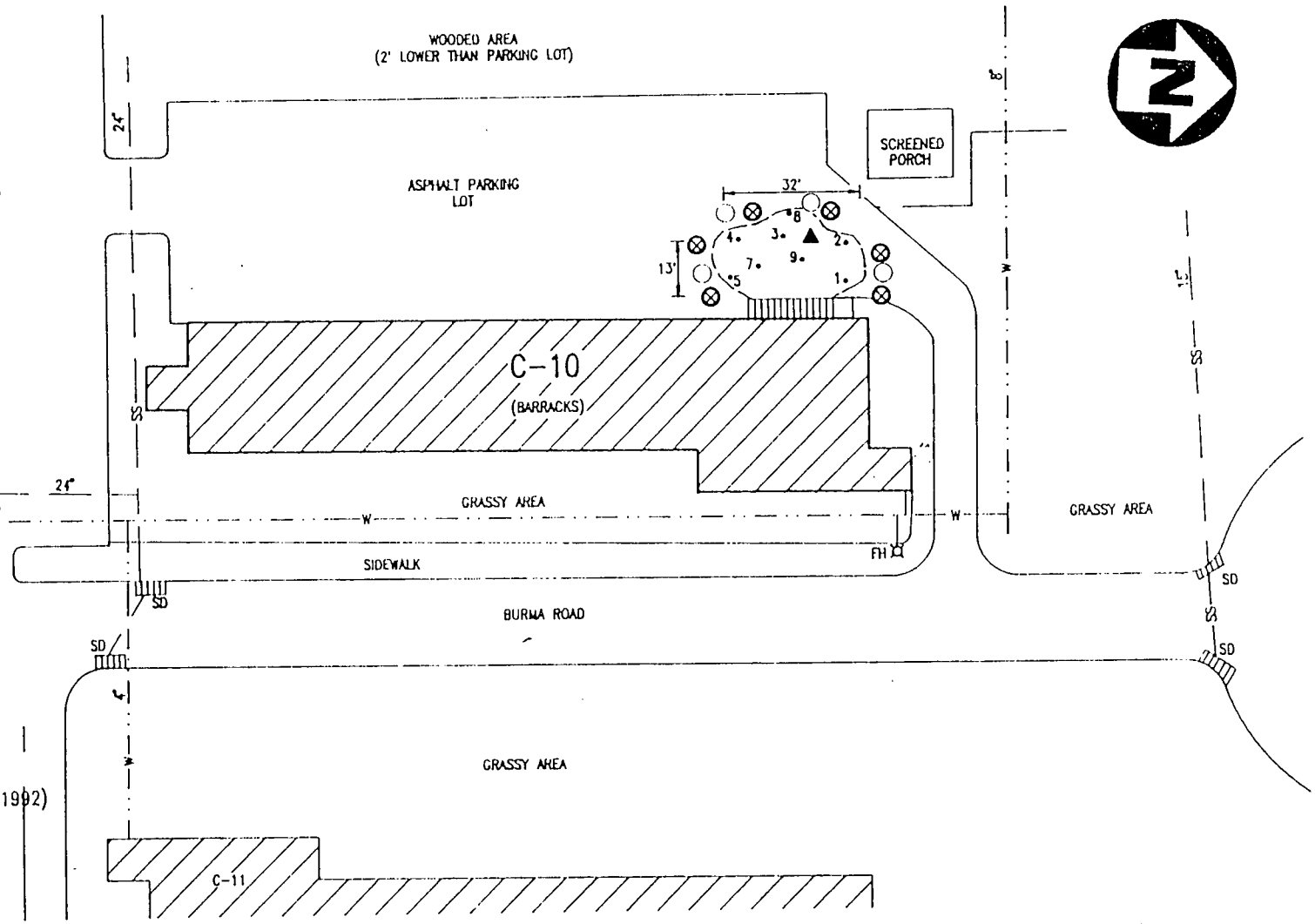
Sample Type	Number of Samples	Analysis	Rationale
Soil Gas	12 samples (1 per Geoprobe site)[1]	BTEX (field analysis using OVA in GC mode)	Delineate the lateral extent of gasoline-derived contamination in soil.
Subsurface Soil	12 samples (1 per Geoprobe site)[1]	TPH (laboratory 24-hour quick turnaround analysis	Delineate the spatial distribution of contamination in subsurface soils.
	8 samples (2 per soil boring)	TPH, VOC+10, lead (laboratory standard turnaround analysis)	Confirm the extent of contamination that is above applicable soil clean-up standards proposed in N.J.A.C. 7:26D.
Groundwater	12 samples (1 per Geoprobe site)[1]	TPH (laboratory 24-hour quick turnaround analysis)	Delineate the extent of contamination in groundwater.
	2 samples (1 per monitoring well)	TPH, VOC+10, MTBE, TBA, and SVOC+15 (laboratory standard turnaround analysis)	Determine if contamination is above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D.
	4 samples (2 per monitoring well; samples to be collected a minimum of 30 days apart)	TPH, VOC+10, MTBE, TBA, and SVOC+15 (laboratory standard turnaround analysis)	Confirm that contamination, if any, is above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D.
Drum - Cuttings	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize cuttings for disposal
Drum - Water	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize water for disposal
Stockpiled Soil	1 sample	TCLP organics and inorganics (laboratory standard turnaround analysis)	Characterize stockpiled soil for disposal

[1] The actual number of samples collected may increase based upon 24-hour quick turnaround analysis.
TPH - Total petroleum hydrocarbons
BTEX - Benzene, toluene, ethyl benzene, and xylene
MTBE - Methyl tertiary butyl ether
TBA - Tertiary butyl alcohol

ANALYTICAL RESULTS (1992)

SAMPLE ID No.	TPH IN
C-10-1	43 mg/kg
C-10-2	33 mg/kg
C-10-3	5920 mg/kg
C-10-4	545 mg/kg
C-10-5	40 mg/kg
C-10-6 *	2130 mg/kg
C-10-7	204 mg/l
C-10-8	32 mg/kg
C-10-9	73 mg/kg

* COMPOSITE PILE SAMPLE



LEGEND

- ▲ PROPOSED MONITORING WELL LOCATION
- ⊗ PROPOSED GEOPROBE SITE LOCATION
- ○ PROPOSED SOIL BORING LOCATION
- EXCAVATED AREA
- 1• APPROXIMATE SAMPLE LOCATION (1992)
- FH FIRE HYDRANT
- SD STORM DRAIN
- RECESSED STAIRS TO BASEMENT
- BUILDING

SCALE

0 20 40 60 100

SCALE IN FEET

NOTE:
ADDITIONAL GEOPROBE SITES MAY BE NEEDED BASED UPON 24-HOUR QUICK TURNAROUND TPH ANALYSIS. PRECISE SOIL BORING LOCATIONS WILL BE BASED UPON TPH ANALYTICAL RESULTS.

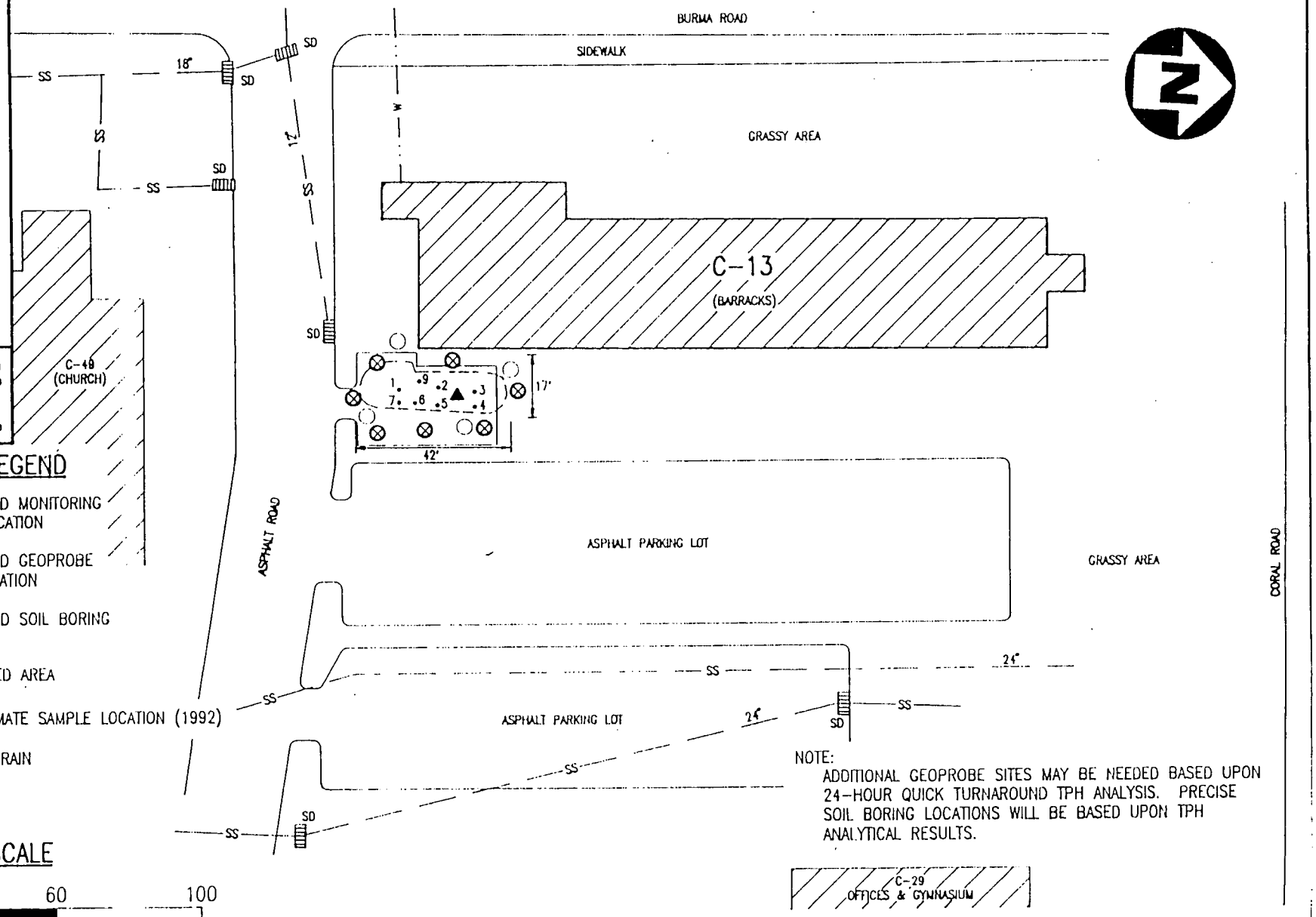
FIGURE 3-1

PROPOSED SAMPLE LOCATION MAP FOR BUILDING C-10
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

HALLIBURTON NUS
Environmental Corporation

ANALYTICAL RESULTS (1992)

SAMPLE ID No.	TPH IN mg/kg
C-13-1	54
C-13-2	2,280
C-13-3	14,000
C-13-4	2,270
C-13-5	3,830
C-13-6	18
C-13-7	73
C-13-8	2,060
C-13-9	5,490
C-13-8	0.280 mg/kg ethyl benzene
C-13-9	2.5 mg/kg ethyl benzene



NOTE:
ADDITIONAL GEOPROBE SITES MAY BE NEEDED BASED UPON 24-HOUR QUICK TURNAROUND TPH ANALYSIS. PRECISE SOIL BORING LOCATIONS WILL BE BASED UPON TPH ANALYTICAL RESULTS.

LEGEND

- ▲ PROPOSED MONITORING WELL LOCATION
- ⊗ PROPOSED GEOPROBE SITE LOCATION
- ○ PROPOSED SOIL BORING LOCATION
- EXCAVATED AREA
- 1• APPROXIMATE SAMPLE LOCATION (1992)
- SD STORM DRAIN
- BUILDING

SCALE

0 20 40 60 100

SCALE IN FEET

FIGURE 3-2

PROPOSED SAMPLE LOCATION MAP FOR BUILDING C-13
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

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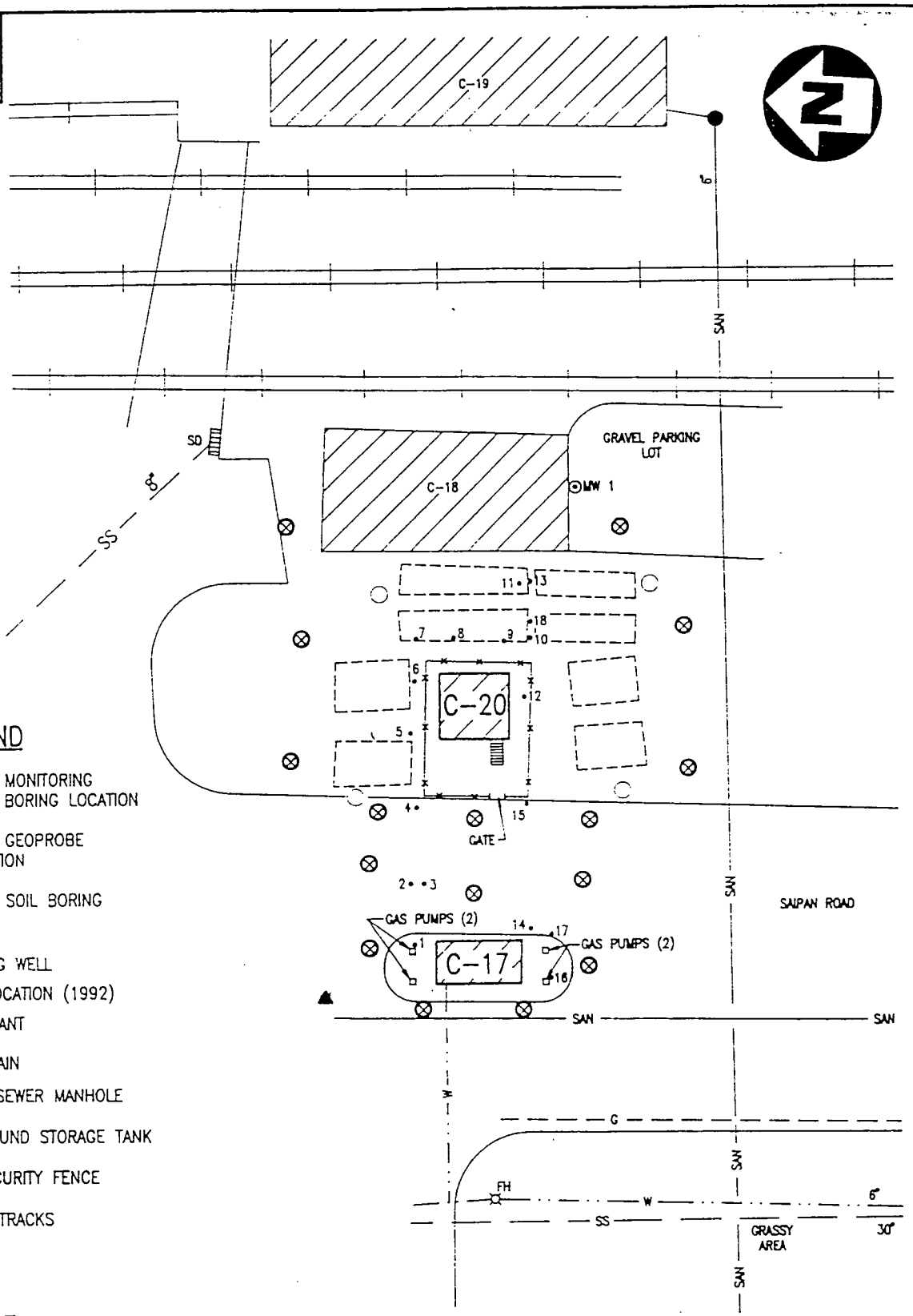
ANALYTICAL RESULTS (1992)
SHOWN ON TABLE 2-3



LEGEND

- ▲ PROPOSED MONITORING WELL/SOIL BORING LOCATION
- ⊗ PROPOSED GEOPROBE SITE LOCATION
- ○ PROPOSED SOIL BORING LOCATION
- ⊙MW 1 MONITORING WELL
- 1• SAMPLE LOCATION (1992)
- FH FIRE HYDRANT
- SD STORM DRAIN
- ● SANITARY SEWER MANHOLE
- UNDERGROUND STORAGE TANK
- METAL SECURITY FENCE
- RAILROAD TRACKS
- BUILDING

SCALE

0 20 40 60 100

SCALE IN FEET

NOTE:
ADDITIONAL GEOPROBE SITES MAY BE NEEDED BASED UPON 24-HOUR QUICK TURNAROUND TPH ANALYSIS. PRECISE SOIL BORING LOCATIONS WILL BE BASED UPON TPH ANALYTICAL RESULTS.

FIGURE 3-3

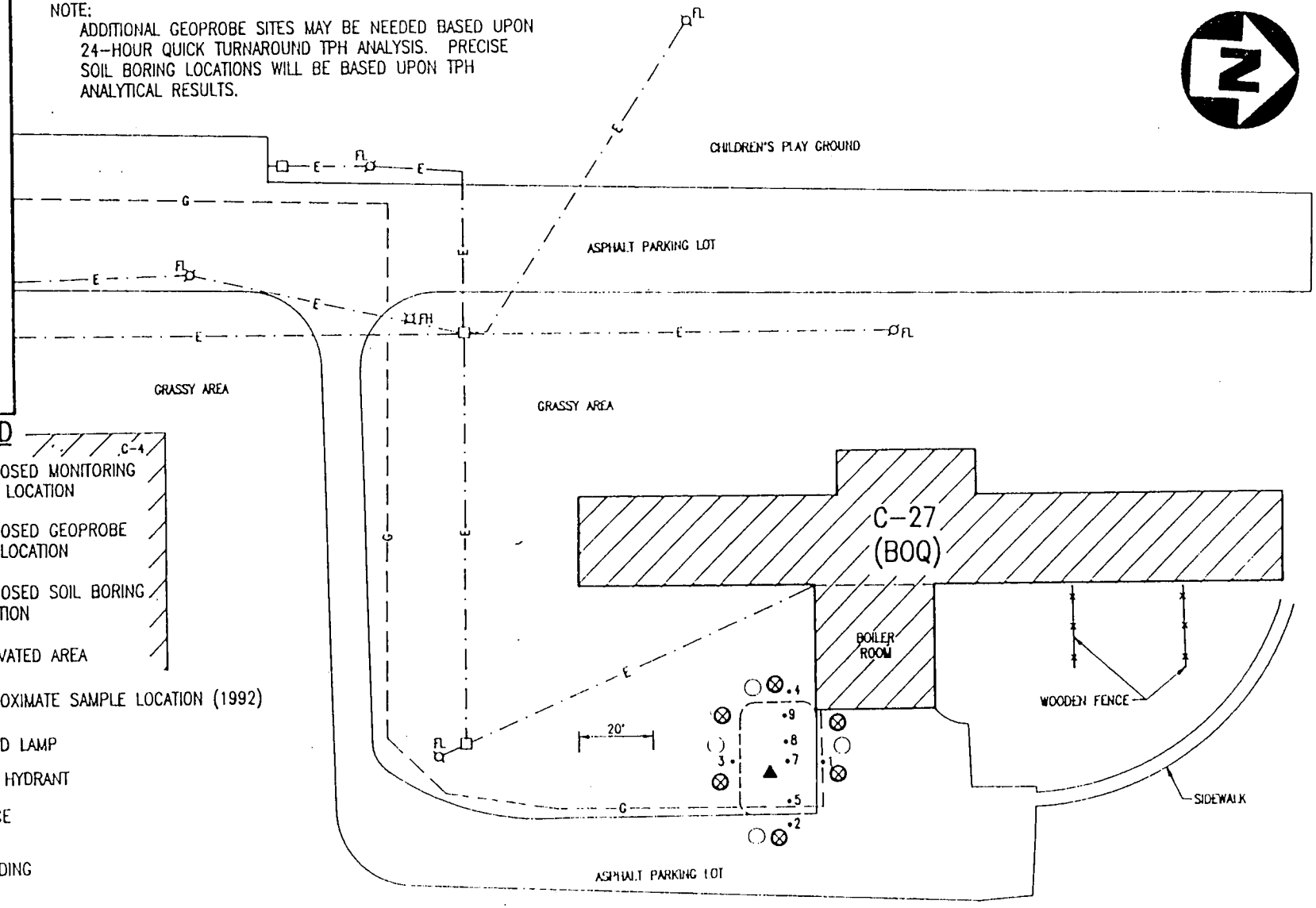
PROPOSED SAMPLE LOCATION MAP FOR
BUILDINGS C-17/C-20
CTO 85-UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

HALLIBURTON NUS
Environmental Corporation

ANALYTICAL RESULTS (1992)

SAMPLE ID No.	TPH IN mg/kg
1(01A)	8,400
1(02A)	3,500
2(03A)	<16
2(04A)	3,700
3(05A)	32
3(06A)	540
4(07A)	12,000
5(08A)	100%
7(09A)	21,000
8(10A)	160
9(11A)	13,000

NOTE:
ADDITIONAL GEOPROBE SITES MAY BE NEEDED BASED UPON 24-HOUR QUICK TURNAROUND TPH ANALYSIS. PRECISE SOIL BORING LOCATIONS WILL BE BASED UPON TPH ANALYTICAL RESULTS.



LEGEND

- PROPOSED MONITORING WELL LOCATION
- PROPOSED GEOPROBE SITE LOCATION
- PROPOSED SOIL BORING LOCATION
- EXCAVATED AREA
- APPROXIMATE SAMPLE LOCATION (1992)
- FLOOD LAMP
- FIRE HYDRANT
- FENCE
- BUILDING

SCALE

0 20 40 60 100

SCALE IN FEET

FIGURE 3-4

PROPOSED SAMPLE LOCATION MAP FOR BUILDING C-27
CTO 85 – UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

HALLIBURTON NUS
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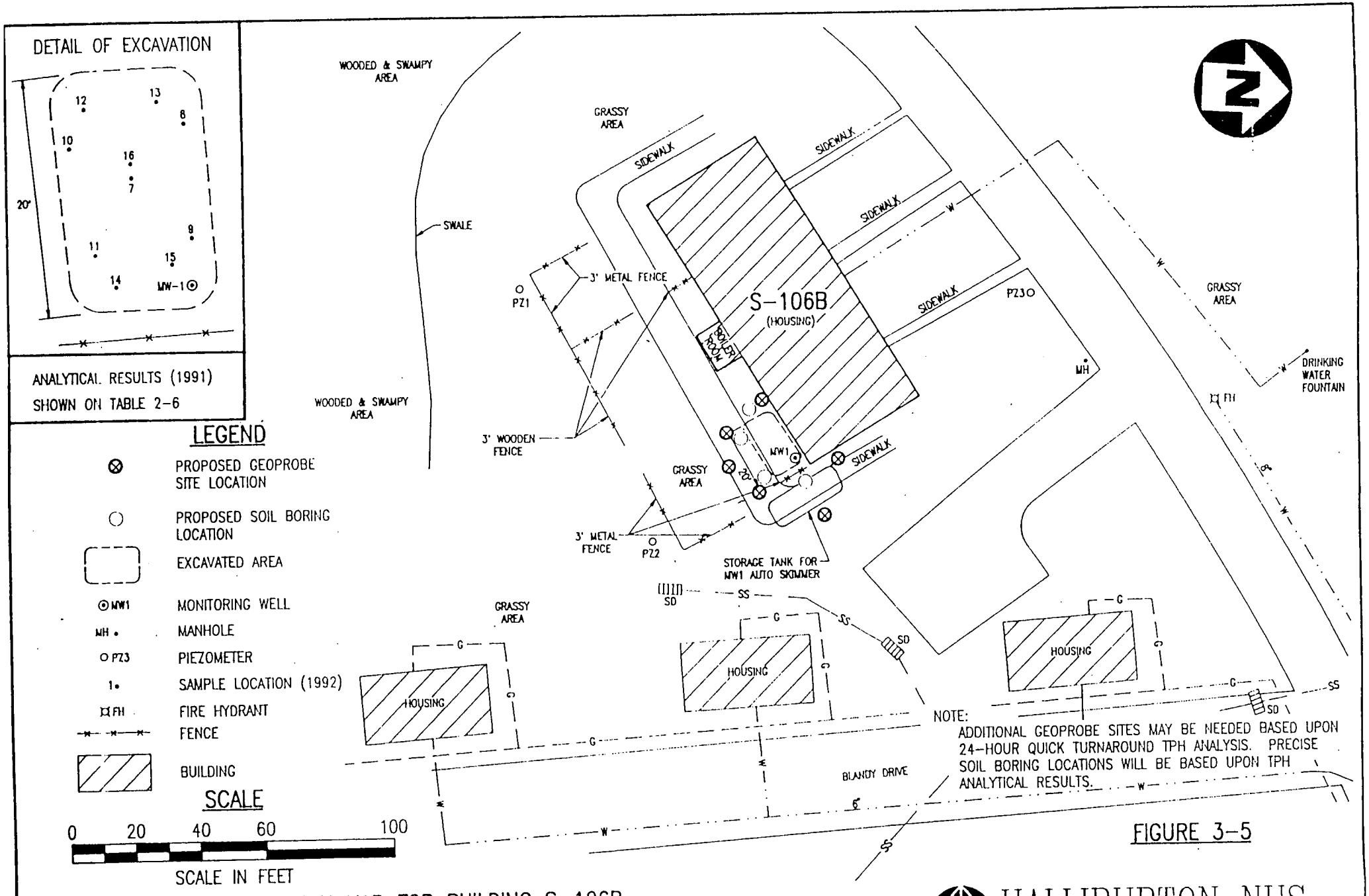

FIGURE 3-5

PROPOSED SAMPLE LOCATION MAP FOR BUILDING S-106B

CTO 85 - UST RI AT VARIOUS SITES

NWS EARLE, COLTS NECK, NEW JERSEY

HALLIBURTON NUS
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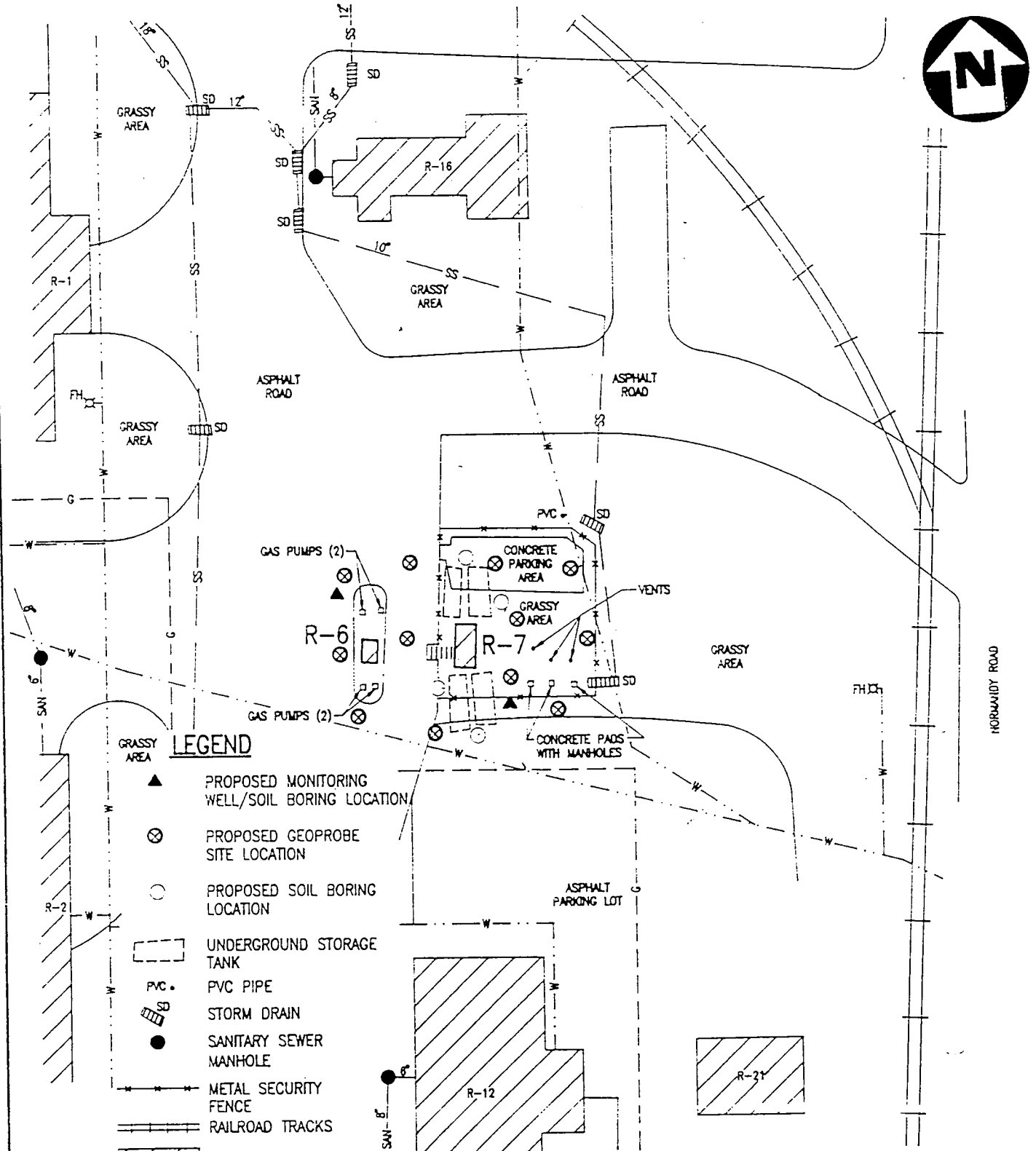

NOTE:
ADDITIONAL GEOPROBE SITES MAY BE NEEDED BASED UPON 24-HOUR QUICK TURNAROUND TPH ANALYSIS. PRECISE SOIL BORING LOCATIONS WILL BE BASED UPON TPH ANALYTICAL RESULTS.

FIGURE 3-6

PROPOSED SAMPLE LOCATION MAP FOR BUILDING R-6/R-7
CTO 85-UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

HALLIBURTON NUS
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to an NJ-DEPE-certified, NEESA-approved laboratory for TPH analysis (24-hour quick turnaround). Soil gas samples will be collected from approximately 10 feet below grade at Geoprobe sites at Buildings C-17/20 and R-6/7. Soil gas samples will be field analyzed using an OVA in the GC mode for BTEX.

In order to construct an accurate map showing the lateral extent of contamination, the location of each Geoprobe site will be surveyed to two permanent on-site structures. Additional Geoprobe sites may need to be selected and subsurface soil and groundwater samples collected for 24-hour quick turnaround laboratory chemical analysis before the installation of soil borings if the analysis of the Geoprobe samples does not allow the determination of the areal extent of contamination. Additional soil gas samples may also be collected for field analysis.

3.3.2 Soil Borings

A total of 24 borings (four each at Buildings C-10, C-13, C-17/20, C-27, S-106B, and R-6/7) will be installed to approximately the top of the water table. Subsurface soil samples will be collected at discrete intervals for standard turnaround laboratory chemical analysis in order to confirm the extent of soil contamination that is above applicable soil clean-up standards proposed in N.J.A.C. 7:26D. The precise boring locations will be determined based upon the results of the 24-hour quick turnaround laboratory chemical analysis of subsurface soil and groundwater samples and the field analysis of soil gas samples collected using the Geoprobe System. In order to characterize the subsurface materials, continuous split-spoon samples will be collected from the four borings installed at each building and fully described.

In order to characterize the drummed materials for disposal purposes, samples from the drummed split-spoon samples (cuttings) will be submitted for standard turnaround laboratory analysis. The samples will be submitted to an NJ-DEPE-certified, NEESA-approved laboratory for TCLP organic and inorganic analyses. Depending on the disposal method selected, additional chemical analyses may be required.

Discrete subsurface soil samples will be collected for standard turnaround laboratory chemical analysis from the ground surface to the soil/water interface in accordance with requirements in N.J.A.C 7:26E. The subsurface soil samples collected at Buildings C-10, C-13, C-27, and S-106B will be submitted to an NJ DEPE-certified, NEESA-approved laboratory for TPH analysis. The subsurface soil samples collected at Buildings C-17/20 and R-6/7 will be submitted to an NJ DEPE-certified, NEESA-approved laboratory for TPH, VOC+10, and lead analysis.

3.3.3 Permanent Groundwater Monitoring Wells

A single permanent groundwater monitoring well will be installed in the excavation area at Buildings C-10, C-13, and C-27. A single permanent groundwater monitoring well will be installed by the pump island at Building C-17/20. Two permanent monitoring wells will be installed at Buildings R-6/7: one near the USTs and one near the pump island. The wells at Buildings R-6/7 will be installed in soil borings. Single monitoring wells currently exist at Buildings C-17/20 and S-106B. A typical monitoring well design in unconsolidated sediments is shown in Figure 3-7. Water levels observed during Geoprobe activities will be used to locate the wells at Buildings C-17/20 and R-6/7 in downgradient positions.

One round of groundwater samples will be collected for standard turnaround laboratory chemical analysis from the permanent groundwater monitoring wells a minimum of two weeks after well completion to determine if groundwater contamination is above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D. The samples collected at Buildings C-10, C-13, C-27, and S-106B will be submitted to an NJ DEPE-certified, NEESA-approved laboratory for TPH, VOC+10, and SVOC+15 analysis. The samples collected at Buildings C-17/20 and R-6/7 will be submitted to an NJ DEPE-certified, NEESA-approved laboratory for TPH, VOC+10, MTBE, TBA, and SVOC+15 analysis. No sample will be submitted for analysis if free product is present in the groundwater sample. If the initial round of sampling indicates that contamination is above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D, two additional rounds of sampling will be conducted 30 days apart.

In order to characterize the drummed materials for disposal purposes, samples from the drummed cuttings and development/decontamination water will be submitted for standard turnaround laboratory analysis. The samples will be submitted to an NJ-DEPE-certified, NEESA-approved laboratory for TCLP organic and inorganic analyses. Depending on the disposal method selected, additional chemical analyses may be required.

The permanent monitoring wells installed as part of this project will be surveyed by a New-Jersey-licensed surveyor to allow for the accurate measurement and monitoring of water levels.

3.4 PHASE II FIELD INVESTIGATIVE TASK DESCRIPTIONS

The need for Phase II field operations will be determined after receipt and validation of analytical results from Phase I sampling operations. Phase II field operations will be conducted if contamination is detected in soil and groundwater samples at concentrations above applicable clean-up standards proposed in N.J.A.C. 7:26D. Phase II investigative methods and rationale are in the following table.

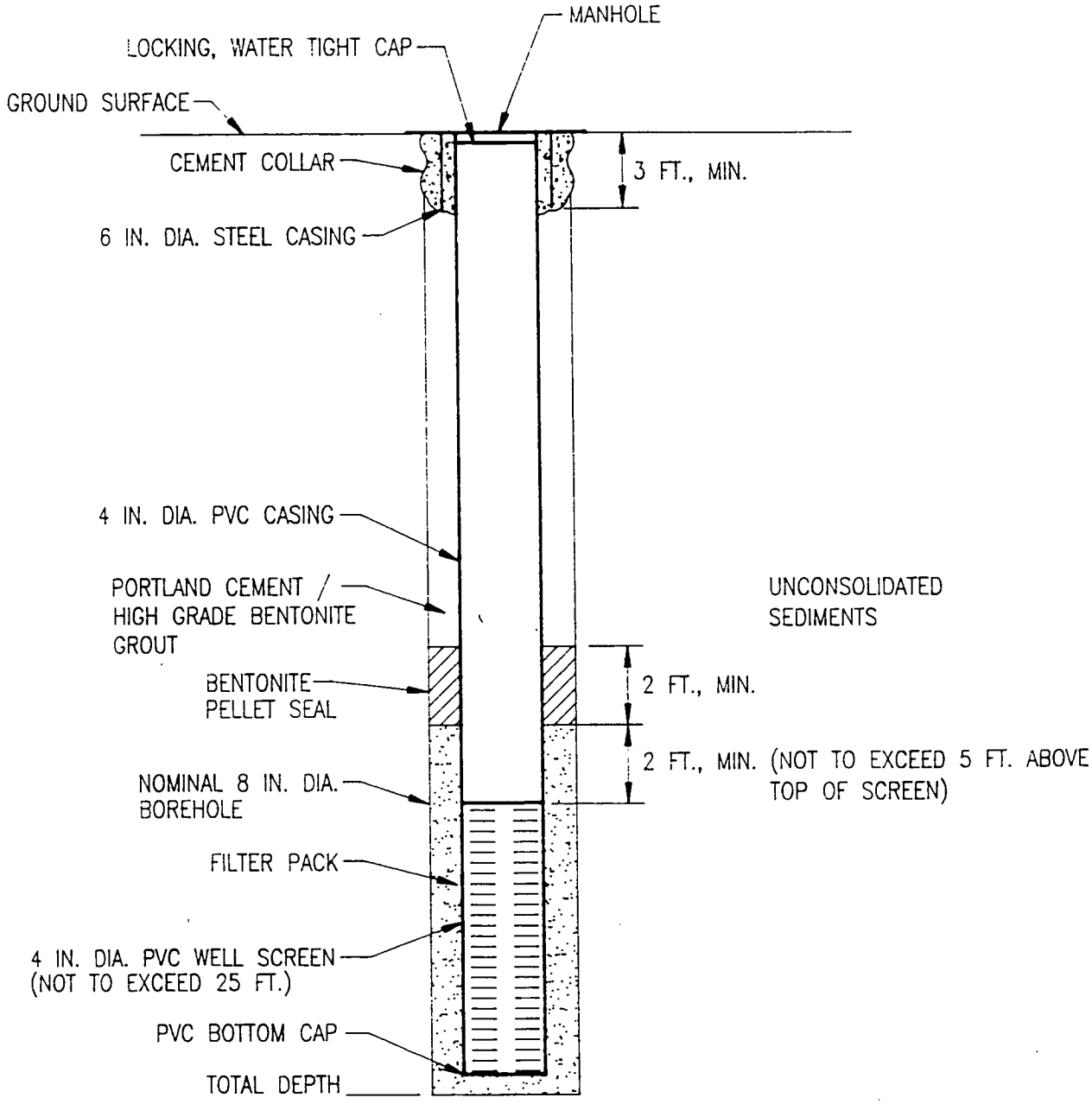

FIGURE 3-7

TYPICAL MONITORING DESIGN IN UNCONSOLIDATED SEDIMENTS
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

HALLIBURTON NUS
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Phase II Inv stigativ Methods and Rational

Investigative Method	Rationale
Permanent Groundwater Monitoring Wells	Determine the direction of groundwater flow and establish a contaminant gradient in accordance with N.J.A.C. 7:26E-4.4 Remedial Investigation of Groundwater.
Aquifer Test	Determine aquifer characteristics such as hydraulic conductivity, storativity, transmissivity, and the rate of groundwater and contaminant flow in the aquifer.
Well Search	Identify all irrigation, monitoring, and domestic wells within 1/2 mile and all industrial wells, public supply wells, and wells with water allocation permits within one mile of AOC(s) that may be affected by groundwater contamination from the AOC(s).
Groundwater Sample Collection	Determine if nearby wells have been impacted by groundwater contamination from the AOC(s).
Surface Water/ Sediment Sampling	Determine if surface water and sediments have been impacted by groundwater contamination from the AOC(s).

The following field activities will be conducted during Phase II operations at Buildings C-10, C-13, C-17/20, C-27, S-106B, and R-6/7 if contamination is detected at concentrations above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D.

- Installation of up to three additional permanent groundwater monitoring wells.
- Collection of one round of groundwater samples for standard turnaround laboratory chemical analysis from the permanent groundwater monitoring wells. Groundwater samples will not be collected from those monitoring wells with free product.
- Collection of two rounds of groundwater-level measurements a minimum of 30 days apart. At Building R-6/7, synoptic static-water-level measurements will be collected over two tidal cycles for two sampling events a minimum of 14 days apart.
- Conduct aquifer tests in the permanent groundwater monitoring wells to determine aquifer characteristics.
- Conduct a well search for all irrigation, monitoring, and domestic wells within 1/2 mile and all industrial wells, public supply wells, and wells with allocation permits within one mile of the AOC.

- Collect groundwater samples for standard turnaround laboratory chemical analysis from any well that is suspected to be impacted by contamination from the AOC.

- Collect surface water and sediment samples for standard turnaround laboratory chemical analysis from any surface water body or wetland that is suspected to be impacted as a result of groundwater contamination from the AOC.

- Conduct treatability, bench scale, and pilot scale studies as needed to help evaluate remedial action alternatives.

- Collect one sample per drum of split-spoon samples/cuttings per site, one sample per drum of development/decontamination water per site, and one sample of stockpiled soil per site for standard turnaround laboratory chemical analysis.

Phase II field activities are presented by task in the following paragraphs. All Phase II field activities will be conducted in accordance with procedures referenced in NJ DEPE FSPM in effect at the date of sampling and in accordance with the health and safety procedures established in the Site HASP (Appendix F).

3.4.1 Permanent Groundwater Monitoring Wells

The need for additional monitoring wells will be determined after the receipt and validation of analytical results from Phase I sampling operations. Up to three additional monitoring wells will be installed at those buildings where contamination is confirmed to be above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D. Monitoring well locations will be determined before the start of Phase II activities. One round of groundwater samples will be collected for standard turnaround laboratory analysis from the permanent groundwater monitoring wells a minimum of two weeks after well completion to establish a contaminant gradient. The samples will be submitted to an NJ DEPE-certified, NEESA-approved laboratory for TPH, VOC+10, and SVOC+15 analysis if the wells are located near Buildings C-10, C-13, C-27, and/or S-106B or for TPH, VOC+10, MTBE, TBA, and SVOC+15 analysis if the wells are located near Buildings C-17/20 and/or R-6/7.

In order to characterize the drummed materials for disposal purposes, samples from the drummed cuttings and development/decontamination water will be submitted for standard turnaround laboratory analysis. The samples will be submitted to an NJ-DEPE-certified, NEESA-approved laboratory for TCLP organic and inorganic analyses. Depending on the disposal method selected, additional chemical analyses may be required.

Two rounds of groundwater-level measurements will be collected a minimum of 30 days apart to determine the direction of groundwater flow in the shallow water-table aquifer. If contamination above applicable groundwater clean-up standards is confirmed at Building R-6/7, two rounds of synoptic static water level measurements over two tidal cycles will be collected a minimum of 14 days apart to determine the effects of tides on the shallow water-table aquifer.

3.4.2 Aquifer Tests

At those buildings where contamination above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D is confirmed, rising-head slug tests will be conducted to help define aquifer characteristics such as hydraulic conductivity (K), transmissivity (T), and storativity (S). Tracer tests or an electronic velocity meter will be used to determine the rate of groundwater flow and contaminant flow in the shallow water-table aquifer. The number of tests to be conducted will be determined after receipt and validation of analytical results from Phase I sampling operations.

3.4.3 Well Search

At those buildings where contamination above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D is confirmed, a physical, documentary, and field search for all irrigation, monitoring, and domestic wells within 1/2 mile and all industrial wells, public supply wells, and wells with water allocation permits within one mile of the AOC will be conducted. Groundwater samples will be collected for standard turnaround laboratory chemical analysis from any well that is suspected to be impacted by contamination from the AOC. The groundwater samples will be submitted to an NJ DEPE-certified, NEESA-approved laboratory for TPH, VOC+10, and SVOC+15 analysis if USTs located at the building possibly affecting the well were filled with heating oil. The groundwater samples will be submitted to an NJ DEPE-certified, NEESA-approved laboratory for TPH, VOC+10, MTBE, TBA, and SVOC+15 analysis if USTs located at the building possibly affecting the well were filled with gasoline and/or diesel.

3.4.4 Surface Water and Sediment Sampling

Surface water and sediment samples will be collected for standard turnaround laboratory chemical analysis from any surface water body or wetland that is suspected to be impacted as a result of the groundwater contamination. The sampling program will be designed to account for seasonal flow and water quality fluctuations, system hydraulics, and potential contaminant characteristics.

Sampling stations will be located upstream and downstream of the contaminated AOC and at any existing discharge points at the AOC. The specific locations, number, and frequency of samples to be collected will be determined after the receipt and validation of the analytical results from Phase I sampling operations.

The surface water and sediment samples will be submitted to an NJ DEPE-certified, NEESA-approved laboratory for TPH, VOC+10, and SVOC+15 analysis if USTs located at the building possibly affecting the surface body were filled with heating oil. The surface water and sediment samples will be submitted to an NJ DEPE-certified, NEESA-approved laboratory for TPH, VOC+10, MTBE, TBA, and SVOC+15 analysis if USTs located at the building possibly affecting the surface water body were filled with gasoline and/or diesel.

3.4.5 Treatability, Bench Scale, and Pilot Scale Studies

Treatability, bench-scale, and pilot-scale studies will be conducted as necessary to help in the evaluation of remedial action alternatives. The need for these studies will be determined after the receipt and validation of analytical results from Phase I sampling operations.

3.4.6 Other Studies

Based upon the results of the first phase of the RI, data will be collected as necessary to

- Evaluate remedial alternatives.
- Evaluate the ecological impact of the contaminants.
- Develop permit limitations for any discharge to an environmental medium that may be required for any remedial action alternative under evaluation.
- Characterize all natural resource damages caused by potential contaminants.
- Identify contaminant and/or stabilization activities to prevent the off-site migration of contaminants and the on-site exposure to contaminants while remedial alternatives are being evaluated.

3.5 SAMPLE DESIGNATION SYSTEM

Each sample collected for analysis will be assigned a unique sample tracking number. This number will consist of a three-segment alpha-numeric code that identifies the building, the sample medium or QC sample designation, and the station or QC sample number. The alpha-numeric coding system to be used is explained in the following diagram and subsequent definitions.

AN, ANN, or ANNN (AOC Identifier)	-	AA, AAA, AAN, or AAAN (Sample Medium or QC Sample Designation	-	NN or NNNN (Station or QC Sample Number)

Character Type:

A = Alpha N = Numeric

AOC Identifier:

C10 = Building C-10
C13 = Building C-13
C20 = Buildings C-17/20
C27 = Building C-27
S106 = Building S-106B
R7 = Buildings R-6/7

Sample Medium:

SGS = Soil Gas Sample
GSS = Geoprobe Site Subsurface Soil Sample
GGW = Geoprobe Site Groundwater Sample
SB = Subsurface Soil Sample
MW1 = Groundwater Sample from Monitoring Well No. 1
NMW1 = Groundwater Sample from Non-Monitoring Well No. 1
SW = Surface Water Sample
SED = Sediment Sample
SP = Stockpiled Soil
DC = Drummed Split-Spoon Samples/Cuttings
DW = Drummed Development/Decontamination Water

QC Sample Designation:

TB = Trip Blank
FB = Field Blank
FD = Field Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate

Station Sample Number:

All sample stations will be assigned a consecutive station number in the order of installation. The station numbers for the soil gas samples, Geoprobe site surface soil and groundwater samples, surface soil samples, monitoring well and non-monitoring well groundwater samples, surface water samples, and sediment samples will consist of a two-digit number. The station numbers for the Geoprobe site subsurface soil samples and soil boring subsurface soil samples will consist of a four-digit number. The first two digits will refer to the geographical location of the sample, and the second two digits will be the upper depth, in feet below the ground surface, from which the sample was collected.

For example, a groundwater sample collected around Building C-10 in the first hole installed using the Geoprobe System would be assigned the tracking number C10-GGW-01.

A subsurface soil sample collected around Buildings C-17/20 from a depth of five to 5.5 feet in the second hole installed using the Geoprobe System would be assigned the tracking number C20-GSS-0205.

A subsurface soil sample collected around Buildings C-17/20 from a depth of five to 5.5 feet in the second soil boring installed would be assigned the tracking number C20-SB-0205.

QC Sample Number:

All QC samples will be assigned a sequential sample number. A designation that blinds the sample's QC identity will be used for all field duplicates. The FD, MS, and MSD samples will be collected from the same station.

For example, the first field duplicate subsurface soil sample collected during sampling at Building R-6/7 would be assigned the tracking number R7-FD-01.

All pertinent information regarding sample identification will be recorded in the field logbooks and on sample logsheets where appropriate.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

The quality assurance project plan (QAPP) identifies specific parameters and procedures that are applicable to the investigation:

- Project organization and responsibilities
- Analytical parameters and sample frequency
- Identification of analytical methods
- Quality assurance objectives for analytical data
- Calibration procedures
- Custody protocol
- Data reduction, validation, and reporting procedures
- Data assessment procedures

Presiding controls for this activity require compliance to quality assurance specifications outlined in N.J.A.C. 7:26E. If a conflict arises between NJ DEPE requirements and CLEAN program controls, the NJ DEPE requirements will take precedence.

4.1 PROJECT ORGANIZATION AND RESPONSIBILITIES

Overall project coordination personnel and responsibilities are detailed in Section 1.3 of this work plan. The Field Team will begin mobilization activities for Phase I field operations upon written notice of authorization to proceed from the Navy. The PM will contact the RPM at NAVFAC NORTHDIV, the Site Contact at NWS Earle, and the appropriate NJ DEPE personnel regarding the initiation of Phase I and Phase II field operations. The PM will then notify the Field Team Leader (FTL) and the field team members who are to participate in the field investigations. The specific FTL and field team members will be determined at a later date. The PM and the FTL will be responsible for arranging all necessary field equipment, transportation, subcontractors, etc. and for coordinating all on-site activities with the RPM, Site Contact, and NJ DEPE personnel. All sampling data and applicable field observations will be recorded on the appropriate log sheets or in the site field logbook. The site field logbook will be maintained by the FTL or designee. Utility clearance will be obtained before any subsurface field activities are begun. Phase II field operations, if required, will begin after receipt and validation of analytical results from Phase I sampling operations.

Subcontracts for the Geoprobe System, drilling services, and laboratory analytical services will be procured and awarded by CLEAN Program Subcontracting Officers before commencement of field activities. The subcontract Geoprobe System Coordinator will ensure that all Geoprobe System activities are in compliance

with NJ DEPE permits and regulations and HNUS requirements. The subcontract Drilling Coordinator will ensure that all drilling activities are in compliance with NJ DEPE permits and regulations and HNUS requirements. The subcontract Laboratory Analytical Coordinator will ensure that the laboratory implements the requirements of NJ DEPE and this QAPP. The subcontract Laboratory Analytical Coordinator is responsible for reviewing the laboratory data before release.

4.2 QUALITY ASSURANCE OBJECTIVES

The QA objective is to ensure that the data generated as part of this investigation are of known and acceptable quality and are suitable for the intended use. The data quality objective (DQO) is established by identifying the end use of the data and the degree of certainty necessary to satisfy that end use.

Phase I data will be used to delineate areas of contamination for purposes of assessing ecological impact and evaluating remedial action alternatives. Phase II data (if generated) will be used to determine contaminant migration pathways and identify potential receptors. The parameters considered in evaluating various analytical options are precision, accuracy, representativeness, completeness, and comparability (PARCC).

The DQO Levels C (standard turnaround analysis) and E (24-hour quick turnaround analysis), as defined by the NEESA guidelines entitled "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program (20.2-047B; June 1988)" are proposed for this project.

QC samples will be prepared in accordance with NJ DEPE and NEESA requirements to ensure that project activities meet the DQO's objectives. The frequency of site-specific QC samples and the analytical parameters are summarized in Table 4-1. QC samples will not be collected for TCLP organic and inorganic analysis.

4.3 QUALITY ASSURANCE PROCEDURES

QA/QC samples are intended to provide control over the collection of environmental data and subsequent validation, review, and interpretation of the analytical results. Various types of blank samples and other related QA/QC concerns such as packaging, handling, and shipping of samples from the site are discussed in this section. Analytical methodologies to be employed are detailed further in Section 4.9 and Table 4-1.

TABLE 4-1
ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

Sample Location	Sample Medium	NEESA DQO(1)	Analytical Parameter	Analytical Method	Number of Samples (10)	Field QC Samples			Laboratory QC Samples		
						Field Duplicates(2)	Field Blanks(3)	Trip Blanks(4)	Matrix Spike	Matrix Spike Duplicate	Laboratory Duplicate
C-10	Subsurface Soil (Geoprobe site)	E	TPH(5)	E418.1	6	1	N/A	N/A	N/A	N/A	N/A
	Subsurface Soil (soil boring)	C	TPH(6)	E418.1	8	1	1	N/A	1	N/A	N/A
	Groundwater (Geoprobe sites)	E	TPH(5)	E418.1	6	1	N/A	N/A	N/A	N/A	N/A
	Groundwater (monitoring well)	C C C	TPH(6) TCL VOC+10(7) TCL SVOC+15(8)	E418.1 CLP SOW OLM01.8 CLP SOW OLM01.8	1 1 1	1 1 1	1 1 1	N/A 1 N/A	1 1 1	N/A 1 1	N/A N/A N/A
	Drum - Cuttings	C C	TCLP organic TCLP inorganic	SW 846 1311/et al. SW 846 1311/et al.	1 1	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
	Drum - Water	C C	TCLP organic TCLP inorganic	SW 846 1311/et al. SW 846 1311/et al.	1 1	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
	Stockpiled Soil	C C	TCLP organic TCLP inorganic	SW 846 1311/et al. SW 846 1311/et al.	1 1	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
C-13	Subsurface Soil (Geoprobe sites)	E	TPH(5)	E418.1	7	1	N/A	N/A	N/A	N/A	N/A
	Subsurface Soil (soil boring)	C	TPH(6)	E418.1	8	1	1	N/A	1	N/A	N/A
	Groundwater (Geoprobe sites)	E	TPH(5)	E418.1	7	1	N/A	N/A	N/A	N/A	N/A
	Groundwater (monitoring well)	C C C	TPH(6) TCL VOC+10(7) TCL SVOC+15(8)	E418.1 CLP SOW OLM01.8 CLP SOW OLM01.8	1 1 1	1 1 1	1 1 1	N/A 1 N/A	1 1 1	N/A 1 1	N/A N/A N/A

TABLE 4-1 (CONTINUED)
ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE
CTO 85 - UST RI AT VARIOUS SITES
NSW EARLE, COLTS NECK, NEW JERSEY

Sample Location	Sample Medium	NEESA DQO[1]	Analytical Parameter	Analytical Method	Number of Samples[10]	Field QC Samples			Laboratory QC Samples		
						Field Duplicates[2]	Field Blanks[3]	Trip Blanks[4]	Matrix Spike	Matrix Spike Duplicate	Laboratory Duplicate
C-13	Drum - Cuttings	C	TCLP organic	SW 846 1311/et al.	1	N/A	N/A	N/A	N/A	N/A	N/A
		C	TCLP inorganic	SW 846 1311/et al.	1	N/A	N/A	N/A	N/A	N/A	N/A
	Drum - Water	C	TCLP organic	SW 846 1311/et al.	1	N/A	N/A	N/A	N/A	N/A	N/A
		C	TCLP inorganic	SW 846 1311/et al.	1	N/A	N/A	N/A	N/A	N/A	N/A
	Stockpiled Soil	C	TCLP organic	SW 846 1311/et al.	1	N/A	N/A	N/A	N/A	N/A	N/A
		C	TCLP inorganic	SW 846 1311/et al.	1	N/A	N/A	N/A	N/A	N/A	N/A
C-17/20	Soil Gas (Geoprobe sites)	E	BTEX[9]	field analysis using an OVA in GC mode	16	1	N/A	N/A	N/A	N/A	N/A
	Subsurface Soil (Geoprobe sites)	E	TPH[5]	E418.1	16	2	N/A	N/A	N/A	N/A	N/A
	Subsurface Soil (soil boring)	C	TPH[6]	E418.1	8	1	1	N/A	1	N/A	N/A
		C	CLP Lead	CLP SOW ILM02.1	8	1	1	N/A	1	N/A	1
		C	TCL VOC+10[7]	CLP SOW OLM01.8	8	1	1	N/A	1	1	N/A
	Groundwater (Geoprobe sites)	E	TPH[5]	E418.1	16	1	N/A	N/A	N/A	N/A	N/A
	Groundwater (monitoring wells)	C	TPH[6]	E418.1	2	1	1	N/A	1	N/A	N/A
		C	TCL VOC+10[7]	CLP SOW OLM01.8	2	1	1	1	1	1	N/A
		C	MTBE	CLP SOW OLM01.8	2	1	1	1	1	1	N/A
		C	TBA	CLP SOW OLM01.8	2	1	1	1	1	1	N/A
		C	TCL SVOC+15[8]	CLP SOW OLM01.8	2	1	1	N/A	1	1	N/A
	Drum - Cuttings	C	TCLP organic	SW 846 1311/et al.	1	N/A	N/A	N/A	N/A	N/A	N/A
		C	TCLP inorganic	SW 846 1311/et al.	1	N/A	N/A	N/A	N/A	N/A	N/A
	Drum - Water	C	TCLP organic	SW 846 1311/et al.	1	N/A	N/A	N/A	N/A	N/A	N/A
		C	TCLP inorganic	SW 846 1311/et al.	1	N/A	N/A	N/A	N/A	N/A	N/A
	Stockpiled Soil	C	TCLP organic	SW 846 1311/et al.	1	N/A	N/A	N/A	N/A	N/A	N/A
		C	TCLP inorganic	SW 846 1311/et al.	1	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 4-1 (CONTINUED)
ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE
CTO 85 - UST RI AT VARIOUS SITES
NSW EARLE, COLTS NECK, NEW JERSEY

Sample Location	Sample Medium	NEESA DQO(1)	Analytical Parameter	Analytical Method	Number of Samples (10)	Field QC Samples			Laboratory QC Samples		
						Field Duplicates(2)	Field Blanks(3)	Trip Blanks(4)	Matrix Spike	Matrix Spike Duplicate	Laboratory Duplicate
C-27	Subsurface Soil (Geoprobe sites)	E	TPH(5)	E418.1	6	1	N/A	N/A	N/A	N/A	N/A
	Subsurface Soil (soil boring)	C	TPH(6)	E418.1	8	1	1	N/A	1	N/A	N/A
	Groundwater (Geoprobe sites)	E	TPH(5)	E418.1	6	1	N/A	N/A	N/A	N/A	N/A
	Groundwater (monitoring well)	C C C	TPH(6) TCL VOC+10(7) TCL SVOC+15(8)	E418.1 CLP SOW OLM01.8 CLP SOW OLM01.8	1 1 1	1 1 1	1 1 1	N/A 1 N/A	1 1 1	N/A 1 1	N/A N/A N/A
	Drum - Cuttings	C C	TCLP organic TCLP inorganic	SW 846 1311/et al. SW 846 1311/et al.	1 1	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
	Drum - Water	C C	TCLP organic TCLP inorganic	SW 846 1311/et al. SW 846 1311/et al.	1 1	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
	Stockpiled Soil	C C	TCLP organic TCLP inorganic	SW 846 1311/et al. SW 846 1311/et al.	1 1	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
S-106B	Subsurface Soil (Geoprobe sites)	E	TPH(5)	E418.1	6	1	N/A	N/A	N/A	N/A	N/A
	Subsurface Soil (soil boring)	C	TPH(6)	E418.1	8	1	1	N/A	1	N/A	N/A
	Groundwater (Geoprobe sites)	E	TPH(5)	E418.1	6	1	N/A	N/A	N/A	N/	N/A
	Groundwater (monitoring wells)	C C C	TPH(6) TCL VOC+10(7) TCL SVOC+15(8)	E418.1 CLP SOW OLM01.8 CLP SOW OLM01.8	1 1 1	1 1 1	1 1 1	N/A 1 N/A	1 1 1	N/A 1 1	N/A N/A N/A

TABLE 4-1 (CONTINUED)
ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE
CTO 85 - UST RI AT VARIOUS SITES
NSW EARLE, COLTS NECK, NEW JERSEY

Sample Location	Sample Medium	NEESA DQO[1]	Analytical Parameter	Analytical Method	Number of Samples[10]	Field QC Samples			Laboratory QC Samples		
						Field Duplicates[2]	Field Blanks[3]	Trip Blanks[4]	Matrix Spike	Matrix Spike Duplicate	Laboratory Duplicate
S-106B	Drum - Cuttings	C C	TCLP organic TCLP inorganic	SW 846 1311/et al. SW 846 1311/et al.	1 1	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
	Drum - Water	C C	TCLP organic TCLP inorganic	SW 846 1311/et al. SW 846 1311/et al.	1 1	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
	Stockpiled Soil	C C	TCLP organic TCLP inorganic	SW 846 1311/et al. SW 846 1311/et al.	1 1	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
R-6/7	Soil Gas (Geoprobe sites)	E	BTEX[9]	field analysis using an OVA in GC mode	6	1	N/A	N/A	N/A	N/A	N/A
	Subsurface Soil (Geoprobe sites)	E	TPH[5]	E418.1	12	2	N/A	N/A	N/A	N/A	N/A
	Subsurface Soil (soil boring)	C C C	TPH[6] CLP Lead TCL VOC+10[7]	E418.1 CLP SOW ILM02.1 CLP SOW OLM01.8	8 8 8	1 1 1	1 1 1	N/A N/A N/A	1 N/A 1	N/A N/A 1	N/A 1 (lead) N/A
	Groundwater (Geoprobe sites)	E	TPH[5]	E418.1	12	1	N/A	N/A	N/A	N/A	N/A
	Groundwater (monitoring wells)	C C C C C	TPH[6] TCL VOC+10[7] MTBE TBA TCL SVOC+15[8]	E418.1 CLP SOW OLM01.8 CLP SOW OLM01.8 CLP SOW OLM01.8 CLP SOW OLM01.8	2 2 2 2 2	1 1 1 1 1	1 1 1 1 1	N/A 1 1 1 N/A	1 1 1 1 1	N/A 1 1 1 1	N/A N/A N/A N/A N/A
	Drum - Cuttings	C C	TCLP organic TCLP inorganic	SW 846 1311/et al. SW 846 1311/et al.	1 1	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
	Drum - Water	C C	TCLP organic TCLP inorganic	SW 846 1311/et al. SW 846 1311/et al.	1 1	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
	Stockpiled Soil	C C	TCLP organic TCLP inorganic	SW 846 1311/et al. SW 846 1311/ et al.	1 1	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A

NOTES:

(1) Naval Energy and Environmental Support Activity (NEESA) "Sampling and Chemical Analysis Quality Control Requirements for the Navy Installation Restoration Program," 20.2-047B, June 1988.

(2) Field duplicate samples are collected in compliance with N.J.A.C. 7:26E at a rate of five percent.

(3) Field blanks are collected in compliance with N.J.A.C. 7:26E at a rate of five percent.

(4) Trip blanks are collected for aqueous samples only at a rate of one per cooler containing samples for aqueous volatile organic analysis.

(5) Sample will be submitted for TPH analysis (24-hour quick turnaround) using Method E418.1

(6) Sample will be submitted for laboratory standard turnaround TPH analysis using Method E418.1.

(7) VOC+10 analysis is to include the EPA CLP Target Compound List for volatile fraction plus a library search for 10 highest-concentration non-target tentatively identified compounds present in the sample.

(8) SVOC+15 analysis is to include the EPA CLP target compound list for the semivolatile fraction plus a library search for the 15 highest-concentration unknown compounds present in the sample.

(9) Sample will be field analyzed for benzene, toluene, ethyl benzene, and xylene using an OVA in the QC mode.

(10) Additional groundwater sampling may be required. Applicable QA/QC samples will be obtained as necessary.

Trip Blank

The trip blank is used exclusively for the monitoring of aqueous volatile organic analysis. (Trip blanks are not required for non-aqueous samples unless specifically requested by NJ DEPE.) The purpose of the trip blank is to measure cross contamination of the samples during shipment to and from the site. These blanks are prepared by the laboratory and must accompany the storage prior to and the shipment of the aqueous volatile organic samples. The rate at which this sample is taken is one per cooler containing aqueous volatile organic samples.

Field Blank

The field blank is used to monitor sample equipment handling, preparation, storage, and shipment. The field blank is prepared in the field, from analyte-free water supplied by the laboratory, by pouring the water over dedicated or decontaminated sampling devices into clean sample bottles. These samples will be preserved in the same manner as the field samples and will only be collected and analyzed for parameters for which the field samples are analyzed. In accordance with NJ DEPE requirements, these samples are collected at a rate of five percent of the number of environmental samples collected during the sampling event. It is not necessary to collect more than one field blank per day.

Field Duplicate Samples

The field duplicate is collected to monitor the precision and reproducibility of the sampling and analytical activities. The sample is prepared by collecting two samples from the same location. In accordance with NJ DEPE requirements, these samples are collected at a rate of five percent of the total number of samples per matrix for the event. These samples are submitted as blind samples to the laboratory.

Matrix Spike/Matrix Spike Duplicate

The matrix spike (MS) samples are collected as monitoring controls for the laboratory and are addressed under Contract Laboratory Program (CLP) analytical protocol. These samples are collected at a rate of five percent of the total number of TCL organic analyses and Target Analyte List (TAL) analyses to be conducted for the event. MS/matrix spike duplicate (MSD) analyses are performed for organic fraction analysis, and MS/laboratory duplicate analyses are performed for metals fraction analysis. The preparation of the organic fraction laboratory QC samples requires supplying triple volume of the designated sample. Laboratory QC samples for inorganic analysis are prepared by the laboratory by splitting the designated MS sample at the laboratory to accommodate the laboratory duplicate analysis. No additional volume is required.

Other Laboratory QC Analys s

The analytical laboratory will perform other QC analyses such as method blank analyses and laboratory control sample analyses, as defined in method-specific and CLP protocol. Adherence to these protocols satisfies NJ DEPE requirements.

4.4 SAMPLING METHODS

Sampling during Phase I field operations will include the collection of soil gas, surface soil, subsurface soil, groundwater, and QA/QC samples. General field sampling and sample documentation procedures to be implemented are described in the May 1992 NJ DEPE FSPM and in HNUS Standard Operating Procedures (SOPs). In all instances, NJ DEPE Field Sampling Procedures take precedence over HNUS SOPs. Pertinent NJ DEPE procedures and HNUS SOPS are in Appendix G. The specific sampling procedures for each task are detailed in the following sections. A summary of the proposed sampling and analysis is in Table 4-2.

4.4.1 Geoprobe System

The Geoprobe System allows for the collection of soil gas and subsurface soil and groundwater samples without the installation of permanent monitoring points by advancing a hydraulically powered probe into the subsurface. The Geoprobe System will be procured and operated by subcontract. The subcontractor will be responsible for obtaining all necessary NJ DEPE permits.

For soil gas, a hydraulic probe of approximately one inch outer diameter will be used to penetrate the soil to the required depth. The hydraulic probe is removed from the hole, and a stainless-steel probe with tubing is inserted the full depth of the hole. The hole is then sealed off at the ground surface to isolate the probe from the atmosphere. A stainless-steel syringe is used to pull a volume of in-situ gas vapor from the soil through the probe and tubing displacing air from the system. The first sample of soil gas is vented to the atmosphere. The second sample is extracted and pulled through the system into a pre-evacuated, self-sealing EPA-clean glass vial. Once the sample is obtained, the sampled hole is filled with bentonite to prevent vertical communication. The probe and sampling system will be decontaminated between sampling events using methods specified in NJ DEPE FSPM and SOP GH-1.6.

Soil gas samples will be collected for field analysis using an OVA in the GC mode.

For subsurface soil sampling, the probe assembly of the Geoprobe System consists of a sampler assembly and probe rods. The sampler assembly consists of a piston tip, piston rod, drive-head, piston stop-pin, and sample tube. The sampler assembly is attached to the lead rod and the entire probe assembly is

TABLE 4-2
PHASE I PROPOSED SAMPLING AND ANALYSIS SUMMARY
CTO 85 - UST RI AT VARIOUS SITES
NWS, EARLE, COLTS NECK, NEW JERSEY

Location	Medium	Sample Depth	Analytical Parameters	Sampling Method
Building C-10				
C10-GSS-0105 through C10-GSS-0608	Soil	Five to 5.5 feet	TPH (laboratory 24-hour quick turnaround)	Geoprobe sample tube
C10-SB-0101 through C10-SB-0401	Soil	One to 1.5 feet (highest PID reading between six to four inches)	TPH (laboratory standard turnaround analysis)	Coring device
C10-SB-0105 through C10-SB-0405	Soil	Five to 5.5 feet (layer with 15 percent silt/clay) or water table (8 to 8.5 feet)	TPH (laboratory standard turnaround analysis)	Coring device
C10-GGW-01 through C10-GGW-06	Water	Water table (eight to 8.5 feet)	TPH (laboratory 24-hour quick turnaround)	Mini-bailer
C10-MW1-01	Water	Water table (eight to 8.5 feet)	TPH, VOC+10, SVOC+15 (laboratory standard turnaround analysis)	Bailer
C10-DC-01	Soil	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Trowel
C10-SS-01	Soil	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Trowel
C10-DW-01	Water	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Bailer
Building C-13				
C13-GSS-0105 through C13-GSS-0705	Soil	Five to 5.5 feet	TPH (laboratory 24-hour quick turnaround)	Geoprobe sample tube
C13-SB-0101 through C13-SB-0401	Soil	One to 1.5 feet (highest PID reading between six to four inches)	TPH (laboratory standard turnaround analysis)	Coring device
C13-SB-0105 through C13-SB-0405	Soil	Five to 5.5 feet (layer with >15 percent silt/clay) or water table (10 to 10.5 feet)	TPH (laboratory standard turnaround analysis)	Coring device
C13-GGW-01 through C13-GGW-07	Water	Water table (10 to 10.5 feet)	TPH (laboratory 24-hour quick turnaround)	Mini-bailer

TABLE 4-2 (CONTINUED)
PHASE I PROPOSED SAMPLING AND ANALYSIS SUMMARY
CTO 85 - UST RI AT VARIOUS SITES
NWS, EARLE, COLTS NECK, NEW JERSEY

Location	Medium	Sample Depth	Analytical Parameters	Sampling Method
C13-MW1-01	Water	Water table (10 to 10.5 feet)	TPH, VOC+10, SVOC+15 (laboratory standard turnaround analysis)	Bailer
C13-DC-01	Soil	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Trowel
C13-SS-01	Soil	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Trowel
C13-DW-01	Water	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Bailer
Buildings C-17/20				
C20-SGS-01 through C20-SGS-16	Soil Gas	Five feet	BTEX (field analysis using an OVA in the GC mode)	Geoprobe sample tube
C20-GSS-0105 through C20-GSS-1605	Soil	Five to 5.5 feet	TPH (laboratory 24-hour quick turnaround)	Geoprobe sample tube
C20-SB-0101 through C20-SB-0401	Soil	One to 1.5 feet (highest PID reading between six and 24 inches)	TPH, VOC+10, lead (laboratory standard turnaround analysis)	Coring device
C20-SB-0105 through C20-SB-0405	Soil	Five to 5.5 feet (layer with >15 percent silt/clay) or water table (10 to 10.5 feet)	TPH, VOC+10, lead (laboratory standard turnaround analysis)	Coring device
C20-GGW-01 through C20-GGW-16	Water	Water table (10 to 10.5 feet)	TPH (laboratory 24-hour quick turnaround)	Mini-bailer
C20-MW1-01	Water	Water table (10 to 10.5 feet)	TPH, VOC+10, MTBE, TBA, SVOC+15 (laboratory standard turnaround analysis)	Bailer
C20-MW2-01	Water	Water table (10 to 10.5 feet)	TPH, VOC+10, MTBE, TBA, SVOC+15 (laboratory standard turnaround analysis)	Bailer

TABLE 4-2 (CONTINUED)
PHASE I PROPOSED SAMPLING AND ANALYSIS SUMMARY
CTO 85 - UST RI AT VARIOUS SITES
NWS, EARLE, COLTS NECK, NEW JERSEY

Location	Medium	Sample Depth	Analytical Parameters	Sampling Method
C20-DC-01	Soil	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Trowel
C20-SS-01	Soil	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Trowel
C20-DW-01	Water	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Bailer
Building C-27				
C27-GSS-0105 through C27-GSS-0605	Soil	Five to 5.5 feet	TPH (laboratory 24-hour quick turnaround)	Geoprobe sample tube
C27-SB-0101 through C27-SB-0401	Soil	One to 1.5 feet (highest PID reading between six to four inches)	TPH (laboratory standard turnaround analysis)	Coring device
C27-SB-0105 through C27-SB-0405	Soil	Five to 5.5 feet (layer with >15 percent silt/clay) or water table (10 to 10.5 feet)	TPH (laboratory standard turnaround analysis)	Coring device
C27-GGW-01 through C27-GGW-06	Water	Water table (10 to 10.5 feet)	TPH (laboratory 24-hour quick turnaround)	Mini-bailer
C27-MW1-01	Water	Water table (10 to 10.5 feet)	TPH, VOC+10, SVOC+15 (laboratory standard turnaround analysis)	Bailer
C27-DC-01	Soil	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Trowel
C27-SS-01	Soil	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Trowel
C27-DW-01	Water	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Bailer

TABLE 4-2 (CONTINUED)
PHASE I PROPOSED SAMPLING AND ANALYSIS SUMMARY
CTO 85 - UST RI AT VARIOUS SITES
NWS, EARLE, COLTS NECK, NEW JERSEY

Location	Medium	Sample Depth	Analytical Parameters	Sampling Method
Building S106B				
S106-GSS-0110 through S106-GSS-0610	Soil	10 to 10.5 feet	TPH (laboratory 24-hour quick turnaround)	Geoprobe sample tube
S106-SB-0101 through S106-SB-0401	Soil	One to 1.5 feet (highest PID reading between six to four inches)	TPH (laboratory standard turnaround analysis)	Coring device
S106-SB-0105 through S106-SB-0405	Soil	9.5 to 10 feet or water table (25 to 25.5 feet)	TPH (laboratory standard turnaround analysis)	Coring device
S106-GGW-01 through S106-GGW-06	Water	Water table (25 to 25.5 feet)	TPH (laboratory 24-hour quick turnaround)	Mini-bailer
S106-MW1-01	Water	Water table (25 to 25.5 feet)	TPH, VOC+10, SVOC+15 (laboratory standard turnaround analysis)	Bailer
S106-DC-01	Soil	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Trowel
S106-SS-01	Soil	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Trowel
S106-DW-01	Water	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Bailer
Buildings R-6/7				
R7-SGS-01 through R7-SGS-12	Soil Gas	Five feet	BTEX (field analysis using an OVA in GC mode)	Geoprobe sample tube
R7-GSS-0105 through R7-GSS-1205	Soil	Five to 5.5 feet	TPH (laboratory 24-hour quick turnaround)	Geoprobe sample tube
R7-SB-0101 through R7-SB-0401	Soil	One to 1.5 feet (highest PID reading between six and 24 inches)	TPH, VOC+10, lead (laboratory standard turnaround analysis)	Coring device
R7-SB-0105 through R7-SB-0405	Soil	Five to 5.5 feet (layer with >15 percent silt/clay) or water table (8 to 8.5 feet)	TPH, VOC+10, lead (laboratory standard turnaround analysis)	Coring device

TABLE 4-2 (CONTINUED)
PHASE I PROPOSED SAMPLING AND ANALYSIS SUMMARY
CTO 85 - UST RI AT VARIOUS SITES
NWS, EARLE, COLTS NECK, NEW JERSEY

Location	Medium	Sample Depth	Analytical Parameters	Sampling Method
R7-GGW-01 through R7-GGW-12	Water	Water table (eight to 8.5 feet)	TPH (laboratory 24-hour quick turnaround)	Mini-bailer
R7-MW1-01	Water	Water table (eight to 8.5 feet)	TPH, VOC+10, MTBE, TBA, SVOC+15 (laboratory standard turnaround analysis)	Bailer
R7-MW2-01	Water	Water table (eight to 8.5 feet)	TPH, VOC+10, MTBE, TBA, SVOC+15 (laboratory standard turnaround analysis)	Bailer
R7-DC-01	Soil	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Trowel
R7-SS-01	Soil	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Trowel
R7-DW-01	Water	- - -	TCLP organics and inorganics (laboratory standard turnaround analysis)	Bailer

TPH - Total petroleum hydrocarbons

BTEX - Benzene, toluene, ethyl benzene, xylene

MTBE - Methyl tertiary butyl ether

TBA - Tertiary butyl alcohol

hydraulically advanced to the top of the interval to be sampled. Extension rods are then lowered into the probe rods and the piston stop-pin is disengaged. This allows the piston tip and rods to retract into the sample tube while the sample is taken. The probe assembly is driven the appropriate distance to obtain the sample. The probe assembly is withdrawn from the subsurface and the sample extruded. Once the sample is obtained, the sampled hole is filled with bentonite to prevent vertical communication. The probe assembly will be decontaminated between sampling events using methods specified in NJ DEPE FSPM and SOP GH-1.6. Subsurface soil samples will be collected using methods specified in NJ DEPE FSPM and SOP GH-1.3.

For groundwater sampling, the probe assembly of the Geoprobe System will basically consist of a removable drive point, screen point groundwater sampler, and probe rods. The groundwater sampler is threaded onto the lead rod, just behind the drive point, and the entire probe assembly is advanced to a specified depth below the top of the water table. The probe assembly is then pulled up 18 inches, leaving the drive point behind and creating an 18-inch open borehole. An extension rod ram is inserted into the probe assembly to push the groundwater sampler out of the probe assembly into the saturated soil section. Groundwater samples are then collected using a peristaltic pump. As an alternative to the removable drive point and screen point sampler, PVC tubing can be inserted into the probe hole after the probe rods are removed. Where necessary, the PVC tubing is allowed to recharge overnight before a groundwater sample is collected. After the samples have been collected, the entire probe assembly, excluding the drive point, is withdrawn from the subsurface. The probe assembly will be decontaminated between sampling events using methods specified in NJ DEPE FSPM and SOP GH-1.6. Groundwater samples will be collected using methods specified in NJ DEPE FSPM and SOPs SA-1.1 and SF-1.2.

All subsurface soil and groundwater samples will be analyzed by an NJ DEPE-certified, NEESA-approved laboratory that will provide 24-hour quick turnaround service. TPH analyses will be conducted using EPA Method 418.1.

All disposable sampling equipment will be dedicated and will be properly disposed. All non-disposable sampling equipment will be decontaminated before use and between each Geoprobe site using methods specified in NJ DEPE FSPM and SOP SF-2.3.

4.4.2 Soil Borings

A subcontracted drilling company will advance a total of 24 soil borings (four soil borings at each building) at Buildings C-10, C-13, C-17/20, C-27, S-106B, and R-6/7 using methods specified in NJ DEPE FSPM and SOP GH-1.4. The subcontracted drilling company will be responsible for obtaining all necessary NJ DEPE permits.

Continuous standard penetration test and split-spoon sampling will be conducted for each two-foot interval, from the ground surface to the total depth of the boring, in the four soil borings installed at each building. Samples will be acquired using nominal two-inch outside diameter (O.D.) split-spoon samplers, according to methods presented in American Society for Testing and Materials (ASTM) D-1586-84. During the advancement of the borings at each building, soils will be inspected from each split-spoon sampler to provide a complete lithologic record of the subsurface materials. A complete boring log will be maintained for the borings at each building by the field geologist using methods specified in NJ DEPE FSPM and SOP GH-1.5. Each log will describe lithologies encountered, depth of contacts, water levels, sample depths, and sample numbers and will include data from Standard Penetration Tests. Soil samples will be described using the Unified Soil Classification System. An example boring log is included in Appendix G.

Upon the opening of each split-spoon sampler, the soils will be monitored for organic vapors using a PID. Discrete soil samples will be collected in all four soil borings using methods specified in NJ DEPE FSPM and SOP GH-1.3. The following soil samples will be collected for standard turnaround laboratory chemical analysis from all soil borings:

- The six-inch interval from six to 24 inches with the highest PID reading.

- If the surface soil consists of less than 15 percent silt/clay, the six-inch interval above the saturated zone or the six-inch interval within the next lower horizontal layer with greater than or equal to 15 percent silt/clay, or the six-inch interval from 9.5 to 10 feet, whichever is first.

It is estimated that two subsurface soil samples will be collected for analysis from each soil boring. Additional soil samples may be required if the ground surface has been regraded or samples show evidence of contamination. Discrete soil samples from Buildings C-10, C-13, C-27, and S-106B will be analyzed by an NJ DEPE-certified, NEESA-approved laboratory for TPH using EPA Method E418.1. Discrete soil samples from Buildings C-17/20 and R-6/7 will likewise be analyzed by an NJ DEPE-certified, NEESA-approved laboratory for TPH and also for TCL VOC+10 and lead using CLP analytical protocol.

Split-spoon samples/drill cuttings and samples that are visibly contaminated with hydrocarbons, if any, will be containerized and stored on site in 55-gallon Department of Transportation (DOT)-approved steel drums (DOT 17-H) using methods specified in NJ DEPE FSPM and SOP SF-2.2. Soils that are visibly clean will be piled on a sheet of plastic located near the respective building.

All disposable sampling equipment will be dedicated and will be disposed properly. All non-disposable sampling equipment will be decontaminated before use and between each soil boring using methods specified in NJ DEPE FSPM and SOP SF-2.3.

At the request of NWS Earle, Halliburton NUS will subcontract the disposal of contaminated soil and water generated during this project. In order to dispose of the contaminated material, samples of the drummed material and stockpiled soils will be analyzed by an NJ-DEPE-certified, NEESA-approved laboratory for TCLP organics and inorganics using SW 846, Method 1311/et al.

4.4.3 Permanent Groundwater Monitoring Well Installation

During Phase I, the subcontracted New-Jersey-licensed drilling company will install one screened and cased monitoring well at Buildings C-10, C-13, C-17/20, and C-27 and two screened and cased monitoring wells at Buildings R-6/7 using methods specified in NJ DEPE FSPM and SOP GH-1.7. Split-spoon samples will not be collected during the borehole drilling of monitoring wells being installed in the excavated areas at Buildings C-10, C-13, and C-27. The wells being installed at Buildings C-17/20 and R-6/7 will be installed in soil borings. During Phase II, the subcontracted New-Jersey-licensed drilling company will install up to three screened and cased monitoring wells at those buildings where contamination is confirmed to be above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D. In both phases, the subcontracted drilling company will be responsible for obtaining all necessary NJ DEPE permits.

The monitoring wells will be constructed of four-inch internal diameter (ID), threaded, flush joint, National Sanitary Foundation (NSF)-certified, Schedule 40 polyvinyl chloride (PVC) well casing and screen. The well screen will have a length of 15 feet and a 0.010 slot size. The top of the screen shall extend five feet above the top of the water table encountered during drilling.

A filter pack, consisting of clean silica sand, will be placed by free fall from the bottom of the well screen to a minimum of two feet above the top of the well screen. A minimum of two feet of bentonite pellets will be placed on top of the filter pack. The bentonite pellets will be activated by potable water before the addition of a bentonite/cement grout. The bentonite cement ground will be placed by tremie pipe from the top of the bentonite pellets to approximately 10 inches below grade. Steel guard casing will be centered around the well casing, cemented in place, and fitted with a flush-mounted cap. The wells will be developed after the grout has been placed. All development water will be containerized in 55-gallon DOT-approved steel drums (DOT 17-E) using methods specified in NJ DEPE FSPM and SOP SF-2.2. The Navy will be responsible for disposal of the drums.

Drill cuttings that are visibly contaminated with hydrocarbons, if any, will be containerized and stored on site in 55-gallon DOT-approved steel drums (DOT 17-H) using methods specified in NJ DEPE FSPM and SOP SF-2.2. Cuttings that are visibly clean will be piled on a sheet of plastic located near the respective building. At the request of NWS Earle, Halliburton NUS will subcontract the disposal of contaminated soil and water generated during this project. In order to dispose of the contaminated material, samples of the drummed material and stockpiled soils will be analyzed by an NJ-DEPE-certified, NEESA-approved laboratory for TCLP organics and inorganics using SW 846, Method 1311, et al.

All disposable sampling equipment will be disposed properly. All non-disposable sampling equipment will be decontaminated before use and between each boring or well using methods specified in NJ DEPE FSPM and SOP SF-2.3.

4.4.4 Surveying

The horizontal position of each Geoprobe Site and soil boring will be surveyed to two permanent on-site structures. The horizontal position and vertical elevation of each permanent groundwater monitoring well will be surveyed by an NJ-licensed surveyor. For each monitoring well, the top of the manhole cover (ground surface) and the top of the innermost casing (excluding cap) will be measured to the nearest 0.01 foot. The survey point will be marked on each well.

4.4.5 Groundwater Sampling of Permanent Groundwater Monitoring Wells

During Phase I operations, an initial round of groundwater samples will be collected a minimum of two weeks after well completion for standard turnaround laboratory chemical analysis. If contamination is detected at concentrations above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D, two additional rounds of groundwater sampling for standard turnaround laboratory chemical analysis will be conducted. During Phase II operations, one round of groundwater samples will be collected for standard turnaround laboratory chemical analysis at those buildings where contamination is confirmed to be above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D. Groundwater samples will not be collected for analysis from those monitoring wells with free product. The groundwater samples will be collected using methods specified in NJ DEPE FSPM and SOP SA-1.1 from each of the monitoring wells at least two weeks after well development. Each well will be purged a minimum of three volumes using bailers. Field testing of pH, temperature, and conductivity will be performed using methods specified in NJ DEPE FSPM and SOP SF-1.1 after well purging and before sampling. Samples will be poured directly from bailers into appropriately pre-preserved sample containers. The samples will include applicable field QA/QC samples (i.e., blanks and duplicates). Samples from wells located at Buildings C-10, C-13, C-27,

and S-106B will be analyzed by a NJ DEPE-certified, NEESA-approved laboratory for TPH using EPA Method 418.1 and TCL VOC+10 and TCL SVOC+15 analyses will be accomplished via CLP protocol, which is allowable under N.J.A.C. 26D. Samples from wells located at Buildings C-17/20 and R-6/7 will be analyzed for the same analytes using the same methods as those used for the other building samples; however, the compounds MTBE and TBA will be added to the TCL VOC analyte list.

All purge water and decontamination fluids generated during groundwater sampling activities will be containerized and stored on site in 55-gallon DOT-approved steel drums (DOT 17-E) using methods specified in NJ DEPE FSPM and SOP SF-2.2.

All disposable sampling equipment will be disposed properly. All non-disposable sampling equipment will be decontaminated before use and between each well using methods specified in NJ DEPE FSPM and SOP SF-2.3.

4.4.6 Groundwater-Level Measurement in Permanent Groundwater Monitoring Wells

During Phase I field operations, one round of groundwater-level measurements will be collected from each permanent groundwater monitoring well. During Phase II field operations, two rounds of groundwater-level measurements will be collected a minimum of 30 days apart at those buildings, excepting Buildings R-6/7, where contamination is confirmed to be above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D. At Buildings R-6/7, two rounds of synoptic static-water-level measurements will be collected over two tidal cycles a minimum of 14 days apart if contamination is confirmed to be above applicable groundwater clean-up standards proposed in N.J.A.C. 7:26D. Methods specified in NJ DEPE FSPM and SOP GH-2.5 will be used to collect measurements. The water level will be measured from the top of the casing and from the top of the ground surface and will be measured to 0.01-foot accuracy.

All disposable sampling equipment will be disposed properly. All non-disposable sampling equipment will be decontaminated before use and between each well using methods specified in NJ DEPE FSPM and SOP SF-2.3.

4.4.7 Aquifer Tests

Any slug tests conducted during Phase II field operations will be in accordance with methods specified in SOP GH-2.4. A rising-head slug test will be performed in at least one of the three permanent groundwater monitoring wells installed in Phase II operations in order to provide approximate K values for that portion of the soil that surrounds the screened interval in the permanent groundwater monitoring well. Water-level measurements will be obtained during the test using a pressure transducer.

Tracer tests or electronic velocity meters will be used in accordance with industry standards to determine the rate of groundwater flow and contaminant flow.

All disposable sampling equipment will be disposed properly. All non-disposable sampling equipment will be decontaminated before use and between each test using methods specified in NJ DEPE FSPM and SOP SF-2.3.

4.4.8 Surface Water and Sediment Sampling

Surface water and sediment samples will be collected for standard turnaround laboratory chemical analysis during Phase II field operations if contamination is confirmed to be above applicable clean-up standards proposed in N.J.A.C. 7:26D. The samples will be collected concurrently in accordance with N.J.A.C. 7:26E-3.9 using methods specified in NJ DEPE FSPM and SOP SA-1.2. The samples will be obtained from the surface water body within three feet of the water line upstream and downstream of the AOC and at any existing discharge points at the AOC. The number and frequency of samples to be collected will be determined after the receipt and validation of the analytical results from Phase I sampling operations.

The surface water sample will be collected from mid-depth in the channel directly into the sample bottle if possible; otherwise, a pond sampler will be used. The surface water samples will be analyzed by an NJ DEPE-certified, NEESA-approved laboratory for TPH using EPA Method 418.1 and TCL VOC+10 and SVOC+15 using CLP analytical protocol if the USTs located at the building possibly affecting the surface body were filled with heating oil. The surface water samples will be analyzed by an NJ DEPE-certified, NEESA-approved laboratory for TPH using EPA Method 418.1 and TCL VOC+10 (with MTBE and TBA added as target analytes) and TCL SVOC+15 using CLP analytical protocol if the USTS located at the building possibly affecting the surface body were filled with gasoline and/or diesel.

Sediment samples will be collected using a scoop or trowel. Excess liquid will not be decanted from the sample bottle. The sediment samples will be analyzed by an NJ DEPE-certified, NEESA-approved laboratory for TPH using EPA Method 418.1 and TCL VOC+10 and SVOC+15 using CLP analytical protocol if the USTS located at the building possibly affecting the surface body were filled with heating oil. The sediment samples will be analyzed for TPH using EPA Method 418.1 and TCL VOC+10 (with MTBE and TBA added as target analytes) and TCL SVOC+15 using CLP analytical protocol if the USTs located at the building possibly affecting the surface body were filled with gasoline and/or diesel. The samples will include applicable field QA/QC samples (i.e., blanks and duplicates). Sediments will also be analyzed for pH, total organic carbon, and particle size.

All disposable sampling equipment will be disposed properly. All non-disposable sampling equipment will be decontaminated before use and between each sample location using methods specified in NJ DEPE FSPM and SOP SF-2.3.

4.4.9 Duplicate and Split Samples

Duplicate samples will be obtained during Phase I activities to monitor sampling techniques in the field and in the laboratory. These samples will be collected at a rate of one duplicate for each 20 field samples. The laboratory will receive them as "blind" samples. Details regarding the field duplicate sampling process are further described below and are provided in the appended SOPs.

Aqueous duplicates are collected by alternatively filling sample containers from the same sampling device for each parameter. Samples for volatile organic analysis will be taken from the same bailer and will be the first samples filled.

Soil samples (non-aqueous) will be collected from the same sample location. The sample material will be homogenized in a stainless-steel mixing bowl before sample containers are filled. Sample material for volatile organic analysis will be collected prior to homogenizing to prevent loss of volatile constituents and to preserve the physical integrity of the volatile fraction.

Split samples are not proposed for this field activity. If field conditions change or the scope of work for this activity changes to include the collection of split samples, this work plan will be amended to reflect the change.

4.5 DECONTAMINATION PROCEDURES

An important aspect of quality control is the decontamination of field sampling equipment. Improperly cleaned and prepared equipment can lead to misinterpretation of environmental data due to interference from cross contamination.

All non-disposable sampling equipment that comes in contact with sample medium will be decontaminated using methods specified in NJ DEPE FSPM and SOP SF-2.3 (Appendix F). Specifically, the following decontamination requirements will be met:

- Potable water rinse.
- Detergent rinse (Alconox/Liquinox).

- Deionized water rinse.
- Air dry.
- Wrap sampling device in clean aluminum foil with the dull side of the foil toward the equipment.

4.6 HANDLING OF INVESTIGATION-DERIVED WASTES

Waste that is generated during field activities must be disposed in a manner that will not further the potential for contamination. Waste materials routinely generated from an investigation of this type consist of drill cuttings, decontamination water, and general refuse. At the request of NWS Earle, Halliburton NUS will subcontract the disposal of contaminated soil and water generated by this project.

4.7 SAMPLE CUSTODY

Chain-of-custody (COC) procedures identified in NJ DEPE FSPM and HNUS SOPs will be followed (Appendix G).

As explained in the procedure, a sample is under custody if it is in

- The possession of the sampler/analyst
- View, after being in the possession of the sampler/analyst
- The possession of the sampler/analyst and then placed in a secured location
- A designated secure area

4.7.1 Sample Collection Custody Procedures

The person doing the actual field sampling is responsible for the care and custody of the samples collected until the samples are properly transferred or dispatched.

Sample labels shall be completed for each sample container, using waterproof ink. Appropriate sample description and other pertinent information must be recorded in the field logbook.

4.7.2 Field Documentation/Logbooks

A summary of all field activities will be properly recorded in a bound logbook with consecutively numbered pages that cannot be removed. Logbooks will be assigned to field personnel but will be stored in a secured area when not in use. Each logbook will be identified by a unique number.

At a minimum, the following information will be recorded in the site logbook:

- The name of the person to whom the logbook is assigned.
- The logbook number.
- The project name.
- The project start date.
- The names and responsibilities of on-site project personnel including subcontractor personnel.
- The arrival/departure of site visitors.
- The arrival/departure of equipment.
- Sampling activities and sample logsheet references.
- A description of subcontractor activities.
- Sample pick-up information including COC numbers, air-bill numbers, carrier, time, and date.
- A description of borehole-, trench-, or monitoring well-installation activities.
- Health and safety issues.
- A description of photographs including the date, time, photographer, roll and picture number, location, and direction of the photograph.

All entries will be written in black ink and no erasures will be made. If an incorrect entry is made, the correction will be made by striking a single line through the incorrect information; the person making the correction will initial and date the change.

Samples will be collected following procedures outlined in Section 4.4. The equipment used to collect the sample will be noted in the logbook along with time of sampling, sampler's name, sample description, depth at which the sample was collected, and the volume and number of containers collected. QC sample information will be appropriately recorded.

Field Changes

Changes in proposed project activities may be necessary as a result of altered field conditions or unanticipated events. Amendments or revisions to approved project plans will undergo the same level of review as the original planning document. A summary of the sequence of events associated with field changes is as follows:

- The FTL notifies the PM of the need for a change in scheduled activities.
- The PM will discuss the change with the appropriate individuals (HNUS senior technical advisors, CLEAN Program Contracting Officer, Navy RPM, and NJ DEPE personnel) and will provide verbal approval or denial for the proposed change.
- The FTL will document the change on a Task Modification Request Form and forward the form to the PM immediately.
- The PM will review and sign the form and distribute copies to the CLEAN Program Contracting Officer, CLEAN Program QA Manager, Navy RPM, FTL, and the project file.
- A copy of the completed Task Modification Request Form will also be attached to the field copy of the affected document (i.e., project work plan, safety plan).

Sample Documentation

A sample logsheet will be filled out for each sample collected (see example in Appendix G). A sample logsheet is used to record specific types of data pertaining to the samples. Sample-specific data include such information as the sample identification number, container type and lot number, sample volume, preservative information, media, sample description, any problems encountered during sampling, shipping information (airbill), date and time of sample, and sampler's signature. Sample logsheets are sequentially numbered and stored in a notebook. The notebook is included in the project file at the completion of field activities. Copies of these pages will be included as an appendix to draft and final project deliverables.

Daily Activities Record

The Daily Activities Record is designed for schedule and budget tracking and progress reporting. This record documents the pay items involved with daily activities and progress for each subcontractor. These sheets summarize the work performed and are used to check the subcontractor's request for payment.

The FTL supervising a subcontractor activity must complete a daily activities record form. The subcontractor's signature is required at the end of each day to verify work accomplished and the various pay items (e.g., hours worked, standby time, and materials used).

Equipment Calibration Log Form

Each HNUS instrument requiring calibration will have a separate equipment calibration log form that documents that the manufacturer's instructions and the SOPs were followed for calibration of the equipment. This information should include the frequency and type of standard or calibration device. This record documents the accuracy, precision, or sensitivity of the measurement. If necessary, it will be used to determine if corrections should be applied to the readings. A separate form will be established and maintained for each field instrument.

These forms will be maintained in a binder and, at the completion of the field activities, will be stored in the project file.

4.7.3 Custody Transfer and Shipment Procedures

Sample COC and shipping procedures are outlined in detail in Appendix G. Samples will be accompanied by a properly completed COC form. When transferring the possession of samples, the individuals relinquishing and receiving the samples will sign, date, and note the time of transfer on the record. The original form and one copy will be sealed inside the cooler for shipment; another carbon copy will be retained by the sampler.

Samples will be properly packaged for shipment and secured with strapping tape and custody seals. Examples of sample paperwork and detailed shipping procedures are included in Appendix G.

If the samples are sent by common carrier, a bill of lading will be used. A receipt or a bill of lading will be retained as permanent project documentation. Commercial carriers are not required to sign the custody form as long as the forms are sealed inside the shipping container and the custody forms remain intact. If the samples are sent by mail, the package will b registered with a return receipt requested.

4.7.4 Laboratory Custody Procedures

Proper custody procedures as required by NJ DEPE and "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program," NEESA 20.2-047B (June 1988) will be followed by the laboratory.

When the samples are received by the laboratory, the bill of lading or shipping manifest will be signed and dated to document sample receipt. The laboratory will keep a copy of the manifest that will be included in the data package. The sample custodian will verify the integrity of the custody seals and the condition of the shipping containers. When the containers are opened, the temperature of the cooler will be measured and documented and the enclosed sample paperwork will be removed.

The samples will be removed from the coolers, and the condition of the bottles will be noted. All pertinent sample paperwork and labels will be inspected for discrepancies. Breakage or discrepancies will be resolved through the PM. Sample preservation will be noted and any improper preservation will be documented on an out-of-control form; corrective action will be taken in accordance with NJ DEPE and NEESA requirements. Holding times will be observed as specified in Table 4-3. Laboratory tracking procedures will be followed as discussed in the laboratory QA Plan provided by the contracted laboratory.

4.8 CALIBRATION PROCEDURES

4.8.1 Field Calibration and Preventative Maintenance Procedures

It is the PM's responsibility to ensure that field team members are trained in the calibration, use, and maintenance of all applicable field instruments and equipment.

Equipment used during field activities and sample collection will be calibrated in accordance with SOPs and manufacturers' instructions.

Equipment will be inspected at the beginning of each day to ensure that it is in operable condition and calibrated. All calibration activities will be documented on equipment calibration log sheets. Instruments in need of repair will be removed from service and clearly marked to ensure against further use.

The field logbook will clearly identify the specific instruments used for each task.

TABLE 4-3
SAMPLE REQUIREMENT SUMMARY
CTO 85 - UST RI AT VARIOUS SITES
NWS EARLE, COLTS NECK, NEW JERSEY

Analytical Parameter	Analytical Method	NEESA DQO Level[1]	Holding Times[6][7]	Sample Volume		Preservative	
TPH[2]	E418.1	E	24 hours	Soil:	One 8-ounce glass jar with Teflon-lined lid	Soil:	Cool to 4°C
				Aqueous:	One 1-liter glass jar with Teflon-lined lid	Aqueous:	HCl to pH <2; Cool to 4°C
TPH	E418.1	C	28 days	Soil:	One 8-ounce glass jar with Teflon-lined lid	Soil:	Cool to 4°C
				Aqueous:	One 1-liter glass jar with Teflon-lined lid	Aqueous:	HCl to pH <2; Cool to 4°C
TCL VOC+10[3] MTBE[4] TBA[4]	CLP SOW OLM01.8	C	14 days to analysis	Soil:	Two 60-ml glass jars with Teflon septum	Soil:	Cool to 4°C
				Aqueous:	Two 40-ml glass jars with Teflon septum	Aqueous:	HCl to pH <2; Cool to 4°C
TCL SVOC+15[5]	CLP SOW OLM01.8	C	Seven days to extraction; 40 days to analysis	Soil:	One 8-ounce glass jar with Teflon-lined lid	Soil:	Cool to 4°C
				Aqueous:	One 1-liter glass jar with Teflon-lined lid	Aqueous:	HCl to pH <2; Cool to 4°C
BTEX[6]	Field analyzed using an OVA in the GC mode	E	- - -	- - -		- - -	
CLP Lead	CLP SOW ILM02.1	C	180 days	Soil:	One 8-ounce glass jar with Teflon-lined lid	Soil:	Cool to 4°C

TABLE 4-3
SAMPLE REQUIREMENT SUMMARY
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Analytical Parameter	Analytical Method	NEESA DQO Level(1)	Holding Times(6)(7)	Sample Volume		Preservative	
TCLP Organic	SW-846 1311/et al.	C	14 days to extraction VOCs: 14 days after extraction to analysis SVOC and PCBs: 7 days after extraction to preparative extraction; 40 days after preparative extraction to analysis	Soil:	One 250-gram glass jar with Teflon-lined lid	Soil:	Cool to 4°C
				Aqueous:	One 4-liter glass jar with Teflon-lined lid	Aqueous:	Cool to 4°C
TCLP Inorganic	SW-846 1311/et al.	C	Mercury: 28 days to extraction; 28 days after extraction to analysis Metals: 180 days to extraction; 180 days after extraction to analysis	Soil:	One 250-gram glass jar with Teflon-lined lid	Soil:	Cool to 4°C
				Aqueous:	One 4-liter glass jar with Teflon-lined lid	Aqueous:	Cool to 4°C

(1) Naval Energy and Environmental Support Activity (NEESA) "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program," 20.2-047B, June 1988.

(2) Analysis to be performed by laboratory on a 24-hour quick turnaround basis.

(3) TCL VOC+10 - Analysis is to include the EPA CLP target compound list for volatile fraction plus a library search for the 10 highest-concentration non-target tentatively identified compounds present in the sample.

(4) MTBE and TBA will be added for select groundwater sample analysis.

(5) TCL SVOC+15 - Analysis is to include the EPA CLP target compound list for the semivolatile fraction plus a library search for the 15 highest-concentration non-target tentatively identified compounds present in the sample.

(6) BTEX - Benzene, toluene, ethyl benzene, and xylenes.

(7) Maximum allowable holding times are calculated from date of sample collection.

4.8.2 Laboratory Calibration Procedures

The laboratory is responsible for properly calibrating and maintaining analytical instrumentation. The laboratory's approved QA plan and method-specific QC activities must be in compliance with NJ DEPE requirements and the NEESA Guidelines 20.2-047B (June 1988). Sufficient documentation of compliance will be provided by the laboratory and will be included as part of the data package.

4.9 ANALYTICAL PROCEDURES

All sampling and monitoring activities conducted in the field will be documented including calibration and use records for field instrumentation. All data generated will be reviewed by the FTL and approved before accepted.

Off-site analytical support will be provided by an NJ DEPE-certified, NEESA-approved analytical laboratory. This laboratory is responsible for compliance to all applicable NJ DEPE and NEESA requirements. Analyses will be conducted according to methods specified in Table 4-3. The analytical data package(s) is required to meet NJ DEPE deliverable requirements. These requirements are further addressed in Section 4.9.2. All method-specific QA/QC requirements and NJ DEPE program requirements will be met.

4.9.1 Laboratory Sample Storage Procedures

The laboratory is required to follow the sample storage procedures outlined in the laboratory's approved QA Plan. Specifically, the samples will be maintained under custody and will be stored in compliance with all applicable method-specific and program QA/QC requirements.

4.9.2 Laboratory Data Deliverable Format

The analytical laboratory will be required to report only sample and associated laboratory method blank analysis results for the 24-hour quick turnaround (NEESA Level E) TPH analyses. These data results will be reported via telecopy to the PM and will be used qualitatively in the field to support the boring location and monitoring well drilling activities.

Data from Phase I (NEESA Level C) TPH, VOC+10 (MTBE and TBA added where applicable), SVOC+15, and CLP lead samples that are submitted to the laboratory for standard turnaround analysis will be used for delineation purposes. Data from Phase I (NEESA Level C) TCLP organic and inorganic samples will be used to characterize the waste material for disposal. The applicable reduced laboratory data

deliverables, as defined under N.J.A.C. 7:26D, Appendix A, will be required for submission by the laboratory. Data generated under Phase II will be used for the determination of contaminant migration pathways and the identification of potential receptors. Full laboratory data deliverables (N.J.A.C. 7:26D, Appendix A) will be required for submission by the laboratory. Submission of electronic data records pertaining to analyses conducted under Phase I and Phase II will also be required. The format of the electronic data records will meet HNUS/CLEAN requirements.

4.10 DATA REDUCTION, VALIDATION, AND REPORTING

Data reduction will be performed by the laboratory in accordance with the laboratory's approved QA plan, laboratory SOPs, and NJ DEPE and NEESA requirements. Documentation to support the data review will be included in the data package. The content and format of the analytical data packages are discussed in the preceding Section 4.9.2.

Additionally, 100 percent of the standard turnaround analytical data generated for Phase I, except data generated from waste sample collection, and Phase II will be formally validated by qualified HNUS personnel to ensure the integrity and accuracy of the data, as reported by the laboratory. In general, the analytical data packages will be validated using the following guidance:

- Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses, EPA (December 1990), as modified for Region II.

- Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses, EPA (June 1988), as modified for Region II.

Supporting guidance is also provided in "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program," NEESA (June 1988). The data pertaining to the TPH analysis will be evaluated according to method-specific QC criteria.

As per the EPA national protocols, the organics and metals analysis data will be evaluated with regard to the following general parameters:

- Data completeness
- Holding times (until preparation/analysis)
- Initial and continuing calibration
- Laboratory and field quality control blank analyses
- Laboratory and field duplicate analyses (as applicable)

- Matrix spike analyses
- Detection limits
- Analyte quantitation

As shown below, parameters specific to the nature of the analyses conducted will also be evaluated:

- Surrogate spike recoveries (organics only)
- Internal standards performance (organics only)
- Interference Check Sample (ICS) analyses (metals only)
- Laboratory Control Sample (LCS) results (metals only)
- Furnace atomic absorption results (metals only)
- Serial dilution analyses (metals only)

The validation described above is documented in memoranda to the file (complete with support documentation) per each data package evaluated. Data validation memoranda are QA checked by the CLEAN Program QA Manager before submittal to the PM.

4.11 DATA ASSESSMENT PROCEDURES

The analytical data will be evaluated for precision, accuracy, and completeness. The acceptability of the analytical precision will be determined by comparing the data to the control limits recommended in the methods. Data determined to be insufficiently precise or accurate will be subject to the corrective action prescribed by the appropriate analytical method. The QC samples used in the determination of precision and accuracy were previously described in Section 4.2. Specific equations used to calculate precision, accuracy, and completeness are presented below.

Precision will be expressed in terms of Relative Percent Difference (RPD).

$$RPD = \frac{\text{Concentration 1 - Concentration 2}}{(\text{Concentration 1 - Concentration 2})/2} \times 100$$

Accuracy as determined from the analysis of an external reference standard will be expressed as Percent Recovery (%R).

$$\%R = \frac{\text{Measured Concentration}}{\text{Actual Concentration}} \times 100$$

Accuracy as determined from the analysis of a spiked sample will also be expressed as %R.

$$\%R = \frac{(\text{Spike Sample Concentration} - \text{Sample Concentration})}{\text{Concentration of Spike Added}} \times 100$$

Completeness will describe the number of useable analytical results as a percentage of the total number of samples submitted for analysis.

$$\%\ \text{Complete} = \frac{\text{Valid Data}}{\text{Total Data Planned}} \times 100$$

5.0 HEALTH AND SAFETY

5.1 PROJECT ORGANIZATION AND RESPONSIBILITIES

The CLEAN Program H&S Manager is responsible for ensuring that the site-specific HASP is in accordance with federal and state regulations and contract specifications. The Clean Program H&S Manager also provides technical safety and industrial hygiene oversight for all field work performed under the CLEAN contract and provides assistance and guidance to the Project H & S Officer. The Project H&S Officer is responsible for preparing the site-specific HASP, and verifying that site personnel adhere to the site safety requirements. The Project H&S Officer also provides guidance about appropriate corrective action procedures and maintains communication between the SSO, PM, and Clean Program H&S Manager.

5.2 HEALTH AND SAFETY OBJECTIVES

HNUS has established a comprehensive health, safety, and training program for all field activities, particularly those that have the potential for chemical exposures. The program is intended to provide adequate procedures, protective gear, monitoring, and follow-up to protect the health of HNUS, subcontractor, and client, as well as the public near our work sites.

This program is driven by the requirement to comply with federal and state Occupational Safety and Health Administrative (OSHA) regulations, the need to minimize the risk of adverse health effects from exposure to work hazards, and the savings inherent in safe work activities. In this regard our objective is to comply with all standards, training requirements, medical monitorings, and employee protection requirements for workers engaged in hazardous waste operations, as required by 29 CFR 1910.120 March 6, 1989.

The site-specific HASP is in Appendix F.