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NSB NEW LONDON
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BRIEFING DOCUMENT
PROPOSED INTERIM REMEDIAL ACTIONS
NAVAL SUBMARINE BASE — NEW LONDON
GROTON, CONNECTICUT

Prepared For:

COPY

NAVAL SUBMARINE BASE — NEW LONDON
GROTON, CONNECTICUT

Prepared By:

ATLANTIC ENVIRONMENTAL SERVICES, INC.
COLCHESTER, CONNECTICUT

ATLANTIC PROJECT NO.: 1256-10-90

MAY 1993

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1.0 INTRODUCTION

1.1 Purpose and Scope

The Naval Submarine Base in New London (NSB-NLON) consists of approximately 547 acres of land and associated buildings in southeastern Connecticut in the towns of Ledyard and Groton. NSB-NLON is on the east bank of the Thames River, approximately 6 miles north of Long Island Sound. Figures 1-1 and 1-2 show the site vicinity and location, respectively. NSB-NLON was placed on the National Priorities List (NPL) on August 28, 1991 by the U.S. Environmental Protection Agency (U.S. EPA) pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980.

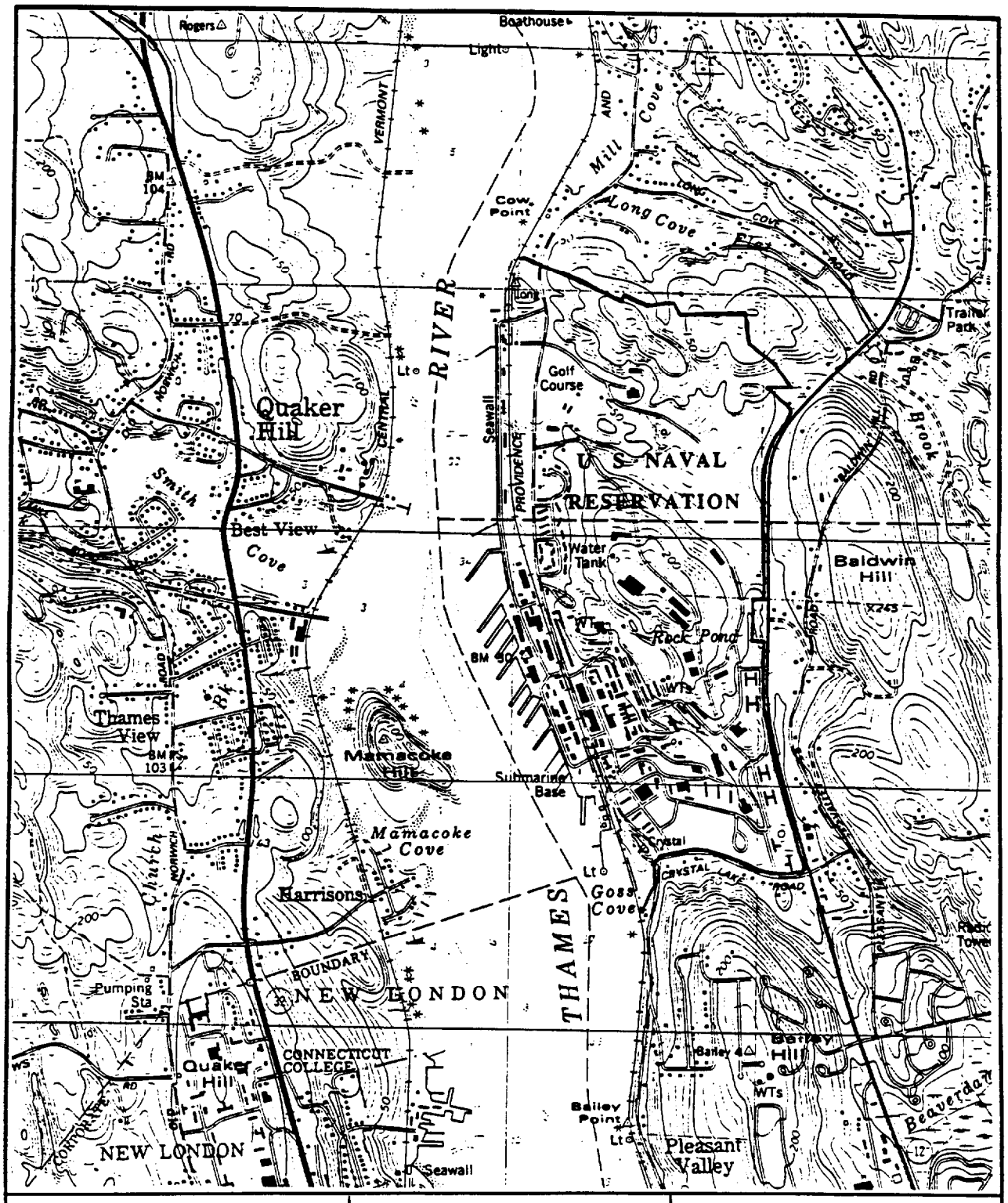
This briefing document summarizes the interim remedial actions proposed for specific areas/medium (operable units) at NSB-NLON in Groton, Connecticut. These interim remedial actions are source control actions. These are remedial actions necessary to prevent the continued release of contaminants into the environment. The Navy's goal is to begin interim remedial actions at NSB-NLON as quickly as possible to protect human health and the environment and to comply with applicable or relevant and appropriate requirements (ARARs). Input from the Technical Review Committee (TRC) and regulatory agencies regarding the general concept of the interim remedial action program is requested. This document was developed solely to facilitate this input and is not intended to be a substitute for the focused feasibility study to be developed as part of this process.

This briefing document provides the following information for each operable unit:

- **Interim Remedial Actions Operable Units:** Description of the proposed interim remedial action at each operable unit, summary of risk calculations, and the rationale for selection.

- **Site Characteristics:** Site background, site-specific geology and hydrology, and nature and extent of contamination.

INSTALLATION RESTORATION STUDY NAVAL SUBMARINE BASE - NEW LONDON GROTON, CT	SOURCE: Marshall Penn-York Co. Inc. Miles 0 1 2 3 N APPROXIMATE SCALE	FIGURE 1-1 SITE VICINITY ATLANTIC ENVIRONMENTAL SERVICES, INC.



INSTALLATION RESTORATION STUDY
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT

SOURCE: Uncasville, Ct.
U.S.G.S. Topographic Map
1984

N

0 1000 2000'
SCALE

FIGURE 1-2
SITE LOCATION

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- **Preliminary Remedial Action Objectives:** Site-specific summary of chemical-specific, location-specific, and action-specific ARARs and to-be-considered (TBC) criteria. Preliminary risk-based standards are also provided.

- **Interim Remedial Actions:** Proposed plan of action for each operable unit, including data collection requirements and engineering considerations. The additional data-collection requirements include implementing some of the sampling and analysis specified in the Phase II Work Plan which pertains to the interim remedial actions for the selected operable units. This work is required to obtain engineering data and to further define the nature and extent of contamination for the remedial design. The remaining aspects of the additional investigations for NSB-NLON will be implemented as part of the overall Phase II Remedial Investigation.

The overall process of proceeding with the interim remedial actions is as follows:

- initiate remedial design and collection of supplemental data (laboratory analysis and engineering);

- complete, focused feasibility study, including evaluation of collected data and remedial alternatives;

- development of proposed plan and record of decision (ROD);

- on-going public participation;

- complete design; and

- implementation of approved, interim remedial actions.

A generalized schedule for the project is included in Table 1-1.

TABLE 1-1
SCHEDULE OF INTERIM REMEDIAL ACTIONS
NAVAL SUBMARINE BASE — NEW LONDON
GROTON, CONNECTICUT

Activities	1993	1994	1995	Beyond 1995
Area A Landfill/Concrete Pad — Soils				
Phase II RI Work Plan	●			
Supplemental Sampling and Analysis	⊕●			
Focused Feasibility Study, Proposed Plan, ROD	⊕	●		
Interim Remedial Design — PCB Soils and Landfill Cap		⊕●		
Interim Remedial Action — PCB Soils and Landfill Cap			⊕●	
Cap Operation and Maintenance			⊕	●
Area A Downstream/OBDA — Sediments				
Phase II RI Work Plan	●			
Supplemental Sampling and Analysis	⊕●			
Focused Feasibility Study, Proposed Plan, ROD	⊕	●		
Interim Remedial Design — DDTR Sediments		⊕●		
Interim Remedial Action — DDTR Sediments			⊕●	
DRMO — Soils				
Phase II RI Work Plan	●			
Supplemental Sampling and Analysis	⊕●			
Focused Feasibility Study, Proposed Plan, ROD	⊕	●		
Interim Remedial Design — Soils		⊕●		
Interim Remedial Action — Soils			⊕●	
Spent Acid Storage and Disposal Area — Soils				
Phase II Work Plan	●			
Supplemental Sampling and Analysis	⊕●			
Focused Feasibility Study, Proposed Plan, ROD	⊕	●		
Interim Remedial Design — Lead Soils		⊕●		
Interim Remedial Action — Lead Soils			⊕●	

⊕ Activity starts
● Activity completed

2.0 INTERIM REMEDIAL ACTION OPERABLE UNITS

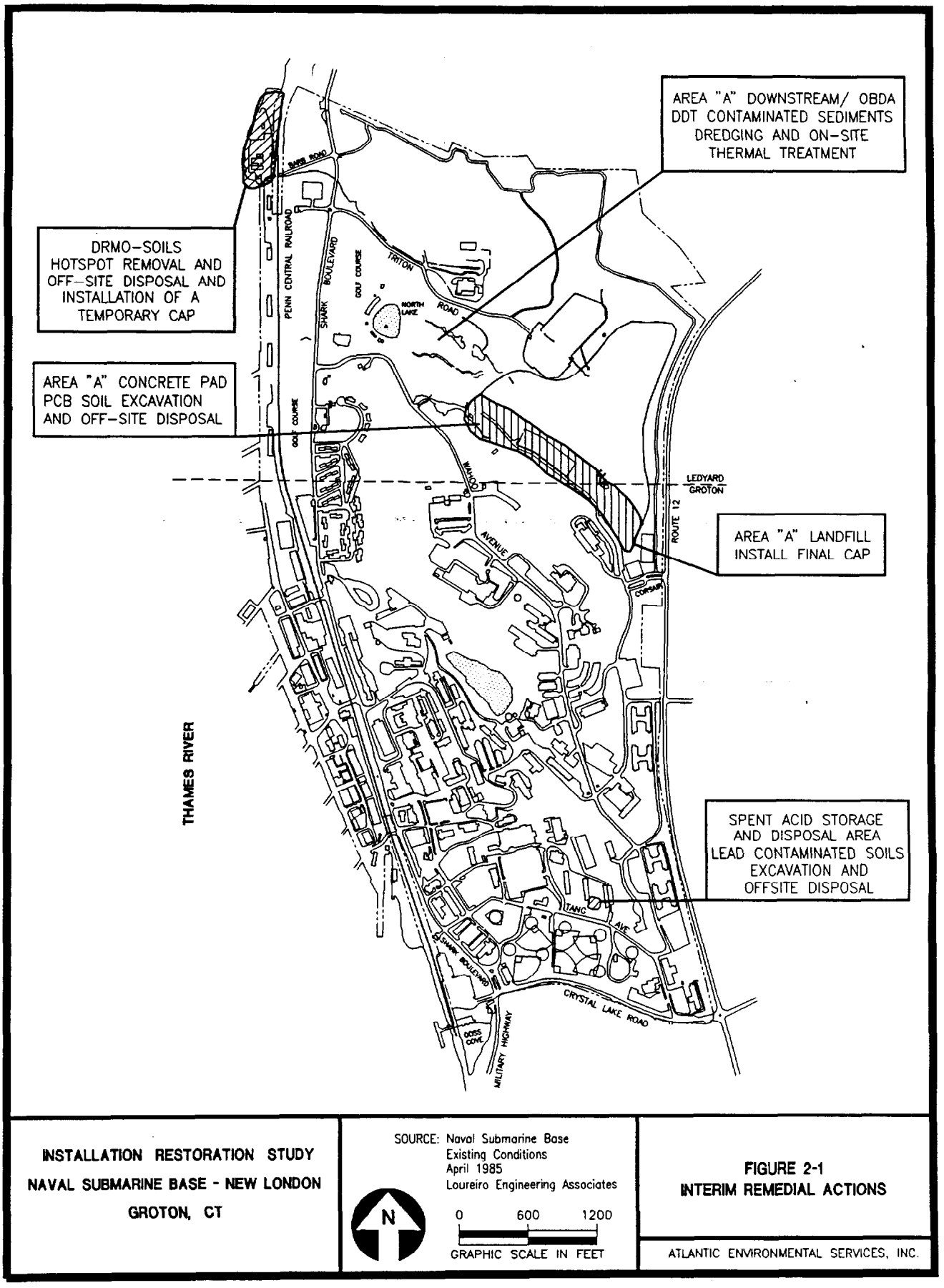
Investigation and remediation at NSB-NLON is being performed under the Navy's Installation Restoration (IR) Program. Sites included in the IR program were identified through an Initial Assessment Study. Any further evaluation required under the IR program consists of two levels of investigation and evaluation: Step I Site Inspections and Step II Remedial Investigation/Feasibility Study. The objectives of the site inspection (Step I) are to determine the presence or absence, as well as the order of magnitude, of specific toxic or hazardous contaminants, or other contaminants that may be present in concentrations considered to be an environmental risk. Step I includes an initial field-sampling program to identify if contamination is present on-site and warrants a Step II remedial investigation/feasibility study. Step II involves comprehensive on-site investigations to determine the extent of contamination, assess health and environmental risks, and evaluate remediation alternatives.

The operable units for which interim remedial actions are proposed and the level of investigations completed to date are listed below and are shown on Figure 2-1:

Operable Unit	Media	Investigations Completed
Spent Acid Storage and Disposal — Soils	Lead Contaminated Soils	Step I
Area A Landfill/Concrete Pad — Soils	Landfill Materials/PCB Contaminated Soils	Step II
Area A Downstream/OBDA — Sediments	DDTR Contaminated Sediment	Step II
DRMO — Soils	Contaminated Soils (Lead, PCB, VOC)	Step II

These interim remedial actions were developed to facilitate implementation of remedial actions based on any one of the following conditions:

- Risks above what is generally considered the minimum for environmental risks to humans (1.0 E-6) for carcinogens were identified (Operable Units — Area A Landfill Soil, Area A/OBDA Downstream Sediments, DRMO Soils).



INSTALLATION RESTORATION STUDY
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT

SOURCE: Naval Submarine Base
Existing Conditions
April 1985
Loureiro Engineering Associates

FIGURE 2-1
INTERIM REMEDIAL ACTIONS

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- Risks from chronic, generally, sublethal effects above the benchmark of one for the hazard index ratio (the ratio of its exposure dose to its reference dose) were identified (Operable Unit — Area A Downstream Sediments).

- Environmental risks above benchmark levels of 10 to 100 for the toxicity quotient (the ratio of a compound's exposure dose effects assessment) were identified (Operable Unit — Area A Downstream Sediments (cap)).

- ARARs indicate a preferred action (Operable Unit — Area A Landfill Soil cap).

A summary of the human health risks, based on the Phase I RI data, is in Table 2-1. Although these actions are interim remedial actions, they have been selected (1) to provide long-term protection to human health and the environment; (2) to fully address the main threats posed by each medium-specific, operable unit; and (3) to address the statutory preference for treatment that reduces the toxicity, mobility, or volume of wastes. As a result, pending the results of future data collection, the final ROD for these operable units should not require any further action for the units/medium being addressed. Further actions for other media, particularly groundwater (e.g., Area A), may be required pending completion of the Phase II Remedial Investigation. These other actions refer to management of migration of ground or surface water contamination, and will be considered during the Phase II Remedial/Investigation/Feasibility Study.

TABLE 2-1
SUMMARY OF HUMAN HEALTH RISKS

Receptor	Pathway of Concern	Cancer Risks		Systematic Health Risks		Contributing Factors to Risk	
		Mean	Maximum	Mean	Maximum	Cancer	Systematic
AREA A LANDFILL							
Utility Worker Sewer Repair	Soil Ingestion/Dermal Abs.	1.7E-07	1.1E-06	2.3E-02	8.2E-02	PCBs	
	Fugitive Dust Inhalation	7.3E-09	2.1E-08	6.3E-04	2.1E-06		
Weapons Center Personnel	Fugitive Dust Inhalation	8.2E-08	2.6E-07	6.3E-04	1.5E-07		
Servicemen Unloading Palettes	Soil Ingestion/Dermal Abs.	9.2E-06	4.2E-05	1.3E-01	3.3E-01	PCBs	
	Fugitive Dust Inhalation	1.3E-09	2.6E-09	1.1E-04	1.7E-04		
Servicemen Recreational Activities	Fugitive Dust Inhalation	7.9E-10	1.6E-09	3.6E-05	5.4E-05		
Groton/Ledyard Residents	Fugitive Dust Inhalation	1.5E-08	2.9E-08	3.1E-04	5.8E-04		
Citizens at Car Auctions	Soil Ingestion	3.2E-07	5.7E-07	6.4E-03	1.0E-02		
AREA A DOWNSTREAM WATERCOURSES							
Children Exploring Woods, including Landfill Area	Soil Ingestion/Dermal Abs.	3.4E-06	1.5E-05	7.1E-02	1.7E-01	PCBs, Be	
	Fugitive Dust Inhalation	1.2E-08	2.2E-08	6.1E-04	8.7E-04		
Children Exploring Streambeds & Wetland	Sed Ingestion/Dermal Abs.	5.6E-06	5.9E-05	5.2E-01	5.5E+00	DDD, DDT, DDE, Be	DDD
Children Swimming in North Lake	Sed Ingestion/Dermal Abs.	3.5E-08	5.2E-08	1.6E-01	1.9E-01		
	SW Ingestion/Dermal Abs.	7.8E-08	1.7E-07	5.2E-02	2.2E-01		
Utility Worker Downstream Watercourses	Soil Ingestion/Dermal Abs.	2.7E-08	3.7E-08	6.4E-04	8.5E-04		
	Fugitive Dust Inhalation	6.0E-09	7.0E-09	9.1E-05	9.8E-05		
	Ground Water Dermal Abs.	0.0E+00	0.0E+00	1.2E-04	2.1E-04		

TABLE 2-1 (continued)
SUMMARY OF HUMAN HEALTH RISKS

Receptor	Pathway of Concern	Cancer Risks		Systematic Health Risks		Contributing Factors to Risk	
		Mean	Maximum	Mean	Maximum	Cancer	Systematic
DRMO							
Citizens at Monthly Auctions	Soil Ingestion	1.6E-06	4.7E-06	3.0E-02	5.5E-02	PAHs, PCBs	
	Fugitive Dust Inhalation	9.7E-09	1.8E-08	2.0E-04	3.6E-04		
Citizens at Weekly Public Sales	Soil Ingestion	1.7E-06	5.1E-06	3.2E-02	5.0E-02	PAHs, PCBs	
	Fugitive Dust Inhalation	8.4E-09	1.6E-08	1.7E-04	3.1E-04		
Navy Workers Sorting Scrap Metal	Soil Ingestion/Dermal Abs.	7.0E-05	1.9E-04	3.5E-01	6.6E-01	PCBs, PAHs	
	Fugitive Dust Inhalation	2.7E-07	5.2E-07	4.7E-03	8.7E-03		
Utility Worker (Current Conditions)	Soil Ingestion/Dermal Abs.	2.7E-07	1.1E-06	6.3E-04	2.5E-03	PCBs	
	Fugitive Dust Inhalation	6.4E-09	1.7E-08	1.2E-04	2.6E-04		
	Ground Water Dermal Abs.	1.2E-11	1.5E-11	9.9E-05	1.2E-04		
Utility Worker (Future Conditions)	Soil Ingestion/Dermal Abs.	2.3E-07	1.6E-06	2.8E-03	3.9E-02	PCBs, PAHs	
	Fugitive Dust Inhalation	8.4E-09	3.8E-08	2.4E-04	2.2E-03		
	Ground Water Dermal Abs.	1.4E-11	2.9E-11	1.1E-04	1.7E-04		
Construction Worker Waste Storage Facility	Soil Ingestion/Dermal Abs.	1.4E-06	9.5E-06	2.2E-01	6.0E-01	PCBs, PAHs	Lead
	Fugitive Dust Inhalation	5.0E-08	2.3E-07	1.9E-02	1.7E-01		
	Ground Water Dermal Abs.	8.4E-11	1.7E-10	9.1E-03	1.3E-02		
Ledyard Residents	Fugitive Dust Inhalation	8.7E-08	1.8E-07	7.8E-04	1.2E-03		
Children	Fugitive Dust Inhalation	6.4E-11	1.4E-10	4.4E-06	1.0E-05		

Notes: Shaded values indicate levels of risk above what is generally considered the minimum for environmental risk to humans (1.0E-6) for carcinogens. For non-carcinogens, shaded values indicate levels of the hazard index ratio (which is the ratio of its exposure dose to its reference dose) in excess of "1", which is used as a benchmark with regard to the potential for chronic, generally sublethal effects.

Abbreviations: Abs = Absorbtion, Sed = Sediment

3.0 SITE CHARACTERISTICS

Regional geology and hydrology are described in the Phase I Remedial Investigation (August 1992, Atlantic) along with detailed, site background information and a description of the nature and extent of contamination. Presented below for each operable unit is a summary of its background-specific geology and hydrology, and the nature and extent of contamination.

3.1 Spent Acid Storage and Disposal Area — Soils

3.1.1 Site Background

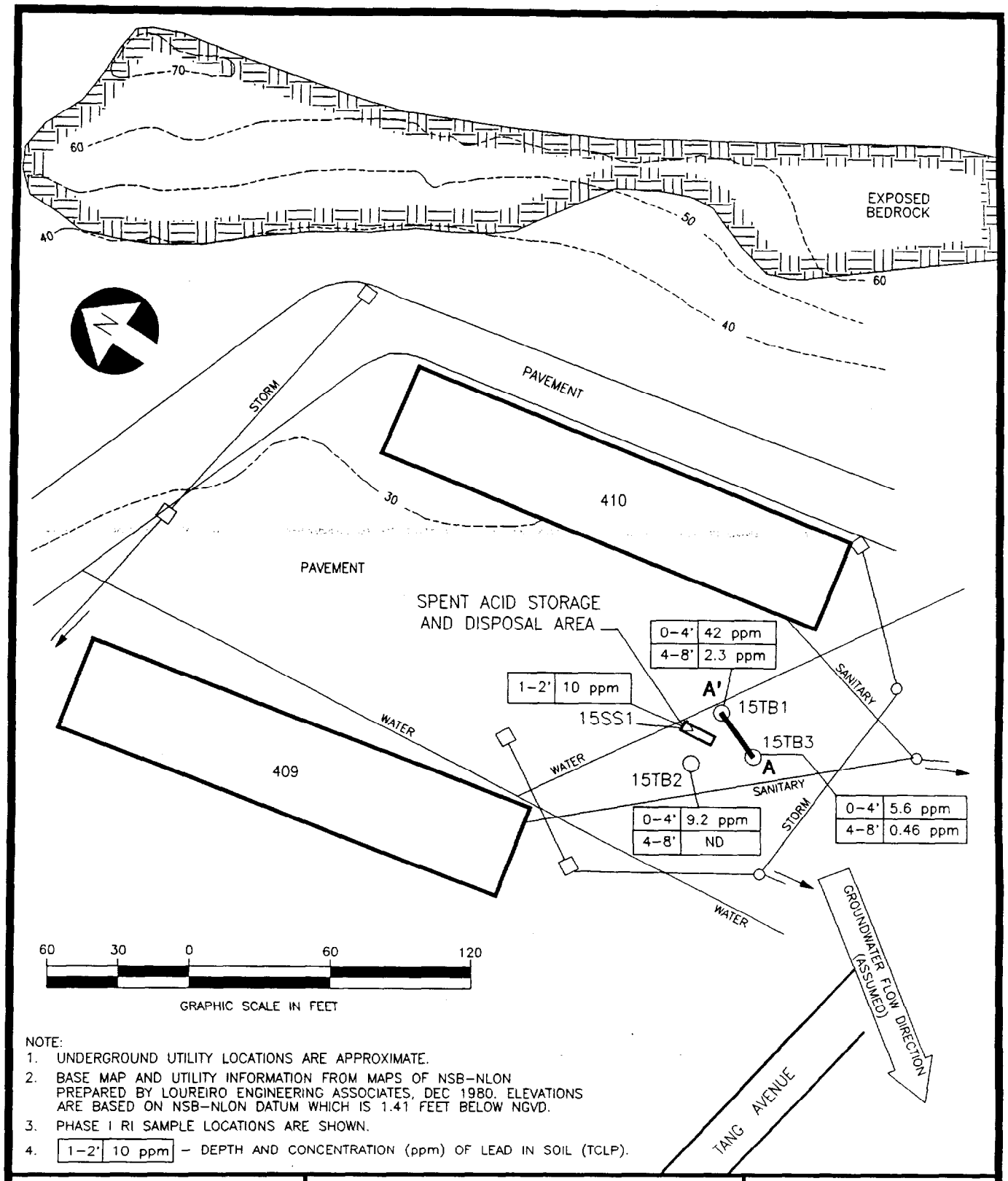
The site is located in the southeastern section of NSB-NLON in the southern portion of the area between Buildings 409 and 410. A 4' x 4' x 12' rubber-coated, underground tank was used for temporary storage of waste battery acid during World War II. The top of the tank is still visible, but the tank has been filled with earth and capped with concrete.

A plan for this site, including previous sample locations, is provided as Figure 3-1.

3.1.2 Site-Specific Geology and Hydrology

Site-specific geology has been determined based on the Phase I Remedial Investigation and interpretation of the 1967 USGS Bedrock Geologic Map, the 1983 SCS Soils Map, and the 1960 USGS Surficial Geology Map.

The 1967 USGS Bedrock Geology Map shows that the site is underlain by a biotite-quartz-feldspar gneiss of the Mamacoke formation. Bedrock was not encountered during the subsurface investigation. The 1983 SCS Soils Map depicts the site area as urban land. This classification is consistent with observed conditions at the site. The 1960 USGS Surficial Geology map shows that this site is located in terrace deposits of the Thames River, which consist of stratified silt, sand, and gravel deposited by gravel meltwater. Subsurface material observed at the site consists of fine- to medium-grained sands and silts with traces of clay. Where clay is present, it usually occurs in discrete, silty lenses of less than 1/2 inch in



NOTE:
1. UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE.
2. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON PREPARED BY LOUREIRO ENGINEERING ASSOCIATES, DEC 1980. ELEVATIONS ARE BASED ON NSB-NLON DATUM WHICH IS 1.41 FEET BELOW NGVD.
3. PHASE I RI SAMPLE LOCATIONS ARE SHOWN.
4. 1-2' | 10 ppm – DEPTH AND CONCENTRATION (ppm) OF LEAD IN SOIL (TCLP).

INSTALLATION RESTORATION STUDY
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT

LEGEND

⊕ 15MW1	MONITORING WELL	A —— A'	CROSS SECTION
○ 15TB1	TEST BORING	----10----	EXIST CONTOUR
□ 15SD1	SEDIMENT SAMPLE	123	BUILDING No.
△ 15SS1	SURFACE SOIL SAMPLE		WATERCOURSE
◇ 15SW1	SURFACE WATER SAMPLE	○	MANHOLE
		□	CATCH BASIN

FIGURE 3-1
SITE PLAN
SPENT ACID STORAGE AND DISPOSAL AREA

ATLANTIC ENVIRONMENTAL SERVICES, INC.

thickness. Rust-colored staining and mottling were common in borings from the east and south side of the spent-acid tank.

No groundwater monitoring was performed at this site. Groundwater was encountered at 6 to 8 feet below the surface during test borings. Groundwater flow is projected to be generally to the southwest. Figure 3-2 is a geologic cross-section of this site, which illustrates subsurface geology and water-table depth.

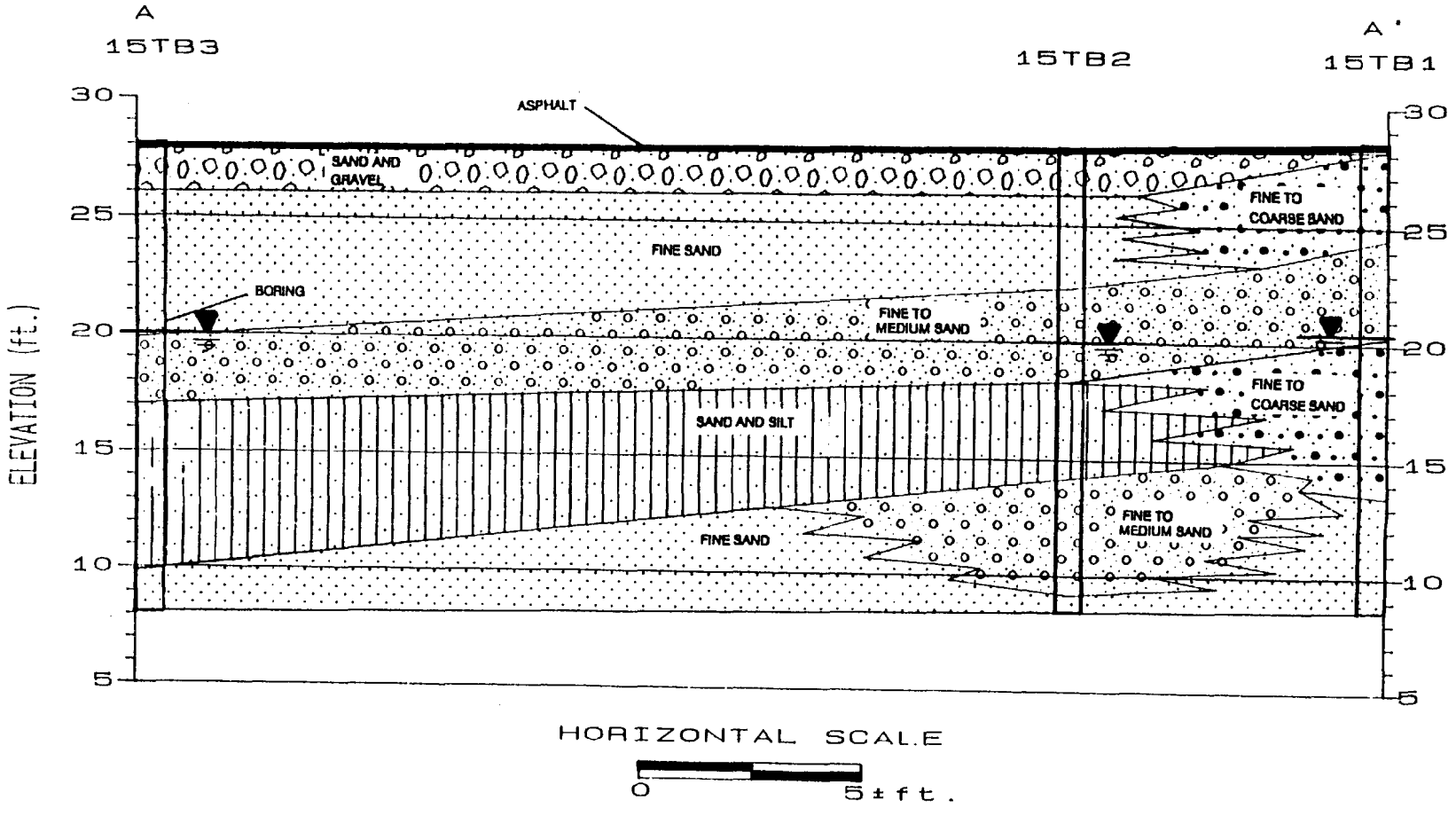
3.1.3 Nature and Extent of Contamination

Seven subsurface soil samples were collected to search for potential release of battery acid from the subsurface tank. High levels of lead were present in 6 of 7 soil samples, based on TCLP analysis. Four samples were classified as RCRA hazardous waste because of the lead concentrations. These samples were collected at the 0- to 4-foot depth interval. Several soil samples also had low pH values. The elevated levels of lead and low pH values indicate that a release of battery acid occurred. The present level of subsurface investigation has not defined the extent or degree of soil contamination. A summary of the lead concentrations are included on Figure 3-1.

3.2 Area A Landfill/Concrete Pad (Soils) and Area A Downstream/OBDA — Sediments

3.2.1 Site Background

The Area A landfill/concrete pad is located in the northeastern and north-central section of NSB-NLON. It is approximately 7 acres in size. Access is via a dirt road off Wahoo Avenue. The Area A landfill is a relatively flat area bordered by a steep, wooded hillside that rises to the south, a steep wooded ravine to the west, and the Area A wetland to the north. Aerial photographs show that the landfill appears to have extended east along the wetland as far as the present position of the tennis courts. Run-off from the landfill drains as overland flow



INSTALLATION RESTORATION STUDY NAVAL SUBMARINE BASE - NEW LONDON GROTON, CT	LEGEND GROUND WATER ELEVATIONS ARE ESTIMATED BASED ON BORING LOGS.	FIGURE 3-2 GEOLOGIC CROSS-SECTION A-A' SPENT ACID ATLANTIC ENVIRONMENTAL SERVICES, INC.

north into the Area A wetland, which discharges to the Area A downstream and into the Thames River.

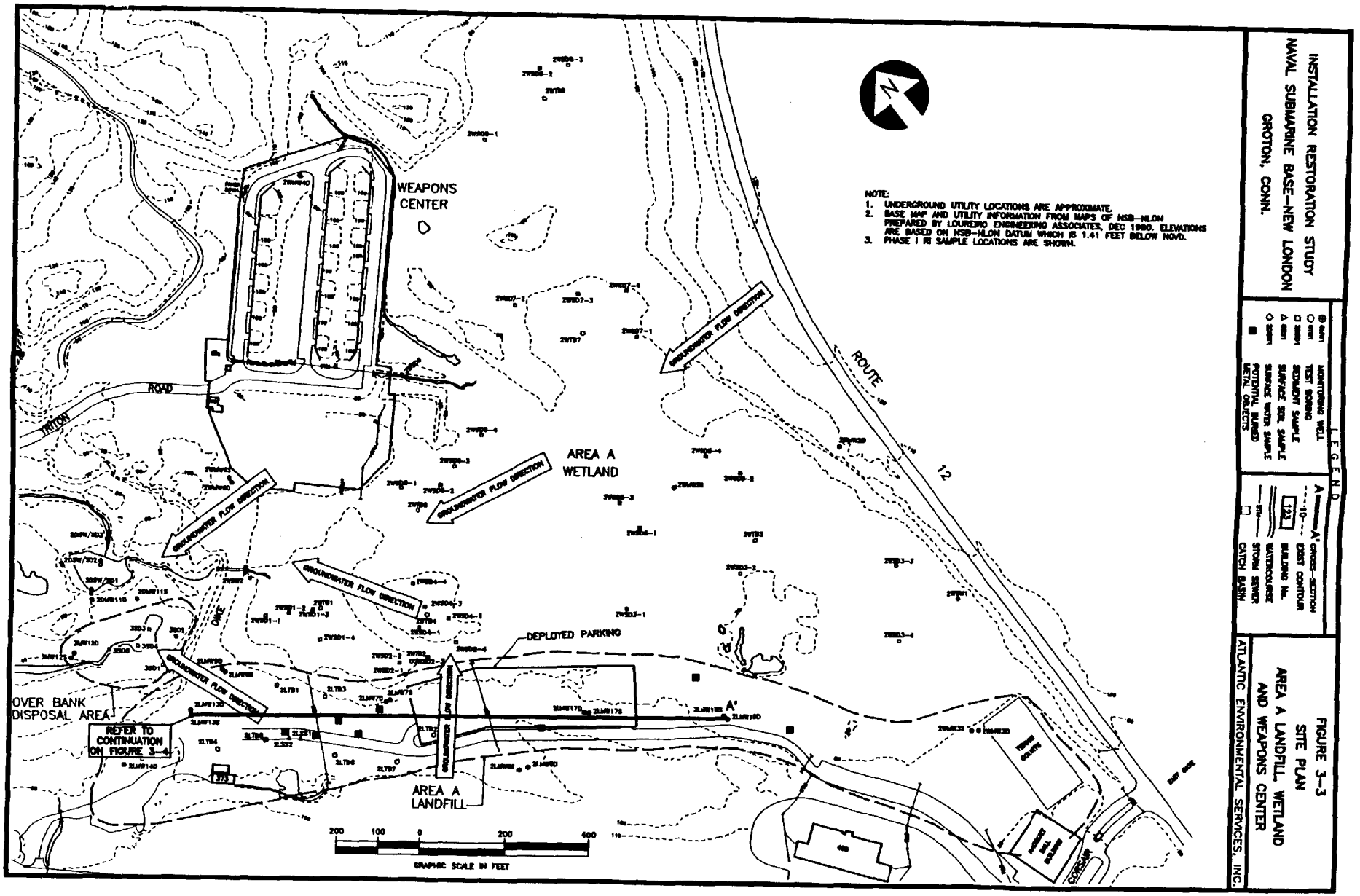
A site plan of the Area A landfill and wetland, including previous sample locations, is provided as Figure 3-3.

The landfill opened some time before 1957. The base incinerator ceased operating in 1963, and from 1963 to 1973 all wastes were disposed unburned in the landfill. During this time, all non-salvageable materials generated by submarines and base operations were disposed in the Area A landfill.

Landfill operations ceased in 1973. After closure, a concrete/bituminous pad was constructed in the southwest portion of the landfill for above-ground storage of industrial wastes. The remainder of the landfill is not paved. At the time of the Initial Assessment Study, 42 steel drums, 87 transformers (mineral and PCB), and 60 to 80 electric switches were stored on the pad. Two transformers and several electrical switches were leaking at that time. Past leakage of oil was also evident. Most drums were stacked on wooden pallets; drums with PCB labels were covered and bound with plastic sheeting. All of these materials have been properly disposed off-site.

In recent years, sand bags and contractor supplies and equipment have been stored over the former landfill. Several transformers, excavated underground storage tanks, crane weights, and other equipment are stored on the concrete pad in the southwest portion of the landfill. The specific items stored in this area changed over time. A gravel-covered, long-term, vehicle parking lot (deployed parking) also exists on the former landfill.

The construction of a paved parking lot on the southeast end of the Area A Landfill was planned, but has been delayed indefinitely.


INSTALLATION RESTORATION STUDY
NAVAL SUBMARINE BASE-NEW LONDON
GROTON, CONN.
LEGEND
MONITORING WELL
TEST BORING
SEDIMENT SAMPLE
SURFACE SOIL SAMPLE
SURFACE WATER SAMPLE
POTENTIAL BURIED METAL OBJECTS
A A' CROSS-SECTION
10 EXIST CONTOUR
BUILDING No.
WATERCOURSE
STORM SEWER
CATCH BASIN
NOTE:
1. UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE.
2. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON PREPARED BY LOUREIRO ENGINEERING ASSOCIATES, DEC 1980. ELEVATIONS ARE BASED ON NSB-NLON DATUM WHICH IS 1.41 FEET BELOW NGVD.
3. PHASE I RI SAMPLE LOCATIONS ARE SHOWN.
FIGURE 3-3
SITE PLAN
AREA A LANDFILL, WETLAND
AND WEAPONS CENTER
ATLANTIC ENVIRONMENTAL SERVICES, INC.
WEAPONS CENTER
TRITON ROAD
ROUTE 12
AREA A WETLAND
GROUNDWATER FLOW DIRECTION
DEPLOYED PARKING
OVER BANK DISPOSAL AREA
REFER TO CONTINUATION ON FIGURE 3-4
AREA A LANDFILL
A'
CORSAIR
200 100 0 200 400
GRAPHIC SCALE IN FEET

The Area A wetland abuts the north side of the landfill and is approximately 30 acres in size. The maximum sediment thickness is approximately 35 feet, based on boring information. Until 1957, this portion of the site was undeveloped, wooded land. In 1957, dredge spoils from the Thames River were pumped to this area and contained within an earthen dike that extends from the Area A landfill to the south side of the weapons storage area. Atlantic learned during this study that pesticide "bricks" were reportedly previously placed on the wetland ice during winter and allowed to discharge into the wetland for mosquito control.

The watercourses within Area A downstream drain from the Area A landfill and wetland. The Area A downstream watercourses include North Lake and several small streams that discharge from Area A and the torpedo shops and ultimately discharge to the Thames River.

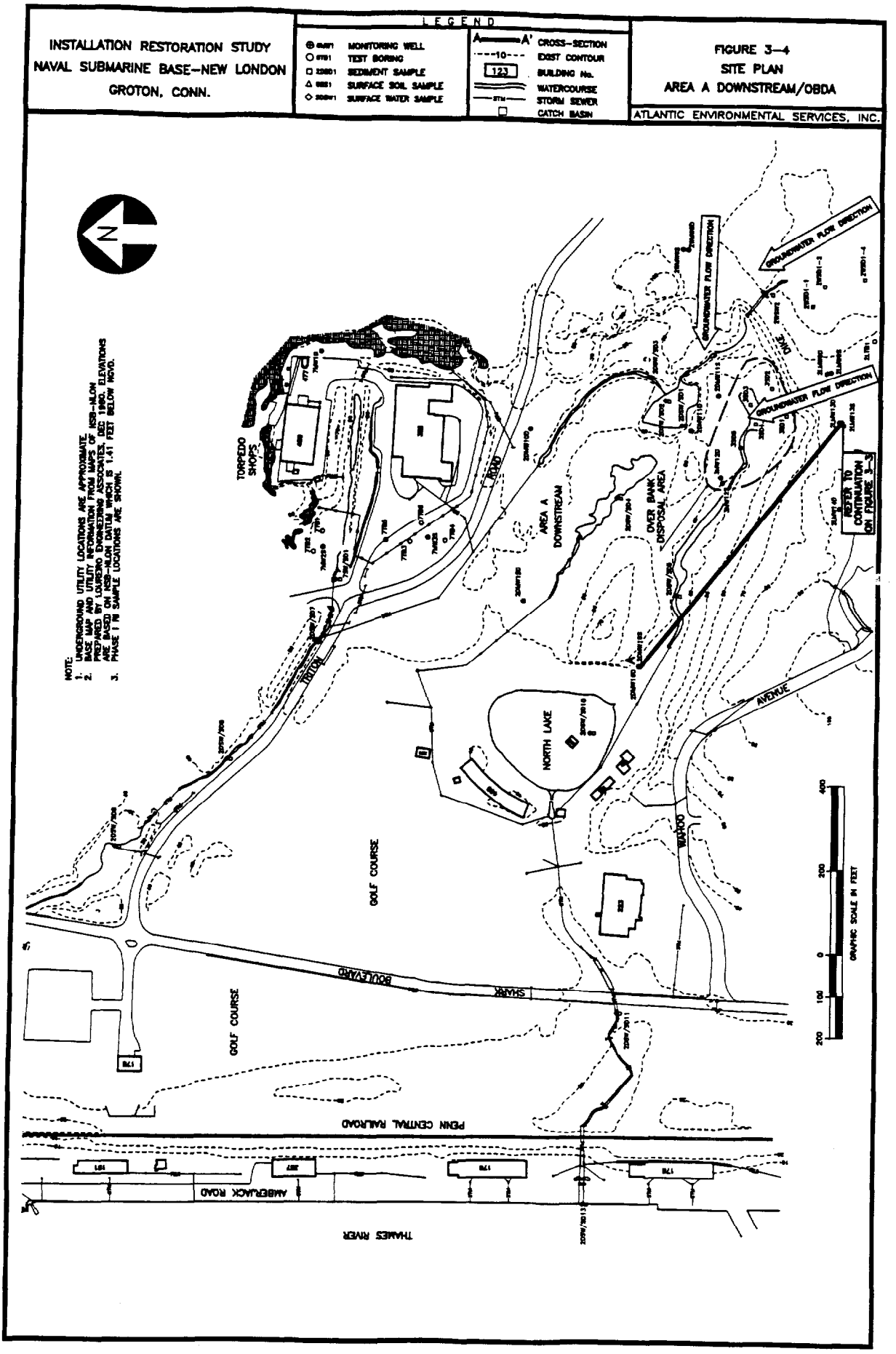
A site plan of Area A downstream, which includes previous sample locations, is provided as Figure 3-4.

Groundwater also discharges from the Area A wetland to a small wetland at the base of the dike and the OBDA site. A stream flows from this wetland west toward North Lake, a recreational swimming area for Navy officers. The stream enters a culvert that bypasses the pond and discharges to a stream below the outfall of the pond. This stream flows west under Shark Boulevard and through the golf course to the Thames River. There is a manhole next to North Lake, which was previously connected to a pipe designed to discharge overflow water from North Lake. This pipe has been plugged to prevent possible discharge from the stream to North Lake.

Further development is not planned for this area.

OBDA is on the slope of the dike below and next to the Area A landfill. A small wetland exists at the base of the dike. OBDA is included within Area A downstream.

A plan for this site is included in Figure 3-4.


INSTALLATION RESTORATION STUDY
NAVAL SUBMARINE BASE-NEW LONDON
GROTON, CONN.
LEGEND
MONITORING WELL
TEST BORING
SEDIMENT SAMPLE
SURFACE SOIL SAMPLE
SURFACE WATER SAMPLE
CROSS-SECTION
EXIST CONTOUR
BUILDING No.
WATERCOURSE
STORM SEWER
CATCH BASIN
FIGURE 3-4
SITE PLAN
AREA A DOWNSTREAM/OBDA
ATLANTIC ENVIRONMENTAL SERVICES, INC.
NOTE:
1. UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE.
2. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON PREPARED BY LOMBARDO ENGINEERING ASSOCIATES, DEC 1980. ELEVATIONS ARE BASED ON LOMBARDO DATUM WHICH IS 1.41 FEET BELOW NGVD.
3. PHASE I IN SAMPLE LOCATIONS ARE SHOWN.
N
TORPEDO SHOPS
ROAD
AREA A DOWNSTREAM
OVER BANK DISPOSAL AREA
GROUNDWATER FLOW DIRECTION
GROUNDWATER FLOW DIRECTION
GROUNDWATER FLOW DIRECTION
REFER TO CONTINUATION ON FIGURE 3-3
NORTH LAKE
AVENUE
WAHOO
GOLF COURSE
GOLF COURSE
BOULEVARD
SHARK
PENN CENTRAL RAILROAD
AMBERJACK ROAD
THAMES RIVER
GRAPHIC SCALE IN FEET
200
100
0
200
400

OBDA became a disposal site after the earthen dike was constructed in 1957. Previous studies (1982) found that the material had been there for many years and included 30 partially covered, 200-gallon, metal fuel tanks and scrap lumber.

Atlantic personnel inspected the site in September 1988 and observed (1) approximately 30 empty, unlabeled 200-gallon tanks, (2) old, creosoted telephone poles, (3) several empty, unlabeled, 55-gallon drums, and (4) rolls of wire. Bright orange, organic sediments (apparently leachate from the landfill) were observed in the water discharging from the base of the dike embankment.

3.2.2 Site-Specific Geology and Hydrology

Site-specific geology has been determined by using the Phase I RI and interpretation of the 1967 USGS Bedrock Geology Map, the 1983 SCS Soils Map, and the 1960 USGS Surficial Geology Map.

Area A Landfill: The 1983 SCS Soils Map shows most of the Area A landfill as udorthents-urban land.

The 1960 USGS Surficial Geology Map shows non-stratified drift in the Area A landfill. This classification is consistent with soils observed (1) below the fill material and dredge spoil in the eastern portion of the landfill, and (2) soils at the surface in the western portion of the landfill.

Subsurface investigations indicate that the Area A landfill is underlain by 10 to 20 feet of miscellaneous fill material, which is generally underlain by 10 to 20 feet of dredge spoil. On the southwestern side, fill material is underlain by compact sand, silt, and gravel, which extend down to bedrock.

The 1967 USGS Bedrock Geology Map shows that the bedrock underlying the majority of Area A is the biotite-quartz-feldspar gneiss of the Mamacoke Formation. The map indicates

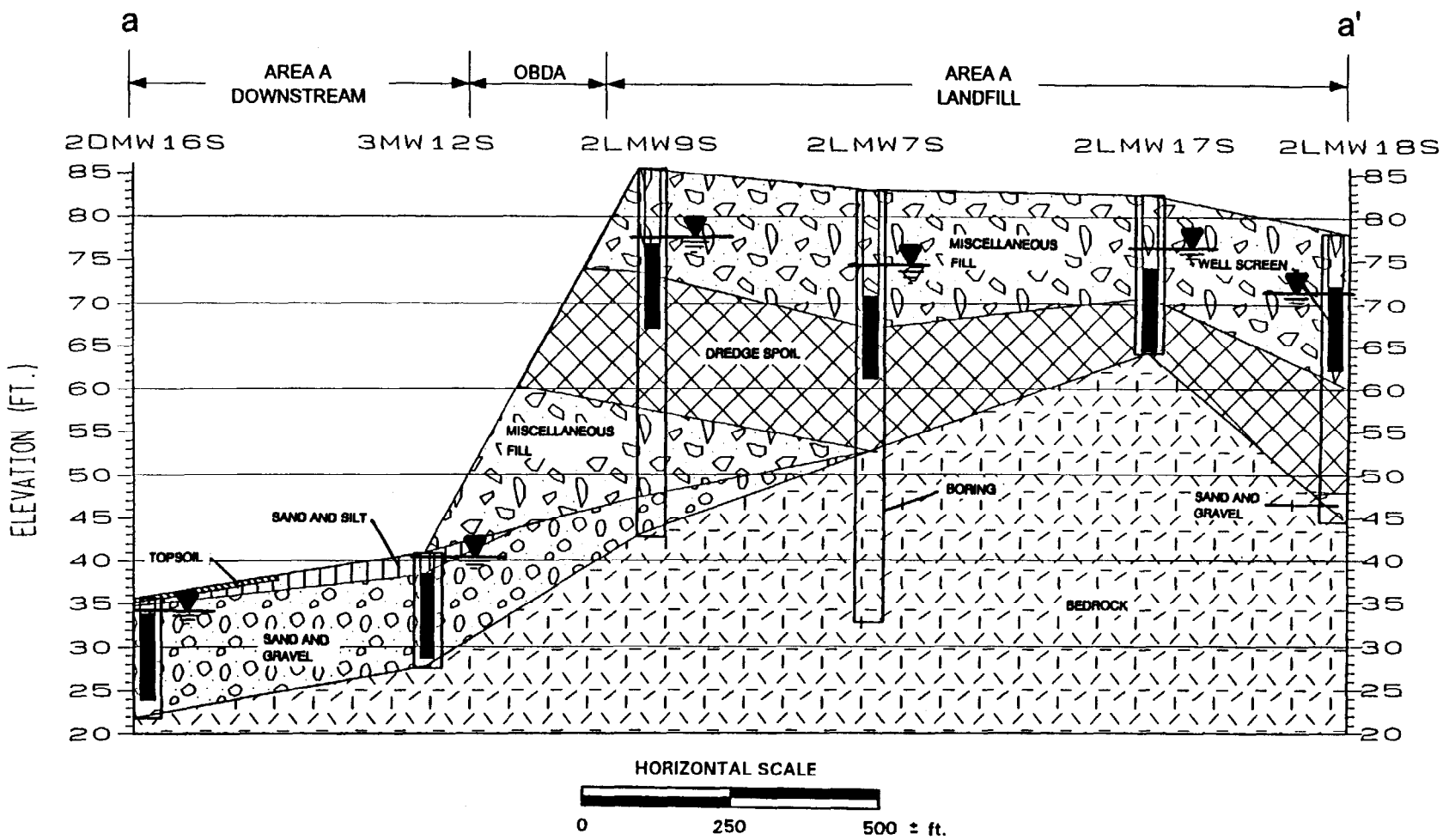
that all of the Area A landfill and OBDA, the southern portion of the Area A wetland, and the northern and eastern portions of the Area A downstream are underlain by bedrock of the Mamacoke Formation.

Bedrock cores were drilled at 2 monitoring well locations within the Area A landfill. The mineralogy and texture of the bedrock cores is generally consistent with that of the biotite-quartz-feldspar gneiss of the Mamacoke Formation.

Groundwater in the central-eastern portion of Area A landfill flows north toward the Area A wetland. Groundwater in the northwestern portion of the Area A landfill flows northwest toward the Area A downstream and eventually flows to the Thames River.

Slug-displacement test data were used to estimate the *in situ* hydraulic conductivity of material in this area. The geometric, mean hydraulic conductivity of the landfill material and the underlying dredge spoil combined was calculated to be 3.2 feet/day. The velocity of groundwater flow through material in the landfill and wetland portions of Area A was estimated to be 0.04 feet/day (with a hydraulic conductivity of 3.2 feet/day), a porosity of 0.30 and hydraulic gradient of approximately 0.004. Figure 3-5 is a geologic cross-section of the Area A landfill and Area A downstream/OBDA, which illustrates the subsurface geology, landfill material (miscellaneous fill), and the water table.

Area A Downstream/OBDA: The 1983 SCS Soils Map shows the Area A downstream as udorthents-urban land to the north and west of North Lake. The portion of the downstream between the earthen dike and North Lake is depicted as Hollis-Charlton Rock with 3 to 15 percent slopes. Both classifications are consistent with observed soil conditions, topography and development in this area. OBDA is also shown as Hollis-Charlton Rock with 15 to 45 percent slopes. This classification is consistent with soil conditions and topography observed at the site.



INSTALLATION RESTORATION STUDY NAVAL SUBMARINE BASE - NEW LONDON GROTON, CT	GROUND WATER ELEVATION DATA: MARCH 21, 1991	FIGURE 3-5 GEOLOGIC CROSS-SECTION A-A' AREA A ATLANTIC ENVIRONMENTAL SERVICES, INC.

The 1960 USGS Surficial Geology Map shows alluvium along the downstream watercourses from (and including) OBDA to North Lake. The area is mapped as Thames River terrace deposits from North Lake west to the Thames River. All classifications are generally consistent with observed soil conditions in the specified areas.

The Area A downstream and OBDA are physically separated from the Area A wetland by an earthen dike and from the Area A landfill by a steep slope. No evidence of fill material was observed in the Area A downstream or OBDA. Unconsolidated material at the bottom of the slope consists of fine-grained sand and silt with rust-colored mottling. Similar soils were observed at 2DMW10 and in borings at the torpedo shops to the north. The sediments at 3MW12 consist of (1) yellow and brown, mottled, fine-grained sand, and (2) silt and clay overlying fine- to medium-grained sand and gravel. Based on the sediments found in this area and the mapped surficial deposits in the vicinity, these sediments are probably alluvial deposits from either the present stream system or one that existed before the construction of the earthen dike.

The southwestern portion of the Area A downstream is mapped as an equigranular, gneissic granite known as the Hope Valley Alaskite Gneiss.

Groundwater flow in the overburden in this area is down the valley west/northwest toward the Thames River. The hydraulic conductivity of the material surrounding well 2DMW16S was calculated to be 6.8 feet/day. The velocity of groundwater flow through the soils in the Area A downstream (using a hydraulic conductivity of 6.8 feet/day, 0.30 for the porosity, and 0.01 for the hydraulic gradient) was calculated to be 0.2 feet/day.

A geologic cross-section of Area A downstream/OBDA is included as the previously referenced Figure 3-5.

3.2.3 Nature and Extent of Contamination

Area A Landfill — Nature and Extent of Soil Contamination: Radiation, geophysical, and soil-gas surveys were conducted. No radiation above background levels was detected. The geophysical survey identified several, suspected, buried metal objects, which were avoided during drilling operations. The soil-gas survey detected volatile organic compounds (VOCs) (predominantly petroleum hydrocarbons) in the deployed parking area.

VOC concentrations in the subsurface soil within the Area A landfill were generally low. No TBC values for VOCs in soil samples were exceeded. One surface soil sample collected near the concrete storage pad did contain elevated levels of petroleum hydrocarbons. Semi-volatile organic compounds (SVOCs), principally polynuclear aromatic hydrocarbons (PAHs), were detected at relatively low levels in several subsurface soil-samples from the landfill. The results of the SVOCs analyses at the Area A landfill were significantly lower than at the former landfill sites of DRMO and Goss Cove. The organic results, in general, do not indicate significant disposal of organic chemicals within the Area A landfill.

No PCBs were detected in the subsurface soils within the Area A Landfill. One surface soil sample contained PCBs above the TBC concentration of 10,000 ppb. This soil sample was collected near the concrete storage pad where drums, PCB transformers, and electric switches were once stored. Based on the 2 surface soil sample locations, the extent of the PCBs in this area was not defined at this time.

Pesticides were detected at 3 subsurface sample locations (2LMW7S, 2LMW8S, and 2LMW18S) at the Area A landfill. DDTR was detected at these locations at relatively low concentrations below TBC values. DDT was present above the TBC value of 500 ppb at one surface soil sample near the concrete storage pad.

Of the 12 subsurface samples analyzed by TCLP, 10 contained one or more metals

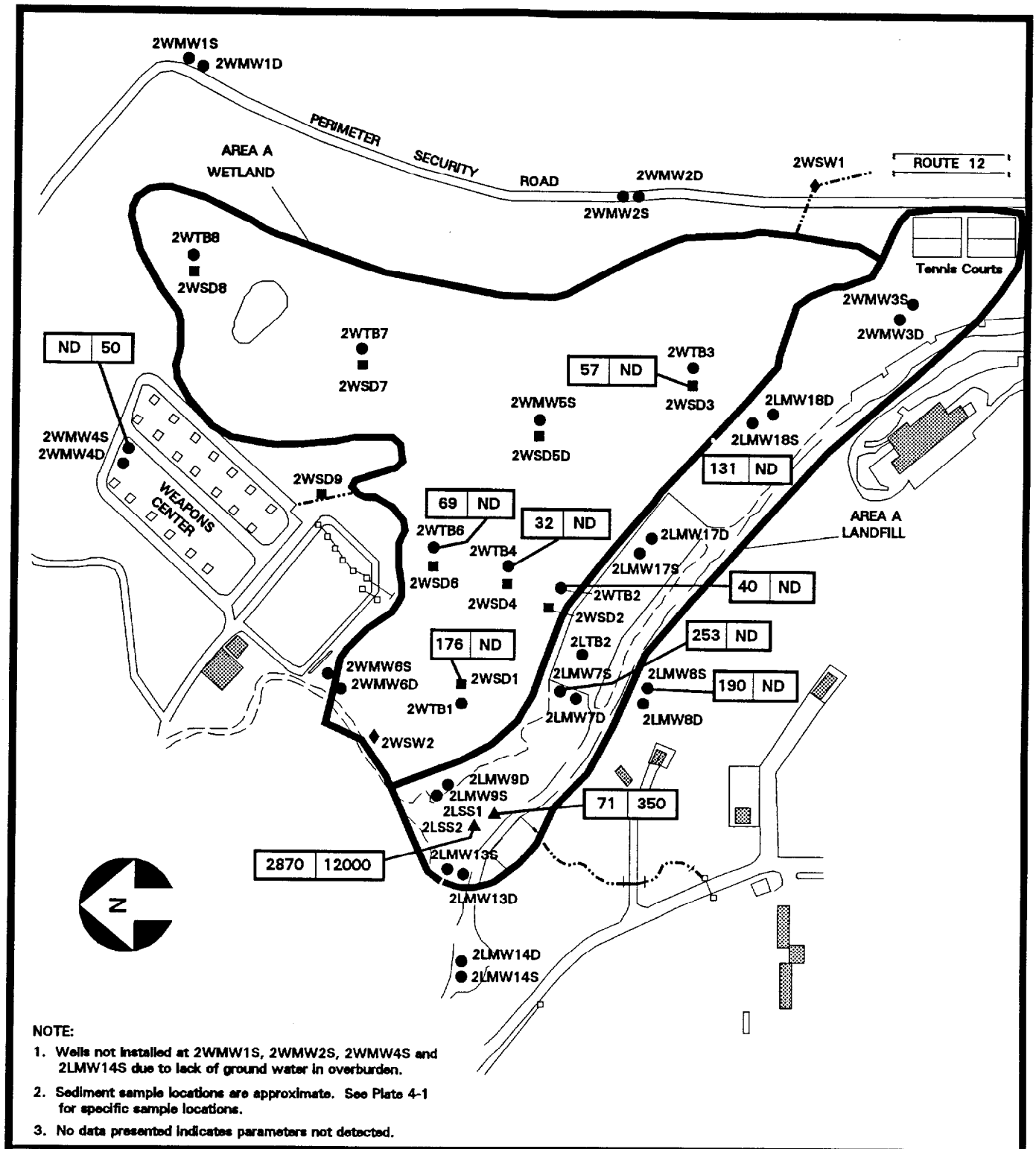
exceeding TBC values. Metals exceeding TBC values included arsenic, cadmium, lead, and selenium. Characteristic values of TCLP hazardous waste were not exceeded for any samples. Several inorganic constituents (including beryllium, cadmium, lead, and mercury) exceeded established background levels based on mass analysis. Other inorganics exceeding background levels included copper, nickel, and boron. The majority of these elevated inorganics are probably related to past landfill disposal.

The lead and cadmium values are generally low and do not indicate the existence of a major source, such as the historical disposal of battery acid reported in this area. Levels of cadmium and, particularly, lead were much higher at the spent acid storage and disposal area and DRMO, where battery-acid storage tanks existed.

The presence of PCBs in soils is of most significance relative to the human health risks associated with the Area A landfill. Figure 3-6 provides a summary of the PCB and pesticide soils/solvent data for this area.

Area A Downstream/OBDA — Nature and Extent of Soil and Sediment Contamination: The subsurface soil samples were collected at well locations in wooded, undeveloped areas where no past disposal was reported or apparent. The exception was 3MW12S, which was located near to the wetland at OBDA where past disposal occurred.

Trichloroethene (24 ppb) and tetrachloroethene (58 pp) were detected at a subsurface soil sample location near North Lake; both samples were above TBC values of 5 ppb. Low levels of toluene and 1,1-dichloroethene were also detected. The source of the solvents detected near North Lake is unknown. One possibility comes from an unconfirmed report of a retired Navy employee, who stated that there was a past disposal area in this general vicinity. This report could not be confirmed by a review of aerial photographs and discussions with other Navy personnel. Further investigation of this area has been included in the Phase II Work Plan.



NOTE:

1. Wells not installed at 2WMW1S, 2WMW2S, 2WMW4S and 2LMW14S due to lack of ground water in overburden.
2. Sediment sample locations are approximate. See Plate 4-1 for specific sample locations.
3. No data presented indicates parameters not detected.

INSTALLATION RESTORATION STUDY

NAVAL SUBMARINE BASE - NEW LONDON

GROTON, CT

LEGEND

- TB1 - Test Boring
- MW1 - Monitoring Well
- SD1 - Sediment Sample
- SS1 - Surface Soil Sample

Pesticides ppm	PCBs ppm

- SW1 - Surface Water Sample
- Building
- Watercourse

Approximate Scale 0 200'

FIGURE 3-6
SUMMARY OF TOTAL PESTICIDES/PCBS DATA IN SOILS/SEDIMENTS
AREA A
LANDFILL AND WETLAND

ATLANTIC ENVIRONMENTAL SERVICES, INC.

No SVOCs were detected in subsurface soils, except for low levels of phthalates at one sample location. Low levels of SVOCs, principally PAHs, were present in a subsurface soil sample at OBDA, which correlates with SVOCs detected in the sediment samples at OBDA.

No PCBs were detected in the subsurface samples. Pesticides, including DDT and its derivatives, were detected in a subsurface soil sample near OBDA and at a sample near North Lake. The detection of pesticides at these locations appears related to past pesticide application in Area A. No significant detections of inorganics were noted in the subsurface soil samples.

Twenty-three sediment samples were collected for analysis from the OBDA wetland, the Area A Downstream and associated ponds, and North Lake. The sediment sampling and analysis programs assessed the extent of sediment contamination (principally pesticides) within this area caused by past application and sediment transport from potential source areas. Previous analysis of sediments in this area indicated the presence of pesticides and metals.

No VOCs were detected above TBC values for the collected sediment samples. At sample locations near the outlet of the Area A wetland, low levels of VOCs (methylene chloride, trichloroethene) were detected, indicating some limited migration of VOCs via sediment transport from the Area A wetland. Within OBDA, all sediment samples contained low levels of VOCs, but below TBC values. VOCs detected include methylene chloride, 2-butanone (methyl ethyl ketone), tetrachloroethene, toluene, ethylbenzene, and xylene. This data indicates that past releases of solvents and petroleum hydrocarbons occurred at the OBDA site. These VOCs could also be partially attributable to adsorption of chemicals to the sediments from groundwater. Low to moderate levels of SVOCs were detected in most sediment samples.

The only detection of PCBs was at 2DSD12, at the outlet of the downstream watercourse to the Thames River, adjacent to DRMO. Elevated levels of PCBs at the DRMO site indicate that this contamination is associated probably with surface water run-off from the DRMO site

and not Area A.

Pesticides (DDTR) were detected at moderate to very high concentrations within the Area A downstream watercourses and ponds. No pesticides were detected in the North Lake sediments. TBC values were exceeded at 10 of the 23 sample locations. The highest concentrations were detected in the two ponds below the Area A dike and within the OBDA sediments. This contamination may result from pesticide application rather than sediment transport, since these concentrations were much higher than those found within the Area A wetland. Lower concentrations downstream of these areas and extending to the Thames River are attributable to sediment transport from the higher concentration areas. The data indicate that ongoing migration of pesticides to the Thames River is occurring by sediment transport from the pond source areas.

Several metals were detected above established background levels. These metals occur in samples closest to the Area A wetland and include beryllium, cadmium, lead, selenium, zinc, and boron. Since cadmium was not detected above background levels in the Area A wetland sediments, the cadmium does not appear to be related to sediment transport from the wetland. No metals were detected above background levels in North Lake sediments.

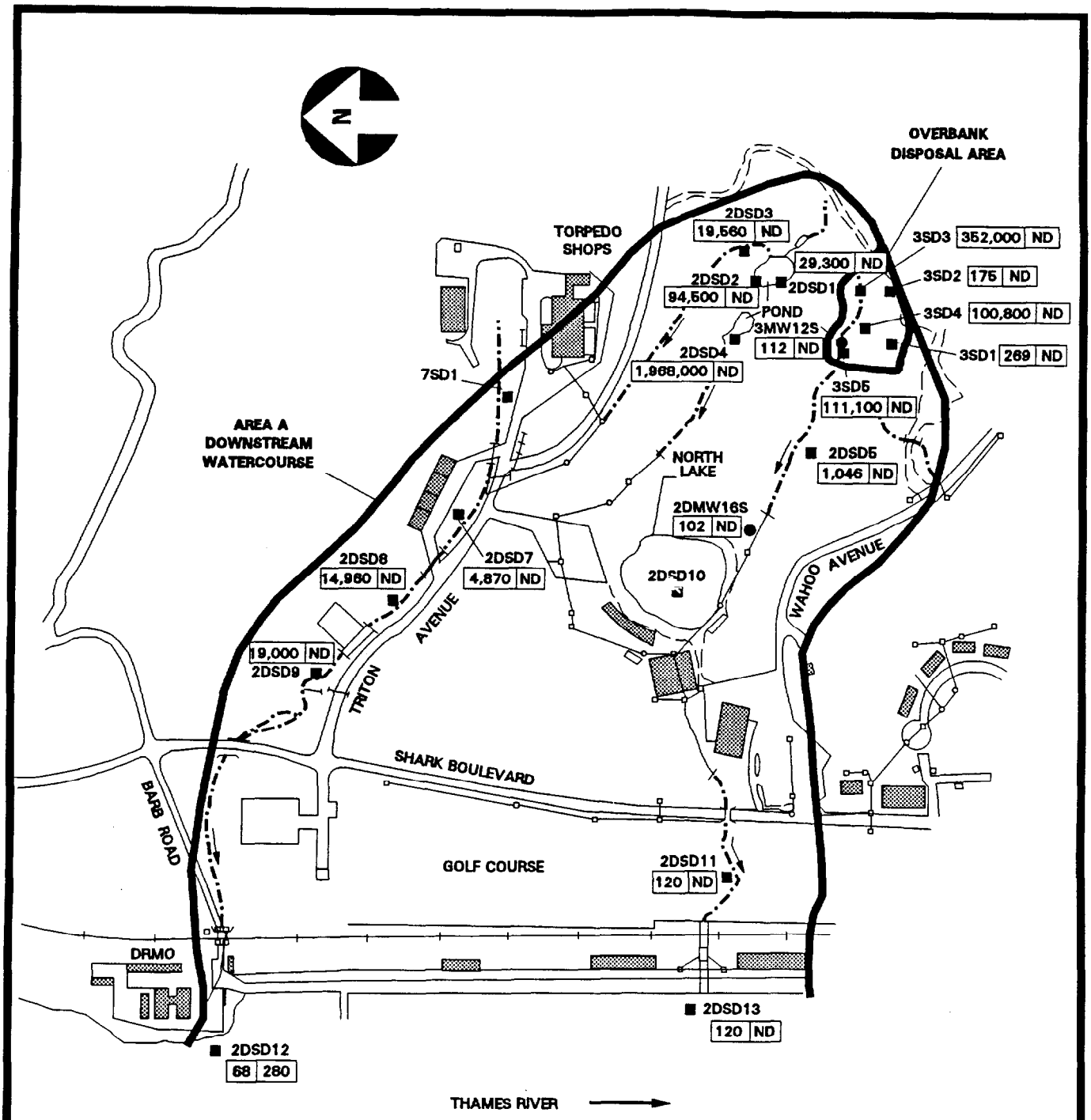
Ten sediment samples were collected from the OBDA area. Sediment samples contained metals above the established background levels for cadmium (3 samples), iron (2), lead (4), selenium (2), and zinc (2). Cadmium sample results based on TCLP analysis correlated with mass weight analysis for 2 samples. TCLP analysis detected no lead. The elevated iron concentration may partially explain the rust-colored leachate that is visible in this wetland area and within the stream bed. The lead and cadmium may suggest battery/battery acid disposal in this area, where the highest concentrations throughout Area A were recorded. Alternatively,

cadmium present in the groundwater could have adsorbed onto sediments while discharging to OBDA.

The presence of pesticides in sediments is the most significant concern relative to the human health/ecological risks in this area. Figure 3-7 provides a summary of the pesticides and PCB soil/sediment data for this area.

Area A — Nature and Extent of Groundwater Contamination: Twenty-eight groundwater monitoring wells were installed and sampled within Area A, which includes the landfill, wetland, and downstream areas. Eleven were overburden wells, and 17 were bedrock wells.

VOCs were detected in only 6 of 28 monitoring wells within Area A. TBC/ARAR values for drinking water were exceeded at only 3 locations. Trichloroethene was detected above ARARs at 2LMW13D (10 ppb) at the west end of the landfill, and 2DMW16D (17 ppb) upgradient of North Lake. These are both bedrock wells. This finding suggests a low-concentration plume of solvents exists within the bedrock aquifer and extends from the western portion of the former landfill downgradient to the North Lake area. The plume appears to be fairly narrow, because no solvents were detected in the Area A downstream wells to the north. This possibility is supported by review of the groundwater specific conductivity data, which is used as a landfill leachate indicator. Solvents were not detected in downgradient well 3MW12D (OBDA), suggesting that preferred fracture flow is occurring in the bedrock. However, this data does not correlate with the cadmium data, which indicated elevated levels of cadmium at 2LMW13S and 3MW12D. The downgradient extent of the solvent plume is undefined, but groundwater is flowing in a westerly direction. Benzene was detected at 10 ppb, above drinking water standards (5 ppb) at 2LMW18S, and may be related to parked vehicles in this area; benzene was not detected in any other well in Area A.



NOTE:
1. Wells not installed at 2DMW10S and 2DMW15S due to lack of ground water in overburden.
2. Pesticide totals for OBDA are highest of 0-6" or 12-18" sample intervals.
3. No data presented indicates parameters not detected.

INSTALLATION RESTORATION STUDY NAVAL SUBMARINE BASE - NEW LONDON GROTON, CT	LEGEND ■ 7SD1 - Sediment Sample Total Pesticides (ppb) 68 280 — PCB's ND - Indicates Not Detected - Building - Watercourse Approximate Scale 0 200'	FIGURE 3-7 SUMMARY OF TOTAL PESTICIDES/PCB'S DATA IN SOILS/SEDIMENTS AREA A DOWNSTREAM WATERCOURSE ATLANTIC ENVIRONMENTAL SERVICES, INC.

Overall, the VOC concentrations, where detected, were low, particularly given the historical use of Area A as a landfill. Although drinking water ARAR/TBC values were exceeded in 3 wells, the results do not indicate any significant, ongoing release of VOC contaminants. Soil gas and subsurface soil data indicate that low levels of aromatic hydrocarbons and solvents are present throughout much of the Area A landfill. This data suggests a generally uniform, low level of soil contamination within the landfill with no definitive source area. The deployed parking area and adjacent area to the east (also used for automobile storage and parking) had the most uniform level of petroleum hydrocarbons based on soil gas data.

PCBs were detected in the groundwater at one location within the landfill. The concentration exceeded solubility, thus further sampling of the well has been suggested for confirmation of the result (included in the Phase II Work Plan).

Cadmium was the only inorganic that exceeded primary drinking water standards (ARARs) within Area A. Cadmium was detected above the 5 ppb drinking water standard at 2LMW18D (7.2 ppb), 2WMW3D (7.7 ppb), 2WMW5S (6.4 ppb), 2WMW3S (10.6 ppb), 2LMW18S (29.1 ppb), 2LMW13D (44.8 ppb), and 3MW12D (16 ppb). The source of these elevated levels of cadmium may be related to soils within the landfill and, possibly, OBDA. However, cadmium soil concentrations in the landfill only exceeded established background levels at one sample location (2LMW8S). Possibly, higher concentrations of cadmium exist in the landfill at locations other than the sample points. Dissolved cadmium levels in Area A groundwater may be partially attributable to low pH values for some wells. The upward groundwater flow gradient within most of the landfill would minimize the transport of cadmium to the bedrock aquifer from a landfill source. However, at bedrock well 2LMW13D, where there is a strong upward gradient, cadmium is present in the bedrock either from a source

upgradient within the landfill or another, unknown, upgradient source. The former weapons center is upgradient of this area along Wahoo Avenue; however, the absence of elevated levels of cadmium in other nearby bedrock wells (2LMW9D, 2LMW17D, and 2LMW14D) does not strongly support an off-site source, but rather a landfill source.

The overburden groundwater flow in the central and eastern portions of the landfill is toward the wetland, and in the western portion of the landfill to the northwest and down the Downstream watercourse valley. The cadmium groundwater contamination appears confined to the landfill and the OBDA area. Cadmium was only detected in well 3MW2D in the OBDA, suggesting a restricted plume to the northwest. Because of the preferred bedrock fracture flow patterns, other wells may not have intercepted the cadmium, and the cadmium plume may be undefined.

Iron and manganese exceeded secondary drinking-water standards in many Area A wells. The results for 2WMW1D and 2WMW2D (upgradient wells) and the residential wells were much lower for iron and manganese, which indicates a source of these inorganics within the Area A landfill material and wetland sediments.

Nature and Extent of Area A Surface Water Contamination: Fifteen surface water samples were collected within Area A, including the Wetland and Downstream areas and Thames River. These samples were collected to assess surface water quality.

Low levels of VOCs were detected in several samples (2DSW5, 2DSW7, 2DSW8, 2DSW12, and 2DSW13). Except for one sample, the constituents detected are petroleum hydrocarbons, which could be associated with run-off. One sample near Triton Avenue contained 3 ppb of tetrachloroethene and 2 ppb of styrene. No ARAR or TBC values were exceeded for the VOCs. No SVOCs were detected at any of the sampling locations.

No pesticides or PCBs were detected in any of the samples except for 2DSW4, which

contained 1.9 ppb of DDD. This sample is from an area where high levels of DDTR, including DDD, were detected in sediments. The origin of DDD in the surface water is probably from the sediments.

ARAR/TBC values for inorganics were exceeded at several sample locations for cadmium (3 of 15), copper (15 of 15), iron (11 of 15), lead (11 of 15), manganese (13 of 15), zinc (14 of 15), and mercury (1 of 15). These ARARs are based upon in-stream, water-quality criteria and standards to protect aquatic life, and may not be appropriate for the wetlands and small drainage streams. The presence of iron and manganese in surface water may be caused by the low pH and reducing conditions created by the Area A landfill. Some of the iron and manganese may originate from wastes; however, the majority of these metals detected in surface water probably leached from native soils. Of note are the ARAR exceedances in the Thames River at sample locations 2DSW12 for manganese and iron and at 2DWS13 for manganese. Area A upstream surface water samples also contained elevated levels of iron and manganese, whereas surface water samples in the Thames River at DRMO and Goss Cove did not contain levels above ARARs. The iron standard of 1000 ppb is based on chronic aquatic toxicity water quality criteria; the manganese standard is based on water-quality criteria for human health risks from fish consumption.

Copper and zinc, which exceeded water quality criteria or standards, were also detected in concentrations above background levels in soils at the Area A landfill. Assumably, the elevated concentrations originate from the Area A landfill.

Cadmium and lead are present above ARAR values and levels normally seen in natural surface waters are present in both the Area A wetland and landfill soils and sediments. The presence may be the result of historical disposal activities. However, cadmium and lead were also detected in the upgradient sample location (2LSW1) above ARAR values.

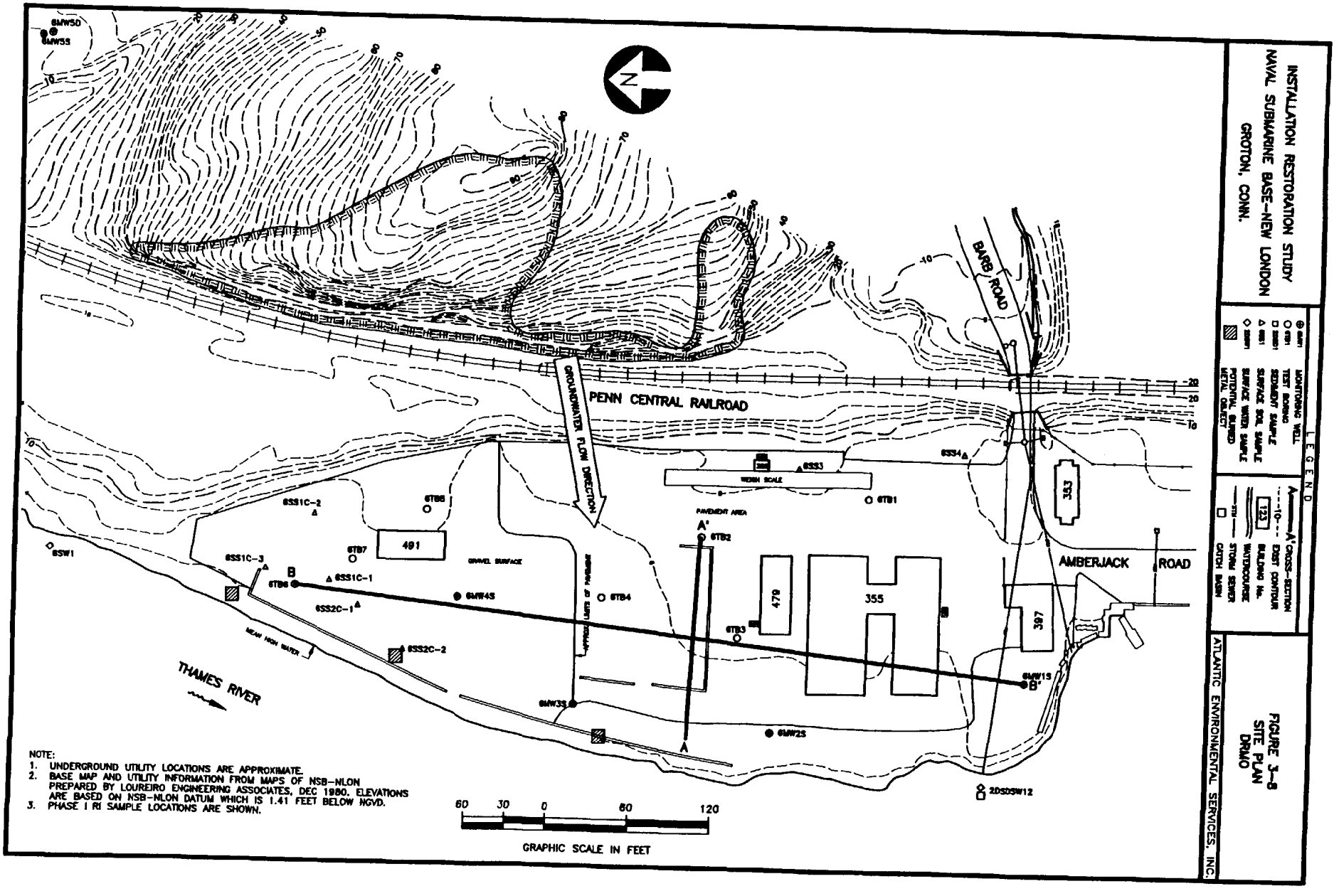
Mercury was detected in only one surface water sample (2DSW9). This location (adjacent to Triton Road) is immediately downgradient of 2 sediment sampling locations where mercury was found. Although the two sediment concentrations were below background levels, mercury was not detected in any other sediment sample. There was one occurrence of mercury above background concentrations in Area A landfill soils. Mercury is rarely found in natural surface waters above one ppb. The source of the mercury in sediments is not apparent, although historical disposal in the Area A landfill is one possible cause. However, more likely a past release occurred upgradient of sample locations 2DSD7 and 2DSD8 along Triton Road. It is noted that sediment sample 7SD1, within a runoff swale from the torpedo shops, contained no mercury, nor did any other soil or groundwater sample at the torpedo shops. This implies that the torpedo shops are not the source.

3.3 Defense Reutilization and Marketing Office — Soils

3.3.1 Site Background

The Defense Reutilization and Marketing Office (DRMO) site is adjacent to the Thames River in the northwest section of NSB-NLON. The DRMO is the storage and collection facility for items to be sold at auction sales held periodically throughout the year. Scrap metal is also temporarily stored before to being transported off this site. A site plan of DRMO, which includes previous sample locations, is provided as Figure 3-8.

The DRMO site was used as a major base landfill and burning ground from 1950 to 1969. The materials burned and landfilled included construction materials, combustible scrap, and other non-salvageable waste items. These materials were reportedly burned on the shoreline and then disposed over the riverbank and partially covered. Also, a former battery-acid handling facility was located near Building 491. An in-ground, rubber-lined tank and associated pumping facilities were present, similar to the spent acid storage and disposal area site.


INSTALLATION RESTORATION STUDY
NAVAL SUBMARINE BASE-NEW LONDON
GROTON, CONN.
LEGEND
MONITORING WELL
TEST BORING
SEDIMENT SAMPLE
SURFACE SOIL SAMPLE
SURFACE WATER SAMPLE
POTENTIAL BURIED METAL OBJECT
CROSS-SECTION
EXIST CONTOUR
BUILDING No.
WATERCOURSE
STORM SEWER
CATCH BASIN
FIGURE 3-8
SITE PLAN
DRMO
ATLANTIC ENVIRONMENTAL SERVICES, INC.
PENN CENTRAL RAILROAD
GROUNDWATER FLOW DIRECTION
BARB ROAD
AMBERJACK ROAD
THAMES RIVER
MEAN HIGH WATER
GRAVEL SURFACE
PAVEMENT AREA
WEIGH SCALE
APPROX. LIMITS OF PAVEMENT
491
479
355
397
383
6MW50
6MW55
6SW1
6SS1C-2
6SS1C-3
6SS1C-1
6SS2C-1
6SS2C-2
6TB6
6TB7
6TB5
6TB4
6TB3
6TB2
6TB1
6SS3
6SS4
6MW45
6MW35
6MW25
6MW15
2DSDSW12
A
A'
B
B'
NOTE:
1. UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE.
2. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON PREPARED BY LOUREIRO ENGINEERING ASSOCIATES, DEC 1980. ELEVATIONS ARE BASED ON NSB-NLON DATUM WHICH IS 1.41 FEET BELOW NGVD.
3. PHASE I RI SAMPLE LOCATIONS ARE SHOWN.
60 30 0 60 120
GRAPHIC SCALE IN FEET

DRMO operations at this site, after the closing of the landfill, include storage of various items, including submarine batteries, white goods, and empty drums.

Other routine grading and minor excavation occurs in the northern portion of the site.

3.3.2 Site-Specific Geology and Hydrology

Site-specific geology has been determined by using the Phase I RI and interpretation of the 1967 USGS Bedrock Geology Map, the 1983 SCS Soils Map, and the 1960 USGS Surficial Geology Map.

The 1967 USGS Bedrock Geologic Map shows the DRMO site as artificial fill underlain by a biotite-quartz-feldspar gneiss of the Mamacoke Formation. The northernmost portion of the DRMO is mapped as a gneissic biotite granite known as the Potter Hill Granitic Gneiss. An outcrop of the Westerly Granite is also mapped on the east side of the DRMO site. Field observations of fill material and bedrock outcrops are generally consistent with mapped classifications, although the Westerly Granite was not positively identified in the field. Bedrock was encountered northeast of the DRMO site (6MW5D) at a depth of 25 feet below grade. Twenty feet of bedrock was cored at this location. The mineralogy and texture of the core sample is consistent with that described as the Potter Hill Granitic Gneiss. Weathered and partially covered bedrock outcrops were present on the east side of the DRMO site adjacent to the railroad tracks. In addition, a prominent bedrock cliff exists east of both the DRMO site and railroad tracks.

The 1983 SCS Soils Map depicts the DRMO site as udorthents-urban land on the portion of the site that is near the Thames River and Hinckley Sandy Loam on the northernmost portion of the site. The 1960 USGS Surficial Geology Map shows artificial fill in the portion of the DRMO that is adjacent to the Thames River and terrace deposits of the Thames River in the northern portion of the DRMO. The classifications of udorthents-urban land and artificial fill

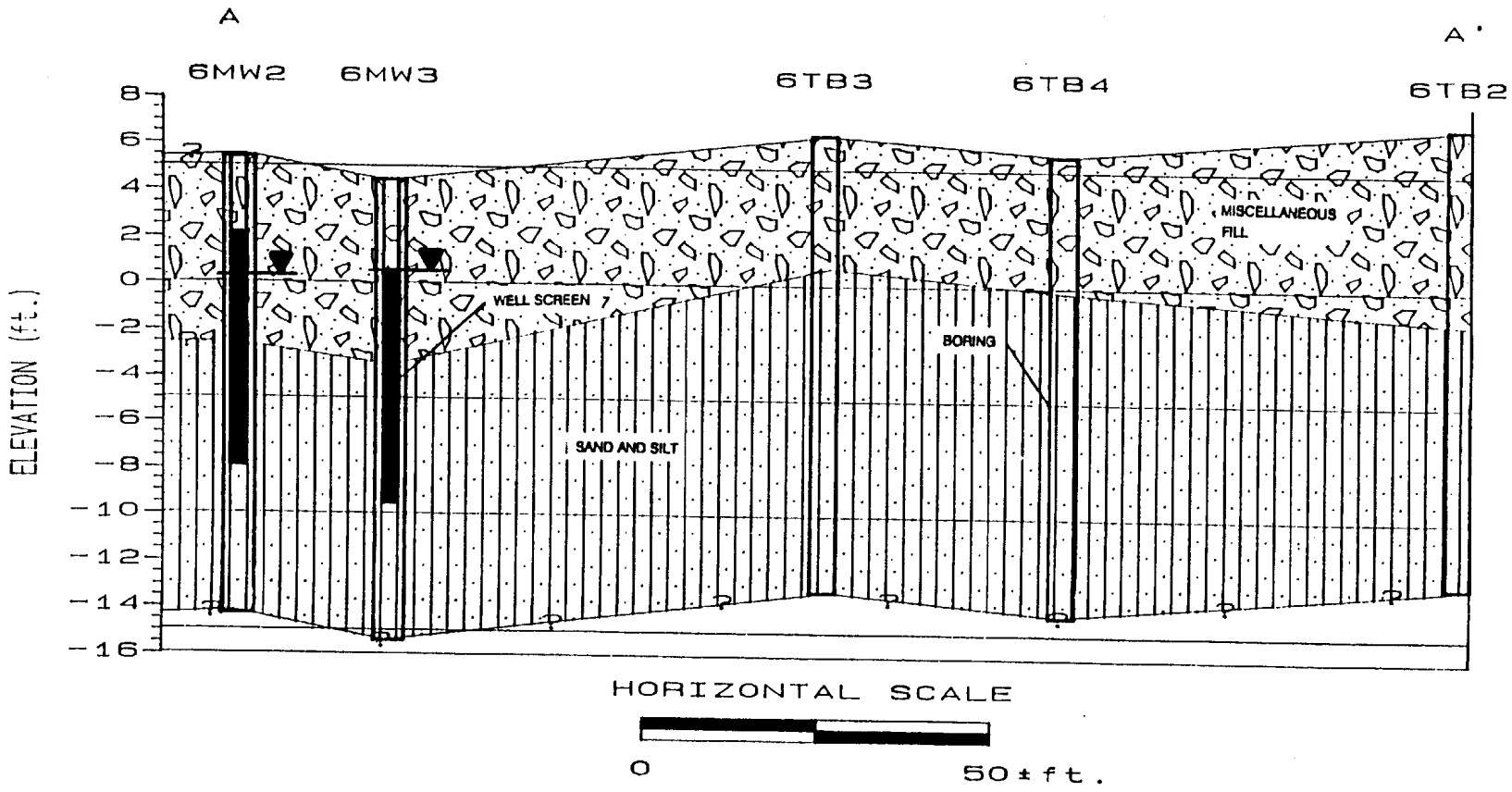
are consistent with the past and present conditions on the southern portion of the DRMO site. Subsurface soil sampling data from the northern portion of the DRMO site is consistent with the description of Hinckley Sandy Loam provided by the SCS. Soils observed at the northern portion of the DRMO site are consistent with a coarse fraction of the terrace deposits.

Subsurface investigations show that DRMO is underlain by between 5 and 20 feet of miscellaneous fill material (predominantly sand and gravel). Fill material is thickest in the northern portion of the site near Building 491, measuring up to 15 feet thick (at 6MW4). The sand and gravel is underlain by sand and silt that contain shell fragments.

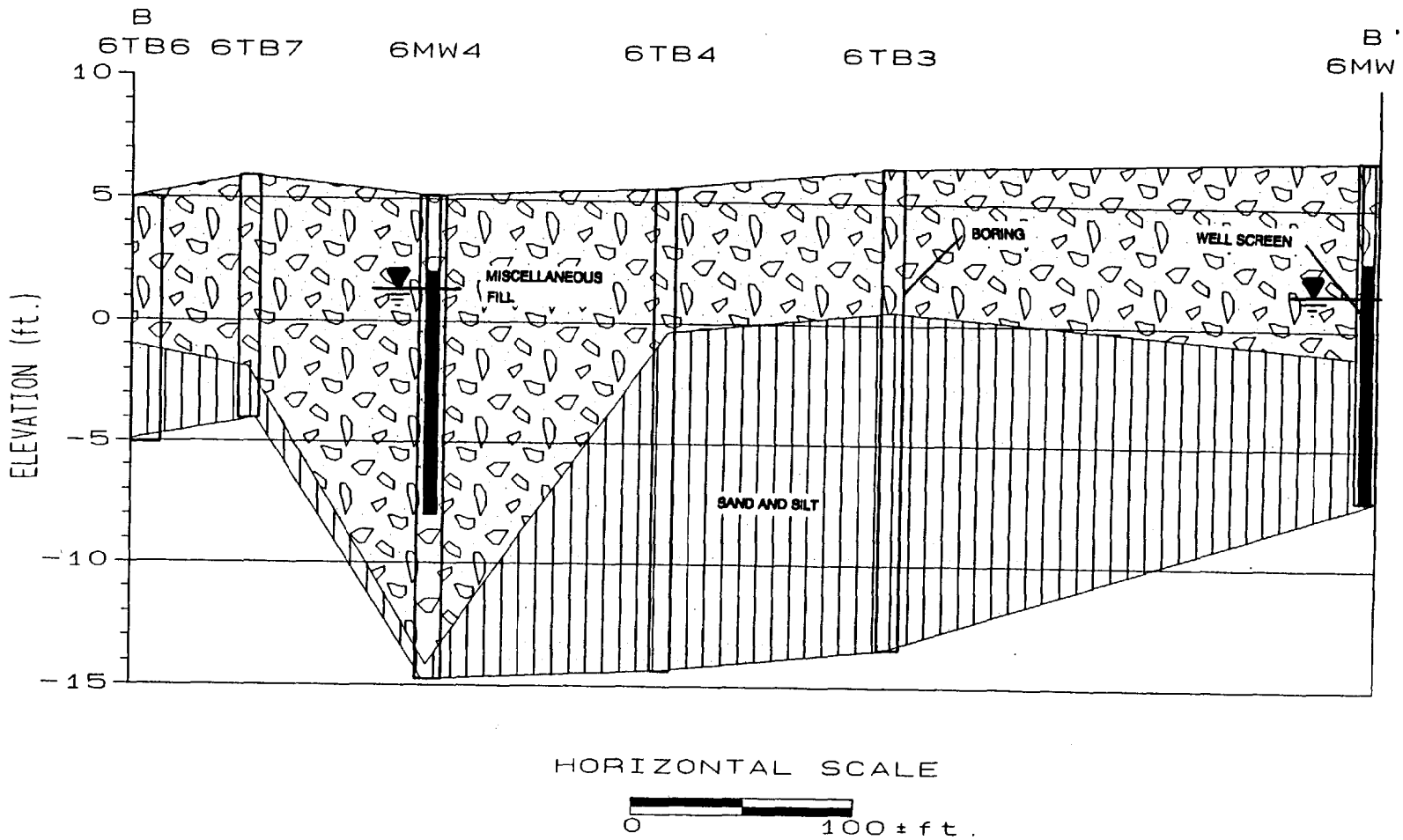
In the southern portion of the site, fill material overlies sand, silt, and clay. Shell fragments were observed in all borings in the southern portion, except 6MW1. Shell fragments in fine-grained soils probably represent the original riverbed. The depth to fine-grained soils ranges from 10 feet in the central portion of the site to 20 feet in the northern portion. Figures 3-9 and 3-10 are geologic cross-sections of the DRMO site, which illustrate the subsurface geology, landfill material (miscellaneous fill), and the water table.

Four overburden monitoring wells and one bedrock monitoring well were installed at DRMO. Groundwater elevations in the overburden aquifer were approximately 4 to 6 feet below grade in the southern portion of DRMO and approximately 12 feet below grade in the north portion of DRMO. Water level measurements taken at the 5 overburden monitoring wells show that groundwater flow is toward the west. As with other sites next to the Thames River, groundwater flow at DRMO is influenced by tidal fluctuations.

Slug displacement tests were done in 2 overburden wells. Single well pumping tests were conducted in one overburden well and one bedrock well. The hydraulic conductivity was calculated to be 7.2 feet/long, and the hydraulic upgradient was 0.005. Using data from these tests, the volume of water discharged from the overburden to the Thames River is estimated to



INSTALLATION RESTORATION STUDY NAVAL SUBMARINE BASE - NEW LONDON GROTON, CT	GROUND WATER ELEVATION DATA: MARCH 21, 1991	FIGURE 3-9 GEOLOGIC CROSS-SECTION A-A' DRMO ATLANTIC ENVIRONMENTAL SERVICES, INC.



INSTALLATION RESTORATION STUDY NAVAL SUBMARINE BASE - NEW LONDON GROTON, CT	GROUND WATER ELEVATION DATA: MARCH 21, 1991	FIGURE 3-10 GEOLOGIC CROSS-SECTION B-B' DRMO ATLANTIC ENVIRONMENTAL SERVICES, INC.

be approximately 23,100 cubic feet per day (172,800 gpd), based on a flow velocity of 0.7 feet per day, a saturated thickness of 50 feet, and a 660-foot section perpendicular to the flow path. Flow to the river is probably greater during low tide.

Data analyses indicate that the transmissivity of the bedrock in the vicinity of this well is 1,670 square feet per day, assuming a porous aquifer thickness of 150 feet.

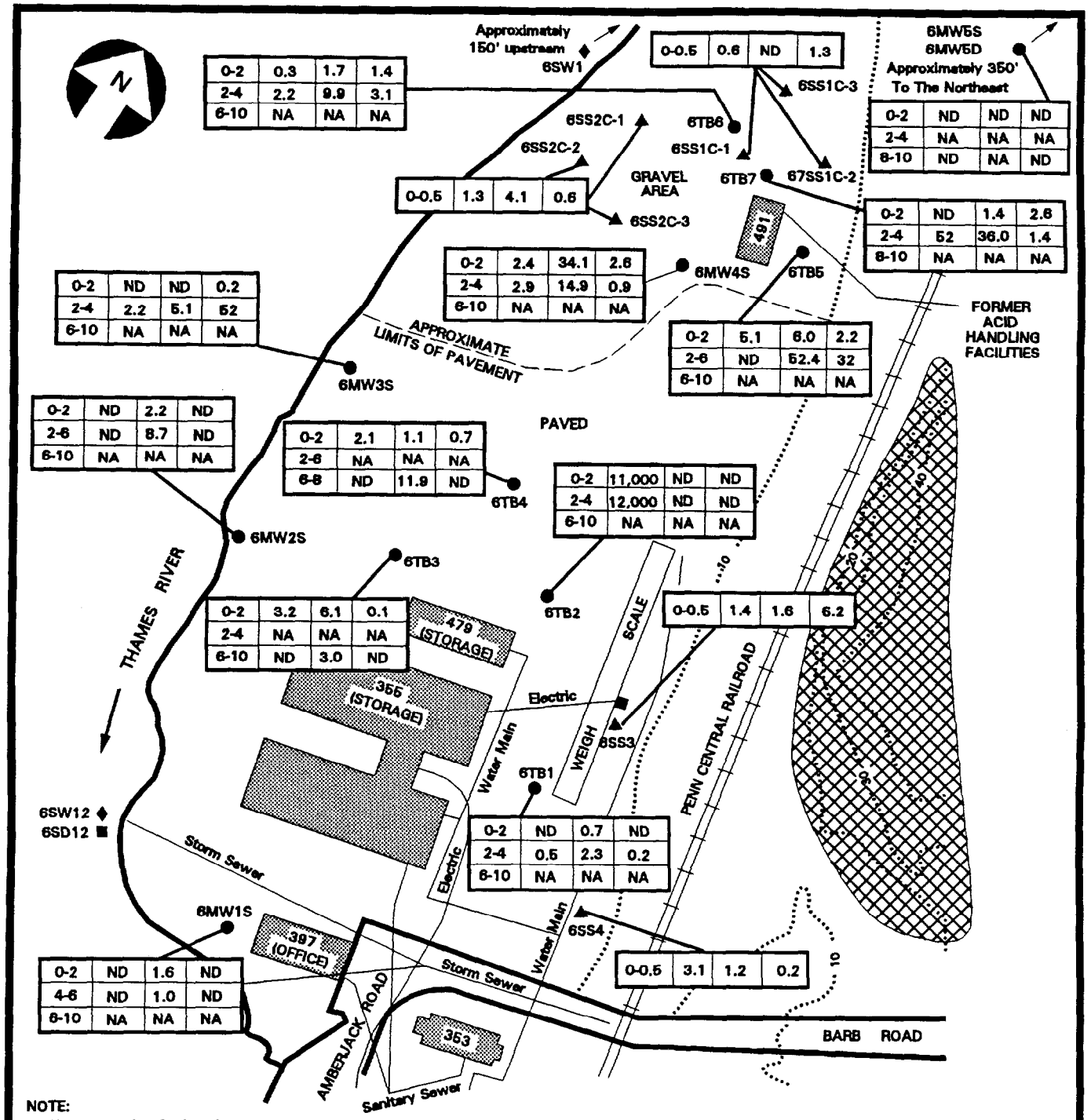
3.3.3 Nature and Extent of Contamination

Radiation, geophysical and soil gas surveys were conducted. No radiation above background levels was detected. The geophysical survey identified several, suspected, buried metal objects, which were avoided during drilling operations. The soil gas survey assisted in defining VOCs in several areas. The extent contamination is shown in Figure 3-11.

Twenty-four soil samples were collected from 12 test boring/monitoring well locations. Four surface soil samples and 6 groundwater samples were collected. These samples were analyzed to define the nature and extent of contamination at the former landfill site.

VOC concentrations in soil at DRMO were generally low. However, elevated VOCs were detected at 6TB4 (6-8 feet), where the following chemicals were found: vinyl chloride (1,300 ppb), trichloroethene (20,000 ppb), and tetrachloroethene (210 ppb). The contamination appears to be generally isolated at the site, based on results of the soil gas survey and other soil samples collected in this area.

SVOCs were present in most samples collected in the former landfill area. The SVOCs predominantly consisted of PAH compounds, many of which were at elevated levels. The spatial density of the sample locations indicates that PAHs are likely present throughout the limits of the DRMO site. Based on the former use of the site as a landfill, and an area where material was burned, the PAHs are probably a result of incomplete combustion and, perhaps to a lesser degree, to petroleum releases.



NOTE:
1. Underground utility locations are approximate.
2. Base map and utility information from maps of NSB-NLON prepared by Loureiro Engineering Associates, Dec 1980. Elevations are based on NSB-NLON datum which is 1.41 feet below NGVD.
3. Refer to analytical tables for specific sample depth interval.

INSTALLATION RESTORATION STUDY
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT

LEGEND
- SD1-Sediment Sample
- SS1-Surface Soil Sample
- SW1-Surface Water Sample

Sample Depth (ft)	PCB (ppm)	PAH (ppm)	TCLP LEAD (ppm)

NA - Not Analyzed
ND - Not Detected

- MW1- Monitoring Well
- TB1- Test Boring
- 95 - Existing Grade
- Building
- Exposed Bedrock

Approximate Scale
0 20 40'

FIGURE 3-11
SUMMARY OF PCB, PAH AND TCLP LEAD IN SOILS
DRMO

ATLANTIC ENVIRONMENTAL SERVICES, INC.

PCB Aroclor 1260 is present at almost all sample locations except 6MW5S (background), 6MW1S, and 6MW2S (rear of office and storage building). Concentrations range from 52 ppb to 12,000 ppb. This contaminant is generally present in both the 0-2 foot and 2-6 foot depths. The presence of PCBs at this site is most likely associated with scrap metal storage (e.g., white goods), associated capacitor leaks, and past storage of transformers. The PCBs do not necessarily come from landfill disposal. PCB Aroclor 1260 was also detected at sediment sample location 2DSD12, which is at the outfall of the storm drainage system from Area A to the rear of Building 397 at DRMO. It was not present in other upgradient sample points along the Area A downstream and may be a result of surface soil transport via surface water run-off from DRMO.

Pesticides at elevated concentrations were detected at one sample location; pesticides were detected at no other sample locations. Total pesticide concentrations were 57,800 ppb, consisting of DDT, DDD and DDE. The DDT concentration was above the TBC value. Because pesticides were detected at only one sample location and at a depth of 2-6 feet, the DDT probably came from past landfilling rather than surficial application.

Out of 24 samples analyzed for TCLP metals, 21 contained one or more metals exceeding TBC values. Metals exceeding TBC values included barium, cadmium, chromium, lead, mercury, and silver. Characteristic values of TCLP hazardous waste were exceeded for lead (5 ppm) at 6MW3S (2-4 feet) (52 ppm), at 6TB5 (2-6 feet) (32 ppm), and at 6SS3 (0-0.5 feet) (6.2 ppm). Lead levels were generally elevated around Building 491 (from former battery-acid handling), indicating that battery acid releases occurred in this area. Many inorganic constituents exceeded established background levels, based on mass analysis. These inorganics included antimony, beryllium, cadmium, cobalt, copper, lead, mercury, nickel, zinc, and boron. The majority of these elevated levels are related probably to a combination of past landfill

disposal and scrap metal storage.

No petroleum hydrocarbons were detected in the groundwater samples. Trichloroethene and 1,2 dichloroethene were present in 3 downgradient wells (6MW2S, 6MW3S, and 6MW4S). Trichloroethene exceeded the ARAR value (5 ppb) with a concentration of 8 ppb at well 6MW4S. The primary source of the solvents in the groundwater, based on the soil analytical results and the soil gas data, is projected to be in the area of 6TB4, 6MW4S, 6TB6, and 6TB7.

No SVOCs, PAHs, pesticides, or PCBs were detected in any wells at the DRMO site. Low levels of phthalates and benzoic acid were detected in the upgradient well 6MW5D. The inorganic groundwater analysis indicates that selenium exceeds the primary drinking water standards (ARARs) at wells 6MW2S, 6MW3S, and 6MW4S. The cause of the elevated levels is unclear but appears to be site-related.

No VOCs, SVOCs, pesticides, or PCBs were detected in the upgradient surface water sample. Comparison of the inorganic results for this sample with the downgradient water sample (Goss Cove) does not suggest any detectable effect on the Thames River from NSB-NLON, based on this limited data.

4.0 PRELIMINARY REMEDIAL ACTION OBJECTIVES

Remedial action objectives consist of specific environmental goals to help develop remedial alternatives to protect human health and the environment. Remedial action objectives specify contaminants and media of concern, potential exposure pathways, and remediation goals. The preliminary remedial action objectives developed to date are described in detail in the Draft Phase II Remedial Investigation Work Plan (March 1993, Atlantic) and summarized below. The preliminary remedial action objectives were based on potential ARARs, to-be-considered requirements (TBC), and/or risk calculations. ARARs include any state or federal promulgated standard or criteria that pertains to protection of human health and the environment that specifically addresses conditions or remedial actions at a Superfund site. TBC are non-promulgated federal or state standards and criteria. ARARs are further characterized as to whether they are classified as chemical-, location- or action-specific. A risk assessment consists of an evaluation performed to assess conditions at a site and determine the risk posed to human health and the environment. Risk calculations are then made to determine the level of a constituent in a specific media below which unacceptable risks are not present. Risk calculations are included as Appendix A of this briefing document.

Presented below for each operable unit is a summary of chemical-specific, location-specific, and action-specific ARAR/TBC, calculated risk-based standards and the remedial action objectives developed in light of these ARAR/TBC and risk-based standards. Before implementation of the proposed interim remedial actions, additional data will be collected, as is described in more detail in Section 5.0. This data will be generated from analyses of soil, sediment and biota tissue, and ecological studies. This new data, along with the Phase I RI data, will be used (1) to reassess the target remediation levels for known constituents of concern and (2) to further quantify the extent of contamination requiring remediation. At all of the interim

remedial action sites, this analysis will likely consist of a refinement of previously developed numbers. The one exception regards target remediation levels in Area A downstream because of ecological risks from DDTR. These standards have not been previously calculated because of the lack of an adequate database.

In addition, for each remedial action objective, general response action, technology types, and process options that pertain to the proposed interim actions have been identified in the sections below for each operable unit. Evaluation of these process options and the alternatives developed will be evaluated during the FFS, as is discussed in more detail in Section 5.0 (Interim Remedial Actions).

4.1 Spent Acid Storage and Disposal Area — Soils

ARAR/TBC, risk-based standards, and the remedial action objectives developed in consideration of these standards are presented below. In addition, for each remedial objective, general response action, technology types, and process options are identified.

Chemical-Specific ARAR/TBC

- 5.0 ppm TCLP lead (ARAR) — Federal and State Hazardous Waste Regulations
- 0.05 ppm EP-TOX (Extraction Procedure Toxicity) lead (TBC) — CTDEP Guidance

Location-Specific ARAR/TBC

- No significant ARARs identified

Action-Specific ARAR/TBC

- Federal Hazardous Waste Regulations (40 CFR 260 to 272)
- State Hazardous Waste Regulations (22a-449(c) 100-110 RCSA and 22a-116-B1 to 11 RCSA)

Risk-Based Standards

- 500 to 1000 ppm total lead (human health)

SPENT ACID STORAGE AND DISPOSAL AREA — SOILS PRELIMINARY REMEDIAL ACTION OBJECTIVES AND ALTERNATIVE PROCESS OPTIONS			
Remedial Action Objective	**General Response Actions**	**Technology Types**	**Alternative Potential Process Options**
Reduce exposure of workers to lead in soils, prevent erosion and generation of leachate.	Limited Action	Access Restrictions	Fence, Deed Restrictions
	Containment	Horizontal Barriers, Surface Water Control	Soil and Membrane Cap, Site Grading
	Removal	Excavation	Excavation with Backhoe
	Treatment (above-ground)	Physical/Chemical	Stabilization
	Disposal (on-site & off-site)	Landfill, Reuse	Off-site RCRA Landfill, On-site Backfill

4.2 Area A Landfill/Concrete Pad — Soils

ARAR/TBC, risk-based standards, and the remedial action objectives developed in consideration of these standards are presented below. In addition, for each remedial objective, general response action, technology types, and process options are identified.

Chemical-Specific ARARs/TBC

- 10 ppm PCB (TBC) — U.S. EPA TSCA Guidance (40 CFR Part 761)
- 2 ppm PCB (TBC) — CTDEP Soil Cleanup Guideline
- 500 ppb DDT (TBC) — U.S. EPA Tolerance Level (40 CFR Part 180)
- 0.05 ppm Arsenic EP-TOX (TBC) — CTDEP Soil Cleanup Guideline
- 0.01 ppm Cadmium — CTDEP Soil Cleanup Guideline
- 0.05 ppm Lead EP-TOX (TBC) — CTDEP Soil Cleanup Guideline
- 0.05 ppm Selenium EP-TOX (TBC) — CTDEP Soil Cleanup Guideline

Location-Specific ARARs

- Federal CWA Section 404 (40 CFR 230 and 33 CFR 320-330)
- Federal Executive Orders 11990 (Protection of Wetlands)

Action-Specific ARARs

- Federal and State Solid Waste Standards (40 CFR 240 to 258, 22a-209-1 to 13 RCSA)

- Federal and State Water Discharge Permit Regulations (40 CFR 122 to 125, 22a 430-1 to 8 RCSA)

- Connecticut Water Diversion Policy Act (22a-372 and 377 RCSA)

- U.S. EPA and Corps of Engineers Rules on Activities in Wetlands and Watercourses (33 USC 404, 33 CFR 320-330, 40 CFR 230)

Risk Based Standards

- Maximum = 10 ppm; Average = 4 ppm (human health)

AREA A LANDFILL/CONCRETE PAD — SOILS PRELIMINARY REMEDIAL ACTION OBJECTIVES AND ALTERNATIVE PROCESS OPTIONS			
Remedial Action Objective	**General Response Actions**	**Technology Types**	**Alternative Potential Process Options**
Reduce infiltration through landfill and prevent erosion of landfill surface soils.	Containment	Horizontal Barriers, Stormwater Control, Groundwater Control	Soil and Membrane Cap, Site Grading, Dewatering
Reduce exposure of workers to PCBs in surface soils.	Limited Action	Access Restrictions	Fence and Deed Restrictions
	Containment	Horizontal Barriers	Soil and Membrane Cap
	Removal	Excavation	Excavation with Backhoe
	Treatment (above-ground)	Thermal	Thermal Desorption
	Disposal (on-site & off-site)	Landfill, Reuse	Off-site RCRA Landfill, On-site Backfill

4.3 Area A Downstream/OBDA — Sediments

ARAR/TBC, risk-based standards, and the remedial action objectives developed in consideration of these standards are presented below. In addition, for each remedial objective, general response action, technology types, and process options are identified.

Chemical-Specific ARARs

- 500 ppb DDTR — U.S. EPA Tolerance (40 CFR Part 180)
- 0.05 ppm Arsenic EP-TOX (TBC) — CTDEP Soil Cleanup Guidelines
- 0.01 ppm Cadmium — CTDEP Soil Cleanup Guidelines
- 0.05 ppm Lead EP-TOX (TBC) — CTDEP Soil Cleanup Guidelines
- 0.05 ppm Selenium EP-TOX (TBC) — CTDEP Soil Cleanup Guidelines
- 0.005 ppm Trichloroethene — CTDEP Soil Cleanup Guidelines
- 0.005 ppm Tetrachloroethene (TBC) — CTDEP Soil Cleanup Guidelines

Location-Specific ARARs

- Federal CWA Section 404 (40 CFR 230 and 33 CFR 320-330)
- Federal Executive Orders 11990 (Protection of Wetlands)
- Federal Fish and Wildlife Coordination Act (16 USC Part 661 et seq., 40 CFR Part 122.29)

Action-Specific ARARs

- Federal and State Solid Waste Standards (40 CFR 240 to 258, 22a-209-1 to 13 RCSA)
- Federal and State Water Discharge Permit Regulations (40 CFR 122 to 125, 22a 430-1 to 8 RCSA)
- Connecticut Water Diversion Policy Act (22a-372 and 377 RCSA)
- U.S. EPA and Corps of Engineers Rules on Activities in Wetlands and Watercourses (33 USC 404, 33 CFR 320-330, 40 CFR 230)

Risk-Based Standards

- 25 ppm DDTR average — human health
- To Be Provided — biological

AREA A DOWNSTREAM/OBDA — SEDIMENTS PRELIMINARY REMEDIAL ACTION OBJECTIVES AND ALTERNATIVE PROCESS OPTIONS			
Remedial Action Objective	**General Response Actions**	**Technology Types**	**Alternative Potential Process Options**
Reduce exposure of children and biota to DDTR in sediments, and prevent transport of sediments.	Limited Action	Access Restrictions	Fence, Deed Restrictions
	Containment	Horizontal Barriers, Surface Water Control	Soil Cap, Site Grading, Stream Channelization
	Removal	Dredging	Hydraulic Dredging
	Treatment (above-ground)	Thermal, Physical/Chemical	Thermal Desorption, Dewatering
	Disposal (on-site and off-site)	Landfill, Reuse	Off-site RCRA Landfill, On-site Backfill

4.4 DRMO — Soils

ARAR/TBC, risk-based standards, and the remedial action objectives developed in consideration of these standards are presented below. In addition, for each remedial objective,

general response action, technology types, and process options are identified.

Chemical Specific ARARs

- 10 ppm PCB (TBC) — U.S. EPA TSCA Guidance (40 CFR Part 761)
- 500 ppb DDT (TBC) — U.S. EPA Tolerance Level (40 CFR Part 180)
- 2 ppm PCB (TBC) — CTDEP Soil Cleanup Guidance
- 1.0 ppm Barium EP-TOX (TBC) — CTDEP Soil Cleanup Guidance
- 0.01 ppm Cadmium — CTDEP Soil Cleanup Guidance
- 0.05 ppm Chromium EP-TOX (TBC) — CTDEP Soil Cleanup Guidance
- 0.05 ppm Lead EP-TOX (TBC) — CTDEP Soil Cleanup Guidance
- 0.002 ppm Mercury EP-TOX (TBC) — CTDEP Soil Cleanup Guidance
- 0.05 ppm Silver EP-TOX (TBC) — CTDEP Soil Cleanup Guidance
- 0.001 ppm 1,2-dichloroethane EP-TOX (TBC) — CTDEP Soil Cleanup Guidance
- 0.007 ppm 1,2 dichloroethene EP-TOX (TBC) — CTDEP Soil Cleanup Guidance
- 0.005 ppm Trichloroethene EP-TOX (TBC) — CTDEP Soil Cleanup Guidance
- 0.002 ppm Vinyl Chloride EP-TOX (TBC) — CTDEP Soil Cleanup Guidance

Location-Specific ARARs

- Federal CWA Section 404 (40 CFR 230 and 33 CFR 320-330)

- Federal Executive Order 11988 (floodplain management)

- Federal and State Fish and Wildlife Coordination Act (16 YSC Part 661 et. seq., 40 CFR Part 122.29)

- Federal and State Coastal Zone Management Act (16 USC Part 1451 et. seq., 22a-92 and 94 CGS)

- State Regulation of Dredge and Fill in Tidal, Coastal, or Navigable Waters (22a-359 to 363 CGS)

Action-Specific ARARs

- Federal Hazardous Waste Regulations (40 CFR 260 to 272)
- Federal Solid Waste Regulations (40 CFR 240 to 258)
- State Hazardous Waste Regulations (22a-449(c) 100 to 110 RCSA)
- State Solid Waste Regulations (27a-209-1 to 13 RCSA)

Risk-Based Standards

- PCB Maximum = 10 ppm; Average = 4 ppm — human health
- Lead Average = 500 - 1000 ppm — human health
- Carcinogenic PAH Maximum = 10 ppm; Average 4 ppm — human health

DRMO - SOILS PRELIMINARY REMEDIAL ACTION OBJECTIVES AND ALTERNATIVE PROCESS OPTIONS			
Remedial Action Objective	**General Response Actions**	**Technology Types**	**Alternative Potential Process Options**
Reduce infiltration through landfill, and prevent erosion of landfill surface soils.	Containment	Horizontal Barriers, Stormwater Control	Soil and Membrane Cap, Site Grading
Reduce exposure of workers to PCBs, PAH, and lead in soils; prevent erosion; and prevent leachate generation.	Limited Action	Access Restrictions	Fence and Deed Restrictions
	Containment	Horizontal Barriers, Surface Water Control	Soil and Membrane Cap, Site Grading
	Removal	Excavation	Excavation with Backhoe
	Treatment (aboveground)	Physical/Chemical, Thermal	Stabilization, Air Stripping, Thermal Desorption
	Disposal (on-site & off-site)	Landfill, Reuse	Off-site RCRA Landfill, On-site Backfill

5.0 INTERIM REMEDIAL ACTIONS

This section presents the overall plan of action for implementation of the interim remedial actions (subsection 5.1) and operable unit-specific implementation details (subsections 5.2 through 5.5).

5.1 Schedule and Procedure

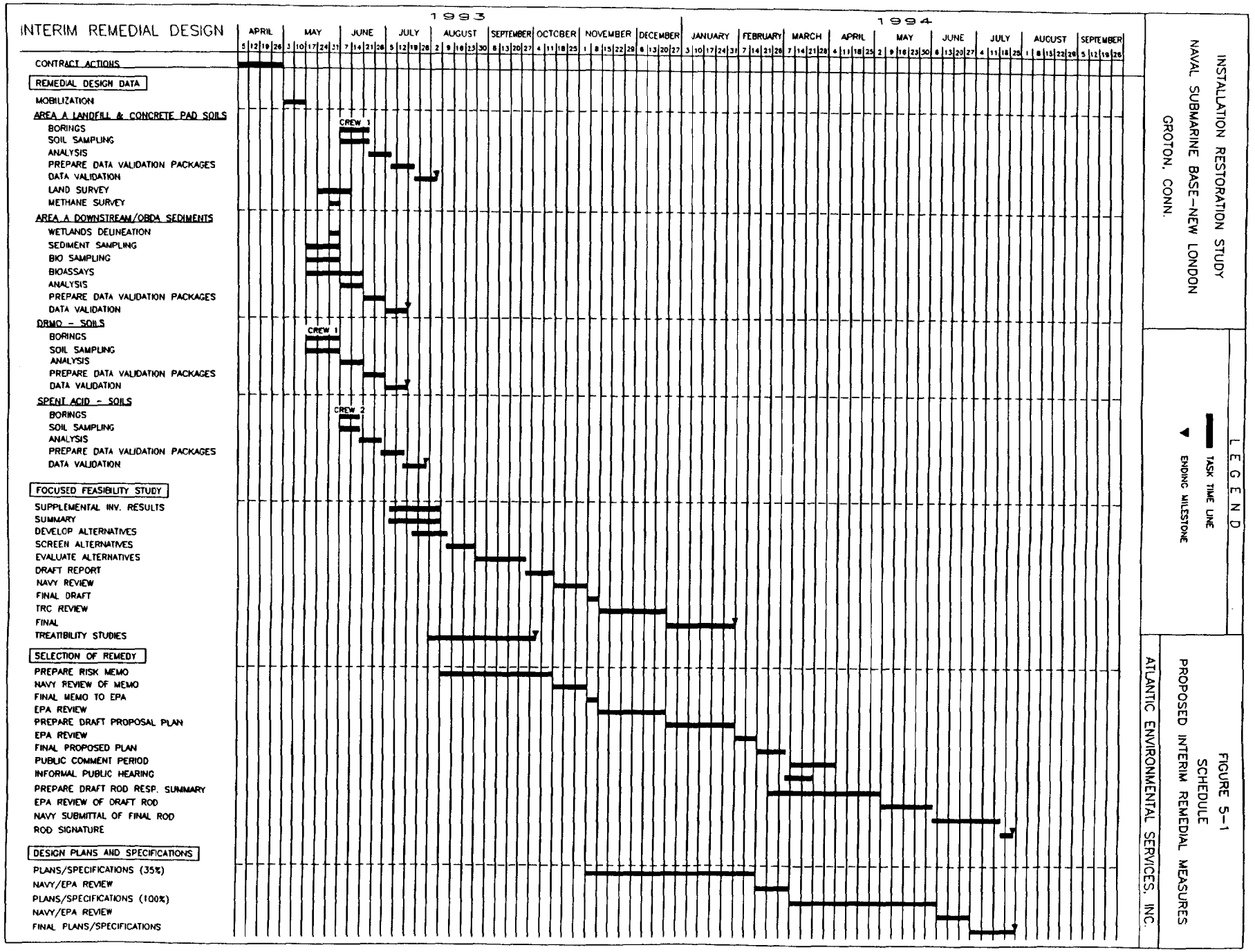
The overall schedule for implementation of the interim remedial action is shown is Figure 5-1.

To document the rationale for selection of the proposed interim remedial action, a focussed feasibility study (FSS) will be performed. Additional remedial design data must be collected to support the FFS and remedial design efforts. This data collection will include the performance of treatability studies and supplemental field investigations.

The FFS will evaluate approximately 3 alternatives for each operable unit. All of the alternatives that were previously developed for these sites during preparation of the final FS (pending completion following implementation of the Phase II RI Work Plan) are shown in Tables 5-1 through 5-6. The alternatives to be evaluated during the FFS have been highlighted for each operable unit. The alternatives selected for evaluation during the FFS were based on a preliminary evaluation of effectiveness, implementability and cost for all the alternatives performed during preparation of the final FS (on hold). Other than the smaller number of alternatives to be evaluated, the FFS will be prepared in accordance with the National Contingency Plan (NCP) and EPA guidance (U.S. EPA 1988) and consist of the following components:

Development and Screening of Alternatives

- Identification of ARARs and TBC Requirements
- Developed Remedial Action Objectives
- Developed General Response Actions



INSTALLATION RESTORATION STUDY
NAVAL SUBMARINE BASE-NEW LONDON
GROTON, CONN.

LEGEND
TASK TIME LINE
ENDING MILESTONE

FIGURE 5-1
SCHEDULE
PROPOSED INTERIM REMEDIAL MEASURES
ATLANTIC ENVIRONMENTAL SERVICES, INC.

TABLE 5-1
SPENT ACID STORAGE AND DISPOSAL AREA - SOILS
DEVELOPMENT OF ALTERNATIVES

RETAINED PROCESS OPTIONS	ALTERNATIVES						
	LIMITED ACTION		CONTAINMENT	OFF-SITE ALTERNATIVE	ON-SITE ALTERNATIVES		
SOIL/SEDIMENT	No Action	Access Restriction	Surface Cap	RCRA Landfill	In situ Stabilization	Above-ground Stabilization	Soil Washing
	6LEAD-1	6LEAD-2	6LEAD-3	6LEAD-4	6LEAD-5	6LEAD-6	6LEAD-7
No Action	●						
Access Restriction		●	●				
Horizontal Barrier - Cap			●				
Surface Water Control			●				
Excavation - Backhoe				●		●	●
In situ Stabilization					●		
Soil Washing							●
Stabilization				●[1]		●	●[1]
On-site Backfill						●	●[2]
Off-site RCRA Chemical Landfill				●			●[2]

Notes:
1. Optional, depends on TCLP analysis. Off-site stabilization can be performed at the selected off-site RCRA landfill.
2. Fine-grained (contaminated) soils separated by the soil washing process will be landfilled, while the larger soil particles will be backfilled.
3. Shading indicates alternatives to be evaluated during the focused feasibility study.

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TABLE 5-2
AREA A LANDFILL AND CONCRETE PAD – SOILS
DEVELOPMENT OF ALTERNATIVES

RETAINED PROCESS OPTIONS	ALTERNATIVES									
	LIMITED ACTION		CONTAINMENT	OFF-SITE ALTERNATIVES[3]		ON-SITE ALTERNATIVES				
SOIL/SEDIMENT	No Action	Access Restriction	Surface Cap	Incineration	RCRA Landfill	In situ Stabilization	Above-ground Stabilization	Incineration[1]	Low Temperature Thermal Desorption[1]	Solvent Extraction[1]
	2L-1	2L-2	2L-3	2L-4	2L-5	2L-6	2L-7	2L-8	2L-9	2L-10
No Action	●									
Access Restriction		●	●							
Horizontal Barrier – Cap			●							
Site Grading & Stormwater Management			●							
Dewatering			●							
Excavation – Backhoe				●	●		●	●	●	●
In situ Stabilization						●				
Solvent Extraction										●
Stabilization							●			
On-site Incineration								●		
Off-site Incineration				●					●[2]	●[2]
On-site Low Temp Thermal Desorption									●	
On-site Backfill							●	●	●	●
Off-site RCRA Chemical Landfill					●					

1. Feasibility of these alternatives is contingent upon specified alternative being selected for remediation of DDTR – contaminated sediments in Area A downstream.
2. The condensed/extracted PCB and spent carbon will be transported offsite for incineration if an afterburner is not used.
3. Off-site low temperature thermal desorption or off-site reuse (asphalt or cement) will be reconsidered if a permitted off-site facility is located.
4. Shading indicates alternatives to be evaluated during the focused feasibility study.

22-Apr-93 PCBALT2.WK3

TABLE 5-3
AREA A DOWNSTREAM/OBDA – SEDIMENTS
DEVELOPMENT OF ALTERNATIVES

RETAINED PROCESS OPTIONS	ALTERNATIVES									
	LIMITED ACTION		CONTAINMENT	OFF-SITE[2]		ON-SITE ALTERNATIVES				
SOIL/SEDIMENT	No Action	Access Restriction	Cap	Incineration	RCRA Landfill	In situ Stabilization	Above-ground Stabilization	Incineration	Low Temperature Thermal Desorption	Solvent Extraction
	2D-1	2D-2	2D-3	2D-4	2D-5	2D-6	2D-7	2D-8	2D-9	2D-10
No Action	•									
Access Restriction		•	•							
Horizontal Barrier – Cap			•							
Site Grading & Stormwater Management		•	•			•[3]				
Excavation – Backhoe										
Dredging – Hydraulic				•	•		•	•	•	•
In situ Stabilization						•				
Dewatering				•	•		•	•	•	•
Solvent Extraction										•
Stabilization							•			
On-site Incineration								•		
Off-site Incineration				•					•[1]	•[1]
On-site Low Temp. Thermal Desorption									•	
On-site Backfill							•	•	•	•
Off-site RCRA Chemical Landfill					•					

1. The condensed/extracted DDT and spent carbon will be transported off-site for incineration if an afterburner is not used.
2. Off-site low temperature thermal desorption or off-site reuse (asphalt or cement) will be reconsidered if a permitted off-site facility is located.
3. Standing water will be removed and treated on-site.
4. Shading indicates alternatives to be evaluated during the focused feasibility study.

22-Apr-93 DDTALT.WK3

TABLE 5-4
DRMO - PCB-CONTAMINATED SOILS
DEVELOPMENT OF ALTERNATIVES

RETAINED PROCESS OPTIONS	ALTERNATIVES									
SOIL/SEDIMENT	LIMITED ACTION		CONTAINMENT	OFF-SITE ALTERNATIVES[3]		ON-SITE ALTERNATIVES				
	No Action	Access Restriction	Surface Cap	Incineration	RCRA Landfill	In situ Stabilization	Above-ground Stabilization	Incineration[1]	Low Temperature Thermal Desorption[1]	Solvent Extraction[1]
	6PCB-1	6PCB-2	6PCB-3	6PCB-4	6PCB-5	6PCB-6	6PCB-7	6PCB-8	6PCB-9	6PCB-10
No Action	●									
Access Restriction		●	●							
Horizontal Barrier - Cap			●							
Site Grading & Stormwater Management			●							
Excavation - Backhoe				●	●		●	●	●	●
In situ Stabilization						●				
Solvent Extraction										●
Stabilization							●			
On-site Incineration								●		
Off-site Incineration (residues)				●					●[2]	●[2]
On-site Low Temp. Thermal Desorption									●	
On-site Backfill							●	●	●	●
Off-site RCRA Chemical Landfill					●					

1. Feasibility of these alternatives is contingent upon specified alternative being selected for remediation of DDTR-contaminated sediments in Area A downstream.
2. The condensed/extracted PCB and spent carbon will be transported off-site for incineration.
3. Off-site low temperature thermal desorption or off-site reuse (asphalt or cement) will be reconsidered if a permitted off-site facility is located.
4. Shading indicates alternatives to be evaluated during the focused feasibility study.

22-Apr-93 PCBALT.WK3

TABLE 5-5
DRMO - LEAD-CONTAMINATED SOILS
DEVELOPMENT OF ALTERNATIVES

RETAINED PROCESS OPTIONS	ALTERNATIVES						
	LIMITED ACTION		CONTAINMENT	OFF-SITE ALTERNATIVE	ON-SITE ALTERNATIVES		
SOIL/SEDIMENT	No Action	Access Restriction	Temporary Cap	RCRA Landfill	In situ Stabilization	Above-ground Stabilization	Soil Washing
	6LEAD-1	6LEAD-2	6LEAD-3	6LEAD-4	6LEAD-5	6LEAD-6	6LEAD-7
No Action	•						
Access Restriction		•	•				
Horizontal Barrier - Cap			•				
Surface Water Control			•				
Excavation - Backhoe				•		•	•
In situ Stabilization					•		
Soil Washing							•
Stabilization				•[1]		•	•[1]
On-site Backfill						•	•[2]
Off-site RCRA Chemical Landfill				•			•[2]

1. Optional, depends on TCLP analysis. Off-site stabilization can be performed at the selected off-site RCRA landfill.
2. Fine-grained (contaminated) soils separated by the soil washing process will be landfilled, while the larger soil particles will be backfilled.
3. Shading indicates alternatives to be evaluated during the focused feasibility study.

22-Apr-93 PBALT.WK3

TABLE 5-6
DRMO - VOC-CONTAMINATED SOILS
DEVELOPMENT OF ALTERNATIVES

RETAINED PROCESS OPTIONS	ALTERNATIVES										
SOIL/SEDIMENT	LIMITED ACTION		CONTAINMENT	OFF-SITE[4]		ON-SITE ALTERNATIVES					
	No Action	Access Restriction	Impermeable Cap	Incineration	RCRA Landfill	Above-ground Stabilization	Above-ground Landfarming	Incineration[1]	Low Temperature Thermal Desorption[1]	Air Stripping	Solvent Extraction[1]
	6VOC-1	6VOC-2	6VOC-3	6VOC-4	6VOC-5	6VOC-6	6VOC-7	6VOC-8	6VOC-9	6VOC-10	6VOC-11
No Action	●										
Access Restriction		●	●								
Horizontal Barrier - Cap			●								
Site Grading & Stormwater Management			●								
Excavation - Backhoe				●	●		●	●	●	●	●
In situ Stabilization						●					
Air Stripping (above-ground)					●					●	
Solvent Extraction											●
Stabilization							●	●[2]	●[2]	●[2]	●[2]
On-site Incineration								●			
Off-site Incineration (residues)				●					●[3]		●[3]
On-site Low Temperature Thermal Desorption									●		
On-site Backfill							●	●	●	●	●
Off-site RCRA Chemical Landfill					●						

1. Feasibility of this alternative is contingent upon specified alternative being selected for remediation of DDTR - contaminated sediments in Area A downstream.
2. Stabilization may be required due to high TCLP lead levels.
3. The condensed/extracted VOC's and spent carbon will be transported off-site for incineration.
4. Off-site low temperature thermal desorption or off-site reuse (asphalt or cement) will be reconsideered if a permitted off-site facility is located.
5. Shading indicates alternatives to be evaluated during the focused feasibility study.

22-Apr-93 VOCALT.WK3

- treatment alternatives
- excavation alternatives
- disposal alternatives
- hot spot removal/treatment
- containment alternatives (site grading, surface drainage, capping, vegetative cover, fencing, deed restrictions, combination of the above)

- Identification and Screening of Technologies

- Technology Process-options Evaluation (effectiveness, implementability, cost evaluation)

- Assemble Alternatives/Screening

Detailed Evaluation of Alternatives

- Redefinition of Alternatives

- Individual Analysis of Alternatives Against Evaluation Criteria

  - overall protection of human health and the environment
  - compliance with ARARs
  - long-term effectiveness and performance (magnitude of residual risk, adequacy and reliability of controls)

- Reduction of Toxicity, Mobility on Volume through Treatment

- Short-Term Effectiveness

Implementability

- Construction and Operation
- Reliability
- Ease of Undertaking Additional Remedial Action (if necessary)
- Monitoring Consideration
- Administrative Feasibility
- Availability of Services and Materials

Cost

- Capital Costs (direct and indirect)
- Annual O&M Costs

Concurrent with the FFS, the proposed plan will be prepared. Following completion of the FFS and proposed plan, final concurrence from EPA/CTDEP will be obtained for the FFS,

proposed plan, and target remediation levels.

The next steps involve the selection of remedy. At the present time, 4 proposed plans and, therefore, subsequently 4 RODs will be prepared as follows:

- **Area A Landfill/Concrete Pad — Soils:** Removal of PCB-contaminated soils and capping of the landfill.
- **Area A Downstream/OBDA — Sediments:** Dredging of DDT-contaminated sediments and on-site thermal treatment.
- **DRMO — Soils:** Removal of contaminated soils (VOCs, PCBs, and lead) and temporary capping of the site.
- **Spent Acid Storage and Disposal Area — Soils:** Removal of lead contaminated soils followed by stabilization (on- or off-site) and off-site landfill or on-site backfill and installation of a temporary cap.

Depending upon the findings of the FFS, the proposed interim remedial action may be revised.

Public participation will consist of a public notice, an informal public hearing, and the public comment period. The interim remedial actions will probably go through the public process in two groups; one consisting of the removal and capping alternatives, and the other for alternatives that include thermal treatment. Although the interim remedial actions are grouped in this way, they will still be done generally concurrently; e.g., informal hearings for each group may be performed on the same or next day. A draft ROD and responsiveness summary will then be prepared for review by EPA, DEP, TRC, and the public. The ROD will then be signed after full consideration of all comments received.

Concurrently with the above tasks for preparation of the FFS and the selection of remedy, design plans and specifications will be prepared. The design work will start after the Navy has reviewed the draft FFS and will be completed shortly after the ROD is signed.

5.2 Interim Remedial Action: Spent Acid Storage and Disposal Area — Soils

This interim remedial action as currently proposed will consist of removal of lead-

contaminated soils followed by on-site or off-site stabilization and on-site or off-site disposal.

5.2.1 Data Collection Requirements

A Step I investigation has been completed at this site. A draft work plan has been developed to perform a Step II RI/FS investigation (Phase II Work Plan, March 1993, Atlantic). Selected aspects of this work plan relevant to the interim remedial action will be implemented. These aspects are highlighted in Table 5-7 and Figure 5-2 from the work plan. In general, these data collection requirements will consist of drilling of up to 11 borings, field screening for lead by X-ray fluorescence (XRF), and laboratory analysis of up to 11 samples.

5.2.2 Engineering Consideration

The only contaminant of concern detected to date at this site is lead. Because lead is an inorganic element, few treatment technologies are available, and none result in destruction of the lead. As a result, ultimate selection of the remedial action will be based on the effectiveness of the proposed stabilization, overall cost-effectiveness, and the desire to implement a permanent remedy that will not require post-closure care and periodic reviews of the remedy.

Key design consideration for stabilization are:

- solidification mixing ratios;
- curring time;
- volume increases of solidified product; and
- strength and leachability of treated soil.

Treatability studies will be performed to determine these parameters. A qualified solidification vendor/contractor will be selected to assess these parameters.

For the excavation of the contaminated soils, key design factors include:

- depth of excavation;
- depth of water table; and
- slope stability of soils.

The boring/testing program proposed will be able to determine these parameters.

TABLE 5-7
FIELD SAMPLING PLAN FOR SPENT ACID STORAGE AND DISPOSAL AREA SOILS

Sample Location	Well Type/ Proposed Depth (ft)	Rationale	Sample Designations	Sample Type		Analysis						
				Soil	Water	VOC	SVOC	Inor-ganics	Pesti-cides	PCB	TCLP	Engi-neering
Monitoring Wells												
15MW1S	Overburden/20±' (advance to bedrock)	Provide chemical data for shallow and deep ground water and subsurface soils in source area, immediately downgradient of the former acid storage tank; determine depth to bedrock.	15MW1S (depth)	●		●	●	●	●	●	●	●
15MW1D	Bedrock/50±'		15GW1S		●	●	●	●	●	●		●
15MW2S	Overburden/20±'	Monitor quality of shallow ground water and test for soil contamination upgradient of the former acid storage tank.	15MW2S (depth)	●		●	●	●	●	●		
			15GW2S		●	●	●	●	●	●		
15MW3S	Overburden/20±'	Monitor quality of shallow ground water and subsurface soils downgradient of the former acid storage tank.	15MW3S (depth)	●		●	●	●	●	●		
			15GW3S		●	●	●	●	●	●		
15MW4S	Overburden/20±' (advance to bedrock)	Monitor quality of shallow ground water and subsurface soils downgradient of the former acid storage tank; determine depth to bedrock.	15MW4S (depth)	●		●	●	●	●	●		
			15GW4S		●	●	●	●	●	●		
Test Borings												
15TB4	NA/15±'	Determine stratigraphy/nature of fill immediately north of the former acid storage tank. Further determine nature, extent and degree of soil contamination.	15TB4 (depth)	●		●	●	●	●	●	●	●
15TB5	NA/15±'	Further define extent of subsurface soil contamination (within 35' southeast of former acid tank).	15TB5 (depth)	●		●	●	●	●	●	●	
15TB6	NA/15±'	Further define extent of subsurface soil contamination (within 35' west of former acid tank).	15TB6 (depth)	●		●	●	●	●	●	●	
15TB7	NA/15±'	Further define extent of subsurface soil contamination (within 50' south of former acid tank).	15TB7 (depth)	●		●	●	●	●	●		
15TB8	NA/15±'	Further define extent of subsurface soil contamination (within 50' northwest of former acid tank).	15TB8 (depth)	●		●	●	●	●	●		
15TB9	NA/15±'	Determine nature and extent of subsurface soil contamination within 50' east of former acid tank.	15TB9 (depth)	●		●	●	●	●	●		
15TB10-15TB14	NA/15±'	Optional borings to be installed to determine extent of soil contamination, if required, based on the field screening results.	15TB10 (depth)-15TB14 (depth)	● (5)		● (5)	● (5)	● (5)	● (5)	● (5)	●	●
			Subtotal Soils	11	0	11	11	11	11	11	4	2
			Subtotal Water[2]	0	4	4	4	4	4	4	0	1

TABLE 5-7 (continued)
FIELD SAMPLING PLAN SPENT ACID STORAGE AND DISPOSAL AREA SOILS

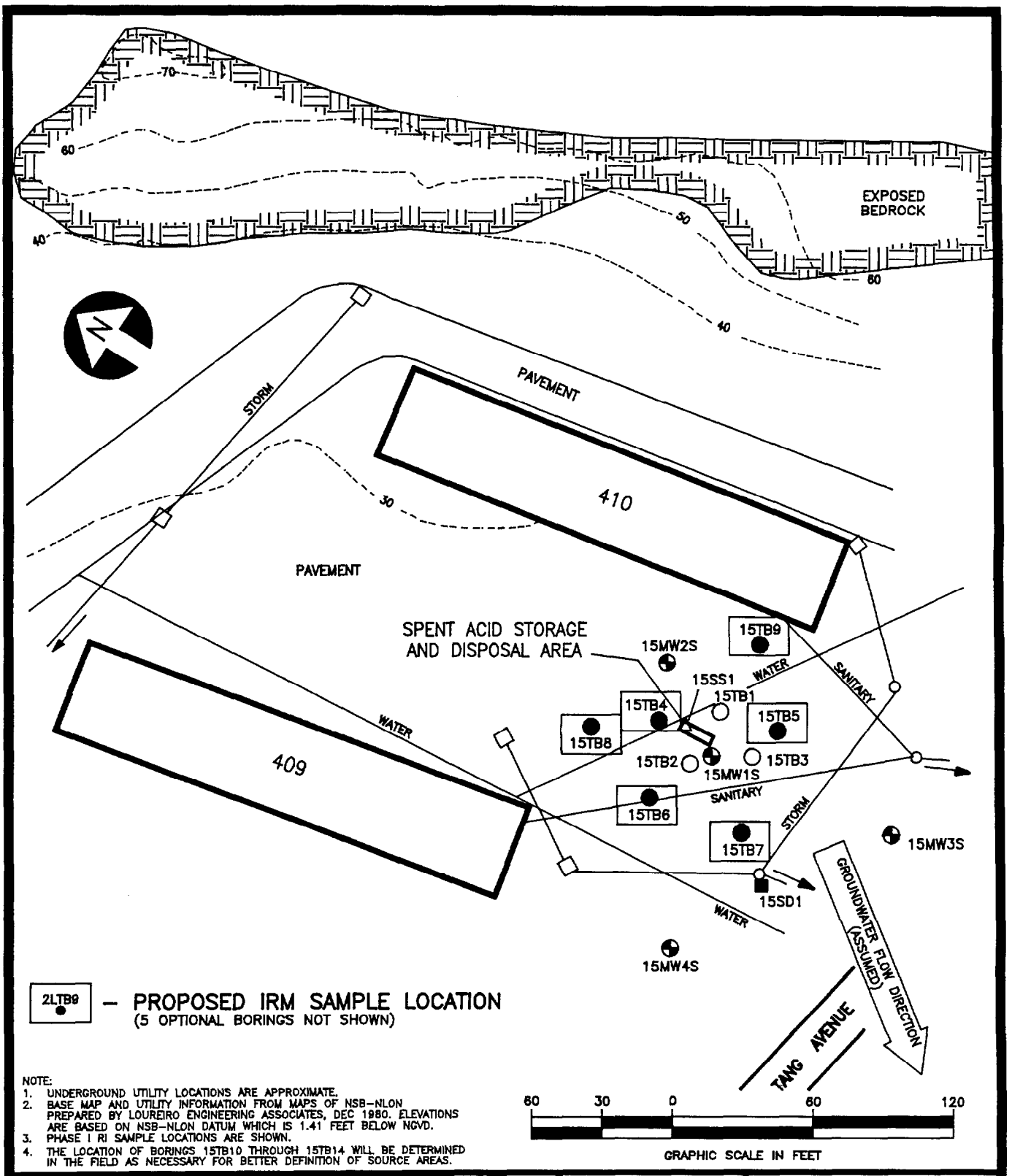
Sample Location	Well Type/ Proposed Depth (ft)	Rationale	Sample Designations	Sample Type		Analysis							
				Soil	Water	VOC	SVOC	Inor-ganics	Pesti-cides	PCB	TCLP	Engi-neering
Sediment Sampling												
i5SD1	-	Provide chemical data for sediment from downgradient, stormwater location to determine whether site contaminants are being transported off-site by these mechanisms.	15SD1	•		•	•	•	•	•		•
		Subtotal Sediments		1	0	1	1	1	1	1	0	1
		Total Soils		**16**	**0**	**16**	**16**	**16**	**16**	**16**	**4[1]**	**3**
		Total Water[3]		**0**	**8**	**8**	**8**	**8**	**8**	**8**	**0**	**2**

PROPOSED

10 Primary test borings (including well borings);
5 Supplemental test borings;
4 Wells.

Notes:

1 Four TCLP inorganic analyses will be conducted based on field screening for lead; one of the four will be selected for full TCLP analysis.
2 Total includes 1 round of sampling only.
3 Total includes 2 rounds of sampling.
4 Shaded sections indicate interim remediate actions field sampling locations.


EXPOSED BEDROCK
70
60
50
40
30
PAVEMENT
410
409
STORM
WATER
SANITARY
SPENT ACID STORAGE AND DISPOSAL AREA
15MW2S
15SS1
15TB1
15TB9
15TB4
15TB5
15TB8
15TB2
15MW1S
15TB3
15TB6
15TB7
15SD1
15MW3S
15MW4S
GROUNDWATER FLOW DIRECTION (ASSUMED)
TANG AVENUE
2LTB9 – PROPOSED IRM SAMPLE LOCATION
(5 OPTIONAL BORINGS NOT SHOWN)
NOTE:
1. UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE.
2. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON PREPARED BY LOUREIRO ENGINEERING ASSOCIATES, DEC 1980. ELEVATIONS ARE BASED ON NSB-NLON DATUM WHICH IS 1.41 FEET BELOW NGVD.
3. PHASE I RI SAMPLE LOCATIONS ARE SHOWN.
4. THE LOCATION OF BORINGS 15TB10 THROUGH 15TB14 WILL BE DETERMINED IN THE FIELD AS NECESSARY FOR BETTER DEFINITION OF SOURCE AREAS.
60 30 0 60 120
GRAPHIC SCALE IN FEET
INSTALLATION RESTORATION STUDY
NAVAL SUBMARINE BASE – NEW LONDON
GROTON, CT
LEGEND
EXIST. PROP.
15MW1 15MW1 MONITORING WELL
15TB1 15TB1 TEST BORING
15SD1 15SD1 SEDIMENT SAMPLE
15SS1 15SS1 SURFACE SOIL SAMPLE
15SW1 15SW1 SURFACE WATER SAMPLE
10 EXIST CONTOUR
123 BUILDING No.
WATERCOURSE
MANHOLE
CATCH BASIN
FIGURE 5-2
FIELD SAMPLING PLAN
SPENT ACID STORAGE
AND DISPOSAL AREA
ATLANTIC ENVIRONMENTAL SERVICES, INC.

5.3 Interim Remedial Action — Area A Landfill/Concrete Pad - Soils

This interim remedial action will consist of:

- Removal of PCB-contaminated soils from around the concrete pad and either off-site disposal or on-site thermal treatment.
- Containment of the landfill, which will consist of capping, control of surface water, and possibly the lowering of groundwater below the waste material.

5.3.1 Data Collection Requirements

A Step II RI/FS investigation has been completed at this site. A draft work plan has been developed to fill any data gaps to support preparation of a FS and remedial design (Phase II Work Plan, March 1993, Atlantic). Selected aspects of this work plan relevant to the interim remedial action will be implemented. These aspects are highlighted in Table 5-8 and Figure 5-3 from the work plan. In general, these data collection requirements will consist of drilling of up to 25 borings, field screening with GC for PCB, and laboratory analysis of up to 13 soil samples.

In addition, the following work more specific to design needs will be performed:

- a land survey;
- a methane survey; and
- analysis of a selected number of samples for geotechnical parameters.

5.3.2 Engineering Consideration for Implementation

The decision about disposing of PCB soils either on-site or off-site will be made by considering the total volume present and the compatibility of treating PCBs in a thermal desorption unit selected to treat DDT-contaminated soils. DDT and PCBs have similar boiling points; however, PCBs require higher temperatures than DDT to prevent the potential formation of dioxins, and 99.9999% destruction removal efficiency is required for PCBs.

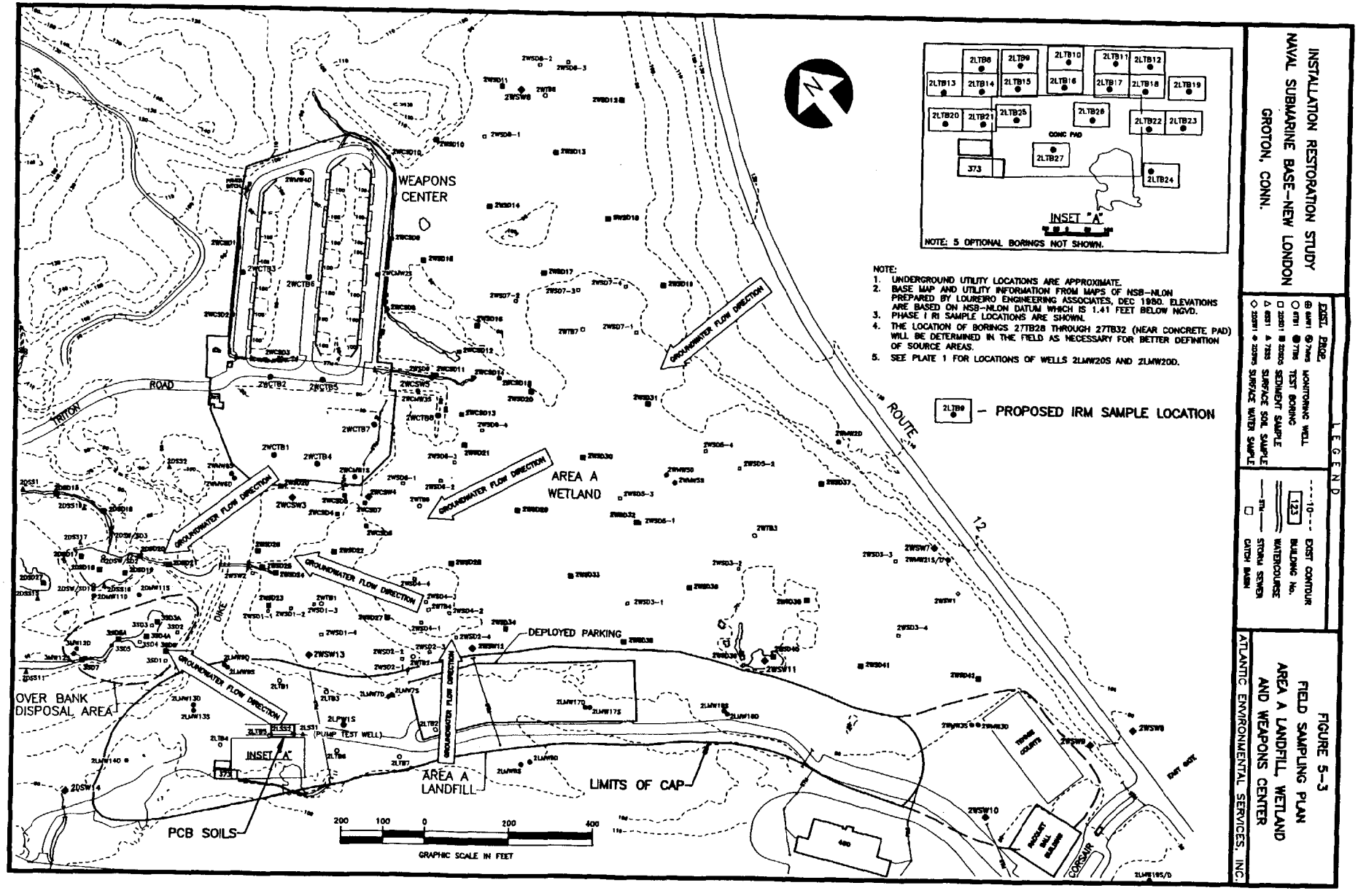
The primary ARAR that governs capping of the landfill is federal and state solid waste

TABLE 5-8
FIELD SAMPLING PLAN FOR AREA A LANDFILL/CONCRETE PAD SOILS

Sample Location	Well Type/ Proposed Depth (ft)	Rationale	Sample Designations	Sample Type			Analysis								
				Soil (No. of Samples)	Sediment (No. of Samples)	Water (No. of Samples)	VOC	SVOC	Inor-ganics	Pesti-cides	PCB	TCLP	Dioxin	RAD	Engi-[4] neering
Monitoring Wells															
26 Existing wells	Existing	Sample all existing wells. Only well 2LMW18S analyzed for PCBs to confirm previous analysis.	Existing			● (26)	● (26)	● (26)	● (26)		● (1)				
2LMW7S 2LMW9D 2LMW13D 2LMW18S 2WMW3D 2WMW4D 2DMW11S 2DMW11D 3MW12S 3MW12D	Bedrock and overburden	Existing wells where radiological parameters exceeded screening levels.	2LGW7S 2LGW9D 2LGW13D 2LGW18S 2WGW3D 2WGW4D 2DGW11S 2DGW11D 3GW12S 3GW12D			● (10)								● (10)	
2LMW19D[1] 2LMW19S 2LMW20D[1] 2LMW20S	Bedrock/100' below bedrock surface; Overburden/20±'	Further assessment of the ground water flow directions between the southeast portion of Area A landfill and homes served by private wells near NSB-NLON east gate; evaluate ground water quality.	2LGW19D 2LGW19S 2LGW20D 2LGW20S			● (4)	● (4)	● (4)	● (4)						
2WMW21S 2WMW21D[1] 2WMW22D[1] 2DMW23D	Bedrock/100' below bedrock surface; Overburden/20±'	Further assessments of the ground water flow directions between Area A wetland and homes serviced by private wells near the east and north NSB-NLON boundaries. Evaluate ground water quality potentially upgradient of affected site areas.	2WGW21S 2WGW21D 2WGW22D 2DGW23D			● (4)	● (4)	● (4)	● (4)						
2WMW5D	Bedrock/20' (minimum penetration of bedrock);	Better define bedrock ground water flow direction within Area A wetland; evaluate ground water quality.	2WGW5D			● (1)	● (1)	● (1)	● (1)						
2DMW24D 2DMW24S 2DMW25D 2DMW25S 2DMW26D 2DMW26S 2DMW27D 2DMW27S 2DMW28D 2DMW28S 2DMW29S 2DMW30S	Bedrock/20' (minimum penetration of bedrock) Overburden/20±'	Further evaluate extent of ground water contamination downgradient of Area A landfill; further evaluate ground water quality/hydrology near North Lake.	2DGW24D 2DGW24S 2DGW25D 2DGW25S 2DGW26D 2DGW26S 2DGW27D 2DGW27S 2DGW28D 2DGW28S 2DGW29S 2DGW30S			● (12)	● (12)	● (12)	● (12)						

TABLE 5-8
FIELD SAMPLING PLAN FOR AREA A LANDFILL/CONCRETE PAD SOILS

Sample Location	Well Type/ Proposed Depth (ft)	Rationale	Sample Designations	Sample Type			Analysis								
				Soil (No. of Samples)	Sediment (No. of Samples)	Water (No. of Samples)	VOC	SVOC	Inor-ganics	Pesti-cides	PCB	TCLP	Dioxin	RAD	Engi-[4] neering
2WCMW1S 2WCMW2S 2WCMW3S	Overburden/20±'	Define ground water flow directions and hydraulic gradients near weapons center; evaluate ground water quality.	2WCGW1S 2WCGW2S 2WCGW3S			• (3)	• (3)	• (3)	• (3)						
2WCMW1S 2WCMW2S 2WCMW3S	Overburden/20±'	Provide chemical data for soils collected from the weapons center.	2WCMW1S (depth) 2WCMW2S (depth) 2WCMW3S (depth)	• (3)			• (3)	• (3)	• (3)						• (1)
2LPW1S	Overburden pump test/ base of saturated thickness	Located in an area considered to represent the average hydrogeologic conditions of Area A landfill.	2LPW1S			• (3)	•[1] (7)	• (3)	• (3)		• (3)				• (3)
			Test Borings												
2LTB8 through 2LTB27	NA/15'	Define lateral and vertical extent and degree of contamination identified around Area A concrete pad. Ten soil samples will be collected for analysis based on GC field screening for PCB and organic vapor analyzer screening for VOCs.	2LTB8 (depth) through 2LTB27 (depth)	• (10)			• (10)	• (10)	• (10)	• (10)	• (10)	• (2)			• (2)
2LTB13 2LTB23	NA/15'	Located in landfill area where dibenzofuran and ash have been detected.	2LTB13 (depth) 2LTB23 (depth)	• (2)									• (2)		
2LTB28 through 2LTB32	NA/15'	Optional borings at Area A concrete pad to be installed to determine the lateral extent of soil contamination (if contamination is detected during field screening). Three soil samples will be collected for analysis based on GC field screening for PCB and total organic vapor analyzer screening for VOCs.	2LTB28 (depth) through 2LTB32 (depth)	• (3)			• (3)	• (3)	• (3)	• (3)	• (3)				
2LC1 through 2LC4	NA/15'	Core samples of the pad to determine if it is contaminated.	2LC1 through 2LC4	• (4)							• (4)				
2WCTB1 2WCTB2 2WCTB3 2WCTB4 2WCTB5 2WCTB6 2WCTB7 2WCTB8	NA/15'	Provide chemical data for soils collected from the weapons center area.	2WCTB1 (depth) 2WCTB2 (depth) 2WCTB3 (depth) 2WCTB4 (depth) 2WCTB5 (depth) 2WCTB6 (depth) 2WCTB7 (depth) 2WCTB8 (depth)	• (8)			• (8)	• (8)	• (8)	• (4)	• (4)	• (1)			• (1)
2DTB1	NA/10'	Optional boring to be installed if soil gas survey indicates presence of VOCs in vicinity.	2DTB1 (depth)	•			•								
			Subtotal Soil Samples	17			13	13	13	13	17	2	2	0	2
			Subtotal Groundwater Sampling[2]			63	57	53	53	0	4	0	0	10	3


INSTALLATION RESTORATION STUDY
NAVAL SUBMARINE BASE-NEW LONDON
GROTON, CONN.
FIGURE 5-3
FIELD SAMPLING PLAN
AREA A LANDFILL, WETLAND
AND WEAPONS CENTER
ATLANTIC ENVIRONMENTAL SERVICES, INC.
LEGEND
EXIST. PROP.
MONITORING WELL
TEST BORING
SEDIMENT SAMPLE
SURFACE SOIL SAMPLE
SURFACE WATER SAMPLE
EXIST CONTOUR
BUILDING No.
WATERCOURSE
STORM SEWER
CATCH BASIN
INSET "A"
NOTE: 5 OPTIONAL BORINGS NOT SHOWN.
CONC PAD
NOTE:
1. UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE.
2. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON PREPARED BY LOUREIRO ENGINEERING ASSOCIATES, DEC 1980. ELEVATIONS ARE BASED ON NSB-NLON DATUM WHICH IS 1.41 FEET BELOW NGVD.
3. PHASE I RI SAMPLE LOCATIONS ARE SHOWN.
4. THE LOCATION OF BORINGS 27TB28 THROUGH 27TB32 (NEAR CONCRETE PAD) WILL BE DETERMINED IN THE FIELD AS NECESSARY FOR BETTER DEFINITION OF SOURCE AREAS.
5. SEE PLATE 1 FOR LOCATIONS OF WELLS 2LMW20S AND 2LMW20D.
PROPOSED IRM SAMPLE LOCATION
WEAPONS CENTER
AREA A WETLAND
GROUNDWATER FLOW DIRECTION
DEPLOYED PARKING
OVER BANK DISPOSAL AREA
AREA A LANDFILL
LIMITS OF CAP
PCB SOILS
TRITON ROAD
ROUTE 12
DIKE
(PUMP TEST WELL)
TENNIS COURTS
HAZMAT MAL. BUILDING
CORSAIR
EAST GATE
GRAPHIC SCALE IN FEET

management regulations. As such, the cap will be designed at a minimum according to the following standards:

- **Infiltration Layer:** A minimum of 18 inches of earthen material that has a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-5} cm/sec, whichever is less.

- **Erosion Layer:** A minimum of 6 inches earthen material, capable of sustaining native plant growth.

Although the above definition is the minimal design requirements, the cap may include a drainage layer and impermeable liner below the cover described above. The final configuration will be selected after the FFS is completed.

Design considerations for the cap include:

- erosion potential of cover soils;
- slope stability;
- promotion of run-off;
- prevention of run-on;
- settlement of cap;
- permeability;
- venting of gases;
- support of vegetation;
- suitability for future site use; and
- crack resistance for any clay layers.

The data proposed to be gathered during the Phase II investigations is suitable to address the design consideration above with the following additions:

- A methane survey will be performed to determine if gas migration is a design concern. The survey will measure methane in soil gas at locations on an approximate 100-foot grid (30 to 40 locations).

- A land survey will be performed to facilitate site grading.

- Three undisturbed samples of the dredge spoils underlying the landfill contents will be collected with a Shelby tube and one-dimensional consolidation tests will be performed. The borings for these samples will be located in the center of the landfill and at the eastern and western ends in order to obtain representative samples.

In addition to the above concerns, the geophysical survey detected some magnetic anomalies that have not been defined. Before construction of the cap, test pits will be dug in these areas, and any liquids or hazardous materials encountered will be removed and properly disposed. This work will be incorporated into the remedial design.

Design considerations for thermal treatment are discussed in Section 5.4 below and for excavation in Section 5.2 above.

5.4 Interim Remedial Actions — Area A Downstream/OBDA - Sediments

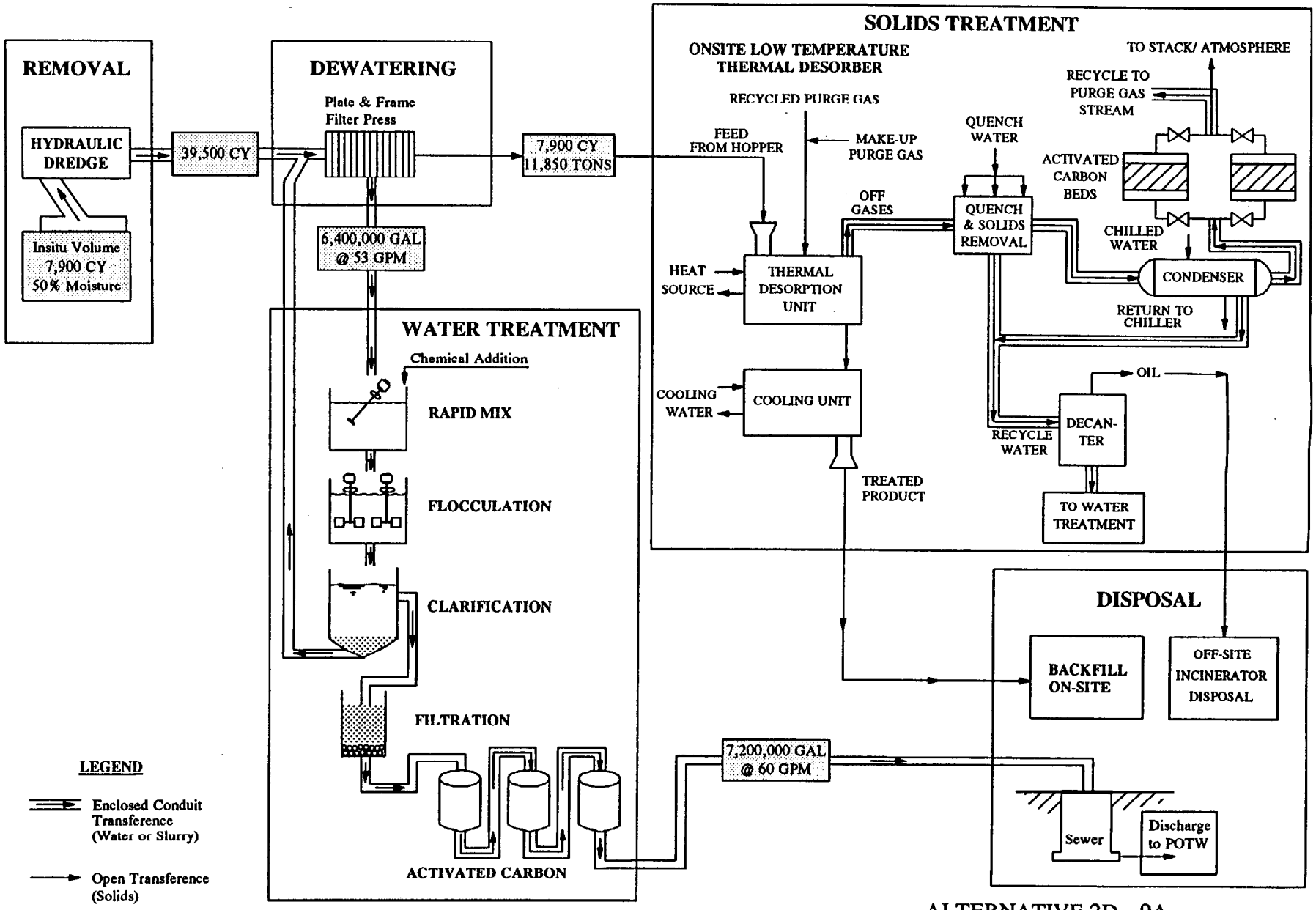
This interim remedial actions will consist of dredging and dewatering DDT-contaminated sediments, followed by on-site thermal treatment along with associated wastewater treatment. Schematics of this interim remedial action are shown in Figures 5-4 and 5-5. Quantities shown are preliminary and subject to change pending further data.

5.4.1 Data Collection Requirements

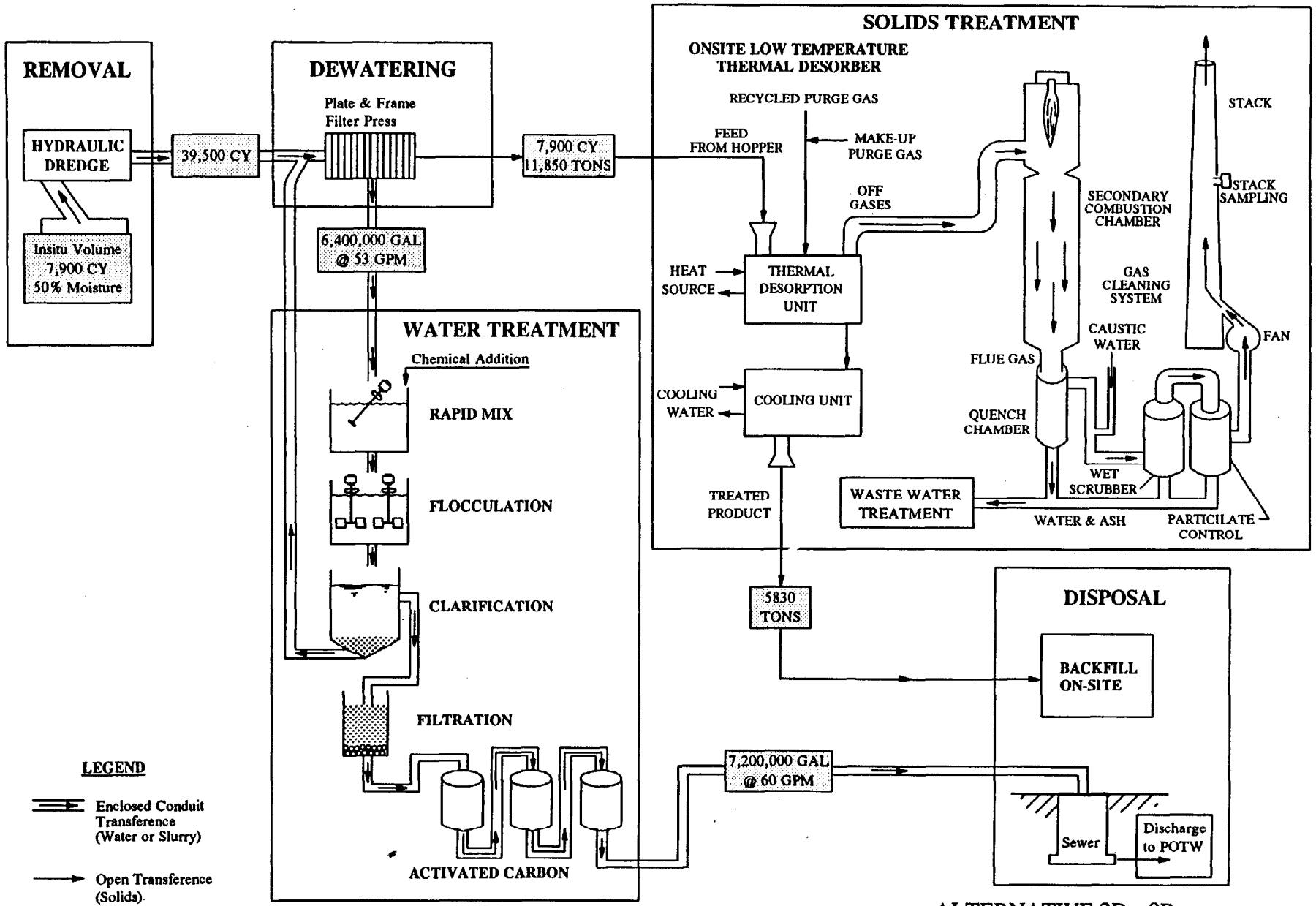
A Step II RI/FS investigation has been completed at this site. A draft work plan has been developed to fill any data gaps to support preparation of a FS and remedial design (Phase II Work Plan, March 1993, Atlantic). Selected aspects of this work plan relevant to the interim remedial action will be implemented. These aspects are highlighted in Table 5-9 and 5-10 and Figure 5-6 from the work plan. In general these data collection requirements will consist of collection of sediment samples at 24 locations and surface soils at 23 locations, field screening for DDTR with a GC, qualitative soil invertebrate and fish surveys, quantitative bioassay and tissue analysis, and a wetlands survey in Area A (100 acres). Up to 21 sediment or soil samples will be analyzed in an off-site laboratory, and up to 43 tissue samples will be analyzed for pesticides in an off-site laboratory.

5.4.2 Engineering Considerations for Implementation

This interim remedial action includes several process options, each with its own design



ALTERNATIVE 2D - 9A
LOW TEMPERATURE THERMAL DESORPTION
FIGURE 5-4



ALTERNATIVE 2D - 9B
LOW TEMPERATURE THERMAL DESORPTION
FIGURE 5-5

TABLE 5-9
FIELD SAMPLING PLAN FOR AREA A DOWNSTREAM/OBDA SEDIMENTS

Sample Location	Well Type/ Proposed Depth (ft)	Rationale	Sample Designations	Sample Type			Analysis								
				Soil (No. of Samples)	Sediment (No. of Samples)	Water (No. of Samples)	VOC	SVOC	Inor-ganics	Pesti-cides	PCB	TCLP	Dioxin	RAD	Engi-[4] neering
Sediment Sampling															
2WSD10 through 2WSD42	0-1' Below sediment surface	Provide additional pesticide analytical data in Area A wetland to confirm that elevated levels of pesticides are not present. Ten soil samples will be collected for analysis based on GC field screening for pesticides.	2WSD10 (0-1') through 2WSD42 (0-1')		• (6)					• (6)		• (1)			• (1)
2WSD23 through 2WSD26			2WSD23 through 2WSD26		• (4)					• (4)					
2DSD14 through 2DSD29 3SD3A 3SD4A 3SD5A 3SD7	0' to base of sediments	Define lateral and vertical extent and degree of pesticides in Area A downstream pond sediments. Ten soil samples will be collected for analysis based on GC field screening for pesticides. Full CLP analysis to be performed on samples 2DSD24 through 2DSD29.	2DSD14 (depth) through 2DSD29 (depth) 3SD3A 3SD4A 3SD5A 3SD7		• (10)		• (6)	• (6)	• (6)	• (10)	• (6)	• (1)			• (5)
2DSD30	0-1'	At ground water seep into North Lake.	2DSD30		• (1)		• (1)	• (1)	• (1)	• (1)	• (1)				
2DSD31	0-1'	At ground water seep into North Lake.	2DSD31		• (1)		• (1)	• (1)	• (1)	• (1)	• (1)				
2DSD32	0-1'	At ground water seep into North Lake.	2DSD32		• (1)		• (1)	• (1)	• (1)	• (1)	• (1)				
2WCSD1 through 2WCSD15	0-1'	Provide chemical data for sediments collected from areas of surface water flow from the weapons center; samples for VOC, PCB, and pesticide analysis selected at culvert outlets and upgradient locations within weapons center.	2WCSD1 through 2WCSD15		• (15)		• (6)	• (15)	• (15)	• (6)	• (6)	• (1)			• (2)
2WCSD11	0-1'	Located in area where dibenzofurans have been detected.	2WCSD11		• (1)								• (1)		
3SD6	0' to base of sediments	Located in area where dibenzofurans have been detected.	3SD6 (depth)		• (1)								• (1)		
		Subtotal Sediment Sampling		0	14	0	6	6	6	14	6	1	0	0	5
Surface Soil Sampling															
2DSS1 through 2DSS18	0-6" below grade	Provide chemical data for surficial soil samples from Area A downstream watercourse. Four surface soil samples will be collected for analysis based on GC field screening for pesticides.	2DSS1 (0-6") through 2DSS18 (0-6")	• (5)						• (5)					

TABLE 5-9 (continued)
FIELD SAMPLING PLAN FOR AREA A DOWNSTREAM/OBDA SEDIMENTS

Sample Location	Well Type/ Proposed Depth (ft)	Rationale	Sample Designations	Sample Type			Analysis								
				Soil (No. of Samples)	Sediment (No. of Samples)	Water (No. of Samples)	VOC	SVOC	Inor-ganics	Pesti-cides	PCB	TCLP	Dioxin	RAD	Engi-[4] neering
2DSS19 through 2DSS23	0-6" below grade	Optional sample locations to be installed (if required) to determine the lateral extent of soil contamination. If additional contamination is detected during field screening, two surface soil samples will be collected for analysis based on GC field screening for pesticides.	2DSS19 (0-6") through 2DSS23 (0-6")	● (2)						● (2)					
		Subtotal Surface Soil		7	0	0	0	0	0	7	0	0	0	0	0
		Surface Water													
2WSW1	Existing	Upgradient adjacent to wetland.	2WSW1			● (1)	● (1)		● (1)	● (1)					
2WSW2	Existing	At wetland outlet.	2WSW2			● (1)	● (1)	● (1)	● (1)	● (1)	● (1)				
2WCSW3		Upgradient of wetland at stormwater under drain outlet from weapons center.	2WCSW3			● (1)	● (1)	● (1)	● (1)	● (1)	● (1)				
2WCSW4		Upgradient of wetland at outlet from weapons center storm drain.	2WCSW4			● (1)	● (1)	● (1)	● (1)	● (1)	● (1)				
2WCSW5		Upgradient of wetland at outlet from weapons center storm drain.	2WCSW5			● (1)	● (1)	● (1)	● (1)	● (1)	● (1)				
2WSW6		Northeast section of wetland.	2WSW6			● (1)	● (1)		● (1)	● (1)					
2WSW7		Upgradient of wetlands in small drainage swale from Route 12.	2WSW7			● (1)	● (1)		● (1)	● (1)					
2WSW8 2WSW9		Upgradient of wetland at stormwater outlets from "urban areas".	2WSW8 2WSW9			● (2)	● (2)		● (2)	● (2)					
2WSW11		From pond in Area A wetland.	2WSW11			● (1)	● (1)		● (1)	● (1)					
2WSW10 2WSW12		Upgradient of wetland at stormwater outlet.	2WSW10 2WSW12			● (2)	● (2)		● (2)	● (2)					
4SW1 4SW2		Upgradient and downgradient, respectively of rubble fill at Bunker A-86 (tabulated under rubble fill at Bunker A-86).	4SW1 4SW2												
2DSW2-5 2DSW7 2DSW9-11	Existing	Surface water sample locations previously sampled during Phase I which were located to measure water quality at various locations in Area A downstream surface waters; 2DSW9 and 2DSW11 analyzed for SVOCs and PCBs.	2DSW2-5 2DSW7 2DSW9-11			● (8)	● (8)	● (2)	● (8)	● (8)	● (2)				

TABLE 5-9 (continued)
FIELD SAMPLING PLAN FOR AREA A DOWNSTREAM/OBDA SEDIMENTS

Sample Location	Well Type/ Proposed Depth (ft)	Rationale	Sample Designations	Sample Type			Analysis								
				Soil (No. of Samples)	Sediment (No. of Samples)	Water (No. of Samples)	VOC	SVOC	Inor-ganics	Pesti-cides	PCB	TCLP	Dioxin	RAD	Engi-[4] neering
2DSW14		Upgradient of Area A downstream at stormwater outfall.	2DSW14			• (1)	• (1)		• (1)	• (1)					
2DSW15		Upgradient of Area A downstream at outfall from torpedo shops.	2DSW15			• (1)	• (1)		• (1)	• (1)					
7SW1	Existing	At downgradient location in torpedo shops. (Tabulated under torpedo shops.)	7SW1												
2DSW30-32		At ground water seep into North Lake.	2DSW30-32			• (3)	• (1)	• (1)	• (1)	• (1)	•				
		Subtotal Surface Water				25	25	7	23	23	7	0	0	0	0
		Total Solids		**78**			**40**	**48**	**48**	**48**	**36**	**6**	**4**	**0**	**12**
		Total Water[3]				**151**	**139**	**113**	**129**	**23**	**15**	**0**	**0**	**20**	**6**

PROPOSED

56 Primary test borings (including well borings);
5 Supplemental test borings;
28 Wells:
- 11 Deep bedrock wells
- 17 Shallow overburden wells

Notes:

1. 100 foot penetration of bedrock to be representative of off-site residential well construction.
2. Total includes one sampling round.
3. Total includes two sampling rounds.
4. All sediment samples will be analyzed for grain size and TOC.
5. VOC samples should be collected at the following pump test intervals: start, 1 hour, 2 hours, 4 hours, 8 hours, 16 hours, and conclusion.
6. Shaded sections indicate interim remediate actions field sampling locations.

TABLE 5-10
AREA A SAMPLING PLAN

ECOLOGICAL SAMPLING						
Sample Type	Location	Sample Quantity				Analysis
		Tissue	Soil	Sediment	Bioassays	
Area A - Qualitative Survey						
Qualitative soil invertebrate survey	Wetland, Downstream, OBDA					Qualitative
Fish	Downstream ponds	●[1] (3)				Qualitative/Pesticides
Area A - Quantitative Survey						
Native earthworms and soils	Downstream	● (5)	● (5)[3]			Pesticides
In situ earthworm bioassays in soils/wetland sediment	Wetland, Downstream, OBDA				● (15-20)	---
Introduced earthworms from bioassays and soils/wetland sediment	Wetland, Downstream, OBDA	● (5)	● (5)[3]			Pesticides
Earthworm bioassays in pond sediment	Downstream watercourses			● (6)[3]	● (9)[2]	Pesticides (sediment only)
Introduced earthworms from bioassays	Downstream watercourses	● (3)[2]				Pesticides
Frogs	Downstream ponds and streams	● (9)				Pesticides
Benthic Invertebrates and reference location	Downstream ponds and streams	● (18)		● (18)[3]		Quantitative benthic analysis, reference area sediments for pesticides
	Total Tissue	**43**				

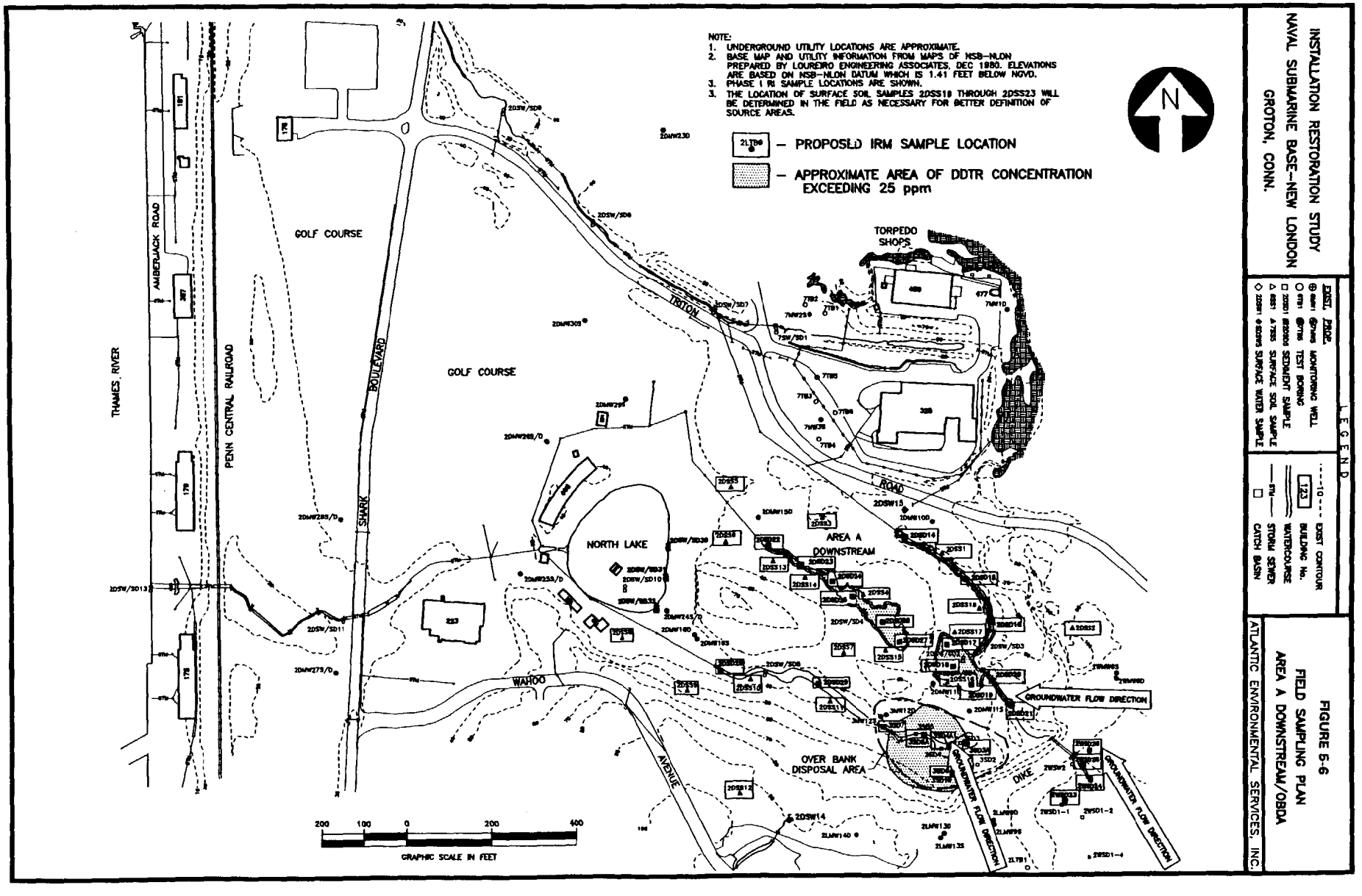
Notes:

[1] If larger fish are found, separate analysis will be conducted for tissue and liver for a total of six analyses.

[2] Includes three reference locations.

[3] Analysis included in Area A field sampling plan.

[4] Shaded sections indicate interim remediate actions field sampling locations.


INSTALLATION RESTORATION STUDY
NAVAL SUBMARINE BASE-NEW LONDON
GROTON, CONN.
LEGEND
EXIST. PROP.
MONITORING WELL
TEST BORING
SEDIMENT SAMPLE
SURFACE SOIL SAMPLE
SURFACE WATER SAMPLE
EXIST CONTOUR
BUILDING No.
WATERCOURSE
STORM SEWER
CATCH BASIN
FIGURE 5-6
FIELD SAMPLING PLAN
AREA A DOWNSTREAM/OBDA
ATLANTIC ENVIRONMENTAL SERVICES, INC.
NOTE:
1. UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE.
2. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON PREPARED BY LOUREIRO ENGINEERING ASSOCIATES, DEC 1980. ELEVATIONS ARE BASED ON NSB-NLON DATUM WHICH IS 1.41 FEET BELOW NGVD.
3. PHASE I RI SAMPLE LOCATIONS ARE SHOWN.
3. THE LOCATION OF SURFACE SOIL SAMPLES 2DSS18 THROUGH 2DSS23 WILL BE DETERMINED IN THE FIELD AS NECESSARY FOR BETTER DEFINITION OF SOURCE AREAS.
– PROPOSED IRM SAMPLE LOCATION
– APPROXIMATE AREA OF DDTR CONCENTRATION EXCEEDING 25 ppm
N
TORPEDO SHOPS
GOLF COURSE
GOLF COURSE
THAMES RIVER
AMBERJACK ROAD
PENN CENTRAL RAILROAD
SHARK BOULEVARD
TRITON ROAD
NORTH LAKE
AREA A DOWNSTREAM
WAHOO AVENUE
OVER BANK DISPOSAL AREA
DIKE
GROUNDWATER FLOW DIRECTION
GROUNDWATER FLOW DIRECTION
GROUNDWATER FLOW DIRECTION
200 100 0 200 400
GRAPHIC SCALE IN FEET

consideration. The main process option consists of:

- dredging of sediments;
- dewatering of sediments;
- thermal treatment of sediments; and
- treatment of dewatering waters by using carbon adsorption.

Design considerations for dredging include:

- pond configuration (depth, area);
- physical nature of sediments (grain size distributions, degree of compaction);
- pumping distance and elevation differential;
- type of aquatic vegetation;
- power source for dredge and pumps; and
- ease of access to ponds.

Design considerations for dewatering include:

- physical nature of dredge sediments (grain size distribution, moisture content, degree of compaction);
- moisture content requirements for the thermal process; and
- volume and characteristics of dewatered water.

Design considerations for thermal treatment include the following:

- moisture content of sediments after dewatering;
- organic hydrocarbon content of sediments;
- required destruction and removal efficiency;
- emission limits and controls for particulates, HCL, NO_x, SO_x, and metals;
- throughput rate;
- temperature/residence time of primary treatment chamber;
- afterburner temperature/residence time;
- efficiency of condenser and carbon absorption if an afterburner is not used;
- stack height and exit temperature;
- size of unit;
- residual handling requirements (treated soils and any wastewater); and
- fuel and electrical requirements.

Design consideration for wastewater treatment include the following:

- flow rate;
- solids loading;
- hardness;
- chemical requirements;
- pumping and discharge flow rate control;
- contingencies for peak flow rate;
- contaminant and organic load;

- contacting method and time;
- regeneration requirements;
- discharge location; and
- effluent limitations.

To supplement the data gathered during the Phase II field investigations for remedial design purposes, vendor treatability studies will be performed regarding:

- dewatering of dredged sediment;
- thermal treatment of dewatered sediments; and
- carbon adsorption of dewatering water.

Qualified contractors will be selected to perform these treatability studies.

5.5 Interim Remedial Action: DRMO — Soils

This interim remedial action will consist of removal of hot spots and installation of a temporary cap. Hot spots consist of soils contaminated with PCBs, VOCs, and lead. Removed soil will probably be disposed off-site; however, it may be treated on-site by several processes separately or in series:

- VOCs — Aeration
- PCBs — Thermal Treatment
- Lead — Stabilization

Any soils treated on-site will either be put back into its excavation or sent for off-site disposal.

5.5.1 Data Collection Requirements

A Step II RI/FS investigation has been completed at this site. A draft work plan has been developed to fill any data gaps to support preparation of a FS and remedial design (Phase II Work Plan, March 1993, Atlantic). Selected aspects of this work plan relevant to the interim remedial action will be implemented. These aspects are highlighted in Table 5-11 and Figure 5-7 from the work plan. In general these data collection requirements will consist of drilling

TABLE 5-11
FIELD SAMPLING PLAN FOR DRMO SOILS

Sample Location	Well Type/ Proposed Depth (ft)	Rationale	Sample Designations	Sample Type		Analysis									
				Soil	Water	VOC	SVOC	Inorganics	Pesticides	PCB	TCLP	Dioxin	RAD[1]	Engineering
Monitoring Wells														
6MW1S	Existing	Existing	6GW1S		●	●	●	●					●	
6MW2S	Existing	Existing	6GW2S		●	●	●	●						
6MW2D[1]	Overburden/50±' (advance boring to determine bedrock contact)	Monitor quality of deep groundwater discharging to river; existing shallow soil analytical data available from 6MW2S.	6GW2D		●	●	●	●						
			6MW2D (depth)	●		●	●	●	●	●				
6MW3S	Existing	Existing	6GW3S		●	●	●	●						●
6MW3D[1]	Overburden/50±' (advance boring to determine bedrock contact)	Monitor quality of deep groundwater discharging to river; existing shallow soil analytical data available from 6MW3S.	6GW3D		●	●	●	●						
			6MW3D (depth)	●		●	●	●	●	●				●
6MW4S	Existing	Existing	6GW4S		●	●	●	●					●	
6MW5S	Existing	Replaced with new upgradient well 6MW6S												
6MW5D	Existing	Replaced with new upgradient well 6MW6D												
6MW6S	Overburden/20±'	Monitor quality of groundwater upgradient of site.	6MW6S (depth)	●		●	●	●	●	●				
			6GW6S		●	●	●	●						
6MW6D[1]	Overburden/50±' (advance boring to determine bedrock contact)	Monitor quality of deep groundwater upgradient of site.	6GW6D		●	●	●	●						
6MW7S	Overburden /20±'	Evaluate groundwater quality in the southeast portion of the site; groundwater elevation data.	6MW7S (depth)	●		●	●	●	●	●				
			6GW7S		●	●	●	●						
6MW8S	Overburden /20±'	Evaluate groundwater quality in the vicinity of previously detected contaminants.	6MW8S (depth)	●		●	●	●			●			
			6GW8S		●	●								
Test Borings														
6TB8	NA/Base of fill (15±')	Further define the extent and degree of contamination. Shallow sample from unpaved area.	6TB8 (0-1)	●		●	●	●	●	●				
			6TB8 (depth)	●		●	●	●	●	●				
6TB9	NA/Base of fill (15±')	Further define the extent and degree of contamination.	6TB9 (depth)	●		●	●	●	●	●				
6TB10	NA/Base of fill (15±')	Further define the extent and degree of contamination.	6TB10 (depth)	●		●	●	●	●	●				
6TB11	NA/Base of fill (15±')	Further define the extent and degree of contamination.	6TB11 (depth)	●		●	●	●	●	●				
6TB12	NA/Base of fill (15±')	Further define the extent and degree of contamination.	6TB12 (depth)	●		●	●	●	●	●				
6TB13	NA/Base of fill (15±')	Further define the extent and degree of contamination. Shallow samples near area of contamination.	6TB13 (0-1)	●		●	●	●	●	●				
			6TB13 (depth)	●		●	●	●	●	●				
6TB14	NA/Base of fill (15±')	Further define the extent and degree of contamination.	6TB14 (depth)	●		●	●	●	●	●				

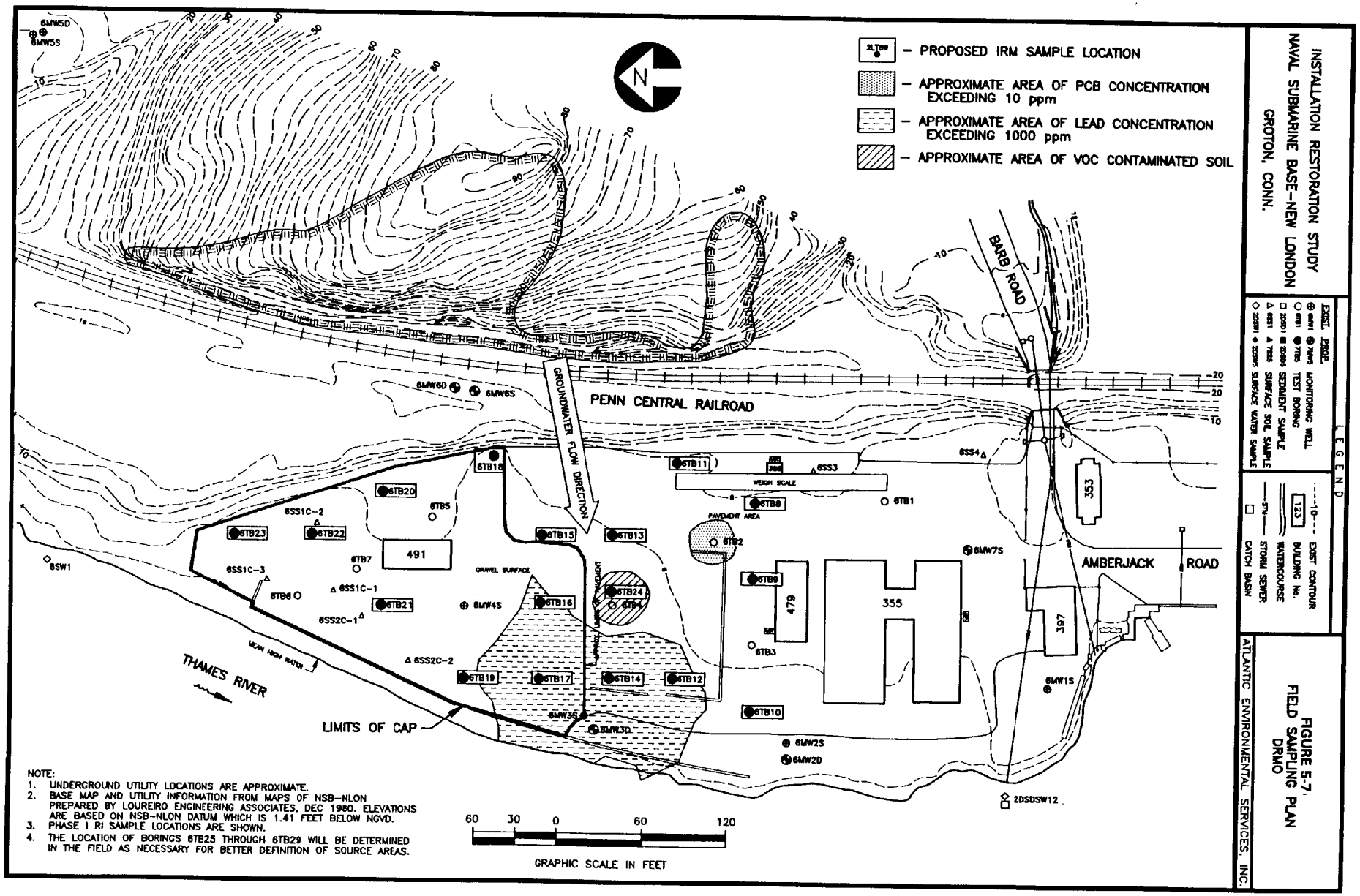
TABLE 5-11 (continued)
FIELD SAMPLING PLAN FOR DRMO SOILS

Sample Location	Well Type/ Proposed Depth (ft)	Rationale	Sample Designations	Sample Type		Analysis									
				Soil	Water	VOC	SVOC	Inorganics	Pesticides	PCB	TCLP	Dioxin	RAD[4]	Engineering
6TB15	NA/Base of fill (15±')	Further define the extent and degree of contamination.	6TB15 (depth)	●		●	●	●	●	●				
6TB16	NA/Base of fill (15±')	Further define the extent and degree of contamination. Shallow sample from unpaved area.	6TB16 (0-1)	●		●	●	●	●	●				
			6TB16 (depth)	●		●	●	●	●	●				●
6TB17	NA/Base of fill (15±')	Further define the extent and degree of contamination.	6TB17 (depth)	●		●	●	●	●	●				
6TB18	NA/Base of fill (15±')	Further define the extent and degree of contamination. Shallow sample from unpaved area.	6TB18 (0-1)	●		●	●	●	●	●				
			6TB18 (depth)	●		●	●	●	●	●				
6TB19	NA/Base of fill (15±')	Further define the extent and degree of contamination. Shallow sample from unpaved area.	6TB19 (0-1)	●		●	●	●	●	●				
			6TB19 (depth)	●		●	●	●	●	●				
6TB20	NA/Base of fill (15±')	Further define the extent and degree of contamination. Shallow sample from unpaved area.	6TB20 (0-1)	●		●	●	●	●	●				
			6TB20 (depth)	●		●	●	●	●	●	●	●		●
6TB21	NA/Base of fill (15±')	Further define the extent and degree of contamination. Shallow surface soil data available at 6SS2C.	6TB21 (depth)	●		●	●	●	●	●		●		●
6TB22	NA/Base of fill (15±')	Further define the extent and degree of contamination. Shallow surface soil data available at 6SS1C.	6TB22 (depth)	●		●	●	●	●	●				●
6TB23	NA/Base of fill (15±')	Further define the extent and degree of contamination. Shallow surface soil data available at 6SS1C.	6TB23 (depth)	●		●	●	●	●	●				
6TB24-6TB28	NA/Base of fill (15±')	Optional resolution borings to be installed to determine extent of soil contamination, if required, based upon the field screening results.	6TB24-28 (depth)	● (5)		● (5)	● (5)	● (5)	● (5)	● (5)				
			Subtotal Soil	28		28	28	28	28	28	2	2	0	4
			Subtotal Groundwater[2]		10	10	9	9	0	0	0	0	2	1
			Total Soil	32		32	32	32	31	31	2	2	0	5
			Total Groundwater[3]		20	20	18	18	0	0	0	0	4	2

PROPOSED

21 Primary test borings (including well borings);
5 Supplemental test borings;
6 Wells:
- 2 - Shallow overburden
- 3 - Deep overburden or bedrock

Notes:
1. Bedrock well may be installed; see Field Sampling Plan for details.
2. One round of sampling.
3. Includes two sampling rounds.
4. RAD means gamma spectrum analysis and gross alpha/beta analysis.
5. Shaded sections indicate interim remediate actions field sampling locations.


INSTALLATION RESTORATION STUDY
NAVAL SUBMARINE BASE-NEW LONDON
GROTON, CONN.
FIGURE 5-7
FIELD SAMPLING PLAN
DRMO
ATLANTIC ENVIRONMENTAL SERVICES, INC.
LEGEND
EXIST. PROP.
MONITORING WELL
TEST BORING
SEDIMENT SAMPLE
SURFACE SOIL SAMPLE
SURFACE WATER SAMPLE
EXIST CONTOUR
BUILDING No.
WATERCOURSE
STORM SEWER
CATCH BASIN
- PROPOSED IRM SAMPLE LOCATION
- APPROXIMATE AREA OF PCB CONCENTRATION EXCEEDING 10 ppm
- APPROXIMATE AREA OF LEAD CONCENTRATION EXCEEDING 1000 ppm
- APPROXIMATE AREA OF VOC CONTAMINATED SOIL
N
PENN CENTRAL RAILROAD
BARB ROAD
AMBERJACK ROAD
GROUNDWATER FLOW DIRECTION
THAMES RIVER
MEAN HIGH WATER
LIMITS OF CAP
491
479
355
397
353
WEIGH SCALE
PAVEMENT AREA
GRAVEL SURFACE
6MW5D
6MW5S
6MW6D
6MW6S
6MW4S
6MW7S
6MW1S
6MW2S
6MW2D
6MW3S
6MW3D
6TB1
6TB2
6TB3
6TB5
6TB6
6TB7
6TB8
6TB9
6TB10
6TB11
6TB12
6TB13
6TB14
6TB15
6TB16
6TB17
6TB18
6TB19
6TB20
6TB21
6TB22
6TB23
6TB24
6SS1C-1
6SS1C-2
6SS1C-3
6SS2C-1
6SS2C-2
6SS3
6SS4
6SW1
2DSDSW12
NOTE:
1. UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE.
2. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON PREPARED BY LOUREIRO ENGINEERING ASSOCIATES, DEC 1980. ELEVATIONS ARE BASED ON NSB-NLON DATUM WHICH IS 1.41 FEET BELOW NGVD.
3. PHASE I RI SAMPLE LOCATIONS ARE SHOWN.
4. THE LOCATION OF BORINGS 6TB25 THROUGH 6TB29 WILL BE DETERMINED IN THE FIELD AS NECESSARY FOR BETTER DEFINITION OF SOURCE AREAS.
60 30 0 60 120
GRAPHIC SCALE IN FEET

of up to 22 borings (one of which will be completed as a monitoring well) and off-site laboratory analysis of up to 28 soil samples.

5.5.2 Engineering Consideration

Design considerations for excavation, thermal treatment, and stabilization have been discussed in previous sections. The only other process that may be used at this site is aeration of VOC-contaminated soils. Design considerations for aeration include:

- physical properties of soils;
- moisture content of soils;
- permeability of soils; and
- vapor pressure of contaminants.

Another major consideration at this site is the extent to which PCBs, VOC and lead contaminated soils are commingled. Based on existing, proposed target remediation levels, and the existing understanding of contaminant distribution, these contaminants are probably not commingled. However, some of the treatment processes being considered may have to be used in series if the contaminants are mixed. For example, aeration followed by stabilization may be required for soils contaminated with VOC and lead, or for example PCB soils contaminated with lead, may cause emission problems and therefore may not be suitable for thermal processing.

Another concern regards the magnetic anomalies detected during the geophysical survey. Before excavation of soils and installation of a landfill cap, test pits will be dug in these areas, and any liquids or hazardous materials encountered will be removed and properly disposed. This work will be incorporated into the remedial design.

APPENDIX A

PRELIMINARY REMEDIATION TARGET LEVELS

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MEMO

FILE NUMBER:

TO: Barry Giroux
FROM: Charlie Menzie
DATE: March 9, 1992
SUBJECT: Target Levels for Soils at the Naval Submarine Base - New London, Groton

This memo summarizes our discussions concerning the development of target levels for soils in support of the Feasibility Study component of the Installation Restoration Study. The risk-based target levels incorporate the comments made by EPA at our February 13, 1992 meeting. At that meeting we noted that the risk assessment document was solid and we have since verified that with some sample calculations. However, we noted that in order to be consistent with EPA's most recent policies, published during and after the risk assessment work was done, we would use their suggested values to estimate target levels. Specifically, this involved: 1) using the new Cancer Potency Factor for benzo(a)pyrene, 2) using new exposure assumptions in the update to the Exposure Factors Handbook, and, 3) using the IU/BK methodology for lead. Our estimates are based on these values and not on the values used in the baseline risk assessment. This is consistent with what we discussed as a reasonable plan with EPA.

Site: DRMO

Synopsis: Risks to human health at DRMO were identified with respect to specific chemicals and receptors. No acute risks or imminent hazards related to the chemicals were found. However, there is *some* risk due to the presence of certain organic compounds - PCBs and PAH - in surface soils and lead in surface and subsurface soils. Receptor groups for which some risk was identified include: 1) workers involved in sorting scrap metal, 2) future construction workers, and, 3) workers involved in servicing underground utilities.

Target Levels for PCBs in Surface Soils

Workers at DRMO may come into contact with surface soils over long periods of time and be exposed to PCBs present within these surface soils. A Risk Reduction Objective has been identified to, "*Reduce exposure of workers to PCBs in surface soils of the DRMO.*" The objective is based on the continued industrial use of the DRMO.

Two target levels are identified for PCBs in surface soils:

- Maximum of 10 mg/kg (ppm)
- Average of 4 mg/kg

The *maximum* of 10 mg/kg was selected because it is consistent with levels that have been used elsewhere - including within Connecticut - to guide remediation efforts. A maximum concentration of 10 mg/kg will ensure that there are no "hot spots" for exposure to soils within the DRMO area.

The *average* of 4 mg/kg was selected for the area as a whole. This value would be applied to all surface areas within the DRMO as a site-wide average. The concentration, 4 mg/kg, corresponds with a 1 in 10,000 (1 E-4) cancer risk for scrap metal workers. Application of this target level as a site-wide average for DRMO will ensure that the residual risk is within the 1 E-6 to 1E-4 target range identified by EPA. Conservative assumptions have been incorporated into the estimate of risk and the derived target level should be protective of long-term scrap metal workers.

The average target level of 4 mg/kg will also ensure that risks to other receptors within DRMO are low. This target level would yield a residual risk of between 1 E-6 and 1 E-5 for frequent visitors to the DRMO that participate in the auctions and for any future construction workers. The target level would yield risks of less than 1 E-6 for utility workers.

Target Levels for Polycyclic Aromatic Hydrocarbons (PAH) Recognized as Probable Human Carcinogens (EPA Classification of B2) in Surface Soils

Workers at DRMO may come into contact with surface soils over long periods of time and

be exposed to carcinogenic PAH[1] present within these surface soils. A Risk Reduction Objective has been identified to, "*Reduce exposure of workers to PAH in surface soils of the DRMO.*" The objective is based on the continued industrial use of the DRMO.

Two target levels are identified for carcinogenic PAH in surface soils:

- Maximum of 100 mg/kg (ppm)
- Average of 24 mg/kg

The ***maximum*** of 100 mg/kg was selected because it is consistent with levels that have been used elsewhere. This value was originally developed by ATSDR by Dr. Stephen Margolis. In deriving this value, ATSDR assumed that all the carcinogenic PAH were as potent as Benzo(a)pyrene. However, Dr. Margolis points out that when considering the significance of contamination at the site, the facts that all PAHs are neither carcinogenic nor (for those suspected carcinogens) as potent as Benzo(a)pyrene must be part of the evaluation.

The ***average*** of 24 mg/kg was selected for the area as a whole. This value has been derived using EPA's new cancer potency factor for Benzo(a)pyrene and that other carcinogenic PAH are as potent as BaP. The latter assumption is judged to be conservative and EPA is planning to develop an alternative method for evaluating these other PAH compounds over the course of the next year.

This average value would be applied to all surface areas within the DRMO as a site-wide average. The concentration, 24 mg/kg, corresponds with a 1 in 10,000 (1 E-4) cancer risk for scrap metal workers. Application of this target level as a site-wide average for DRMO will ensure that the residual risk is within the 1 E-6 to 1E-4 target range identified by EPA. Conservative assumptions have been incorporated into the estimate of risk and the derived target level should be protective of long-term scrap metal workers.

The average target level of 24 mg/kg will also ensure that risks to other receptors within DRMO are low. This target level would yield a residual risk of between 1 E-6 and 1 E-5 for frequent visitors to the DRMO that participate in the auctions. The target level would yield a residual risk of between 1 E-5 and 1 E-4 for future construction workers. The

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[1]PAH compounds were evaluated with regard to carcinogenic risks and systemic (non-carcinogenic) risks. The analysis indicated that there was some carcinogenic risk but no systemic health risk. A subset of the higher molecular weight PAH compounds are considered to be probable human carcinogens (B2). The target levels apply only to these compounds as a group.

target level would yield risks of approximately 1 E-6 for utility workers.

Based on a review of the data for DRMO, soil contamination with carcinogenic PAH is very limited.

Target Level for Lead in Soils

Lead contamination of soil appears to be present in a few local areas of the DRMO. As agreed at our February 13, 1992 meeting with EPA, we have used EPA's Integrated Uptake/Biokinetic (IU/BK) Model as the basis for assessing exposure to workers at the DRMO Site. In order to do this, we modified the model slightly so that blood lead levels for adults could be estimated; the existing model only considers children. We used a blood lead level of 15 ug/dl as a target and recognize that this may be conservative with regard to effects on adults. Results are presented as ranges depending on the assumptions used and the dose-response function describing lead intake and blood lead level.

The model was run for different assumptions concerning incidental soil ingestion by workers (100 mg/day for scrap metal workers and 100 to 480 mg/day for future construction workers). For scrap metal workers, the estimated target level for lead in soils ranged between 2,400 to 4,700 mg/kg depending on the dose-response curve. For the future construction worker the rage was between 500 mg/kg and 4,500 mg/kg. The former number is based on a high continual daily soil ingestion of 480 mg/day and application of the Harley & Kneip dose-response model; the latter is based on an incidental soil ingestion rate of 100 mg/day and the Sherlock/Coole model. If an intermediate (but still conservative) soil ingestion rate of 200 mg/day is used the range is 1,200 mg/kg to 2,325 mg/kg.

Based on the back-calculated target levels for lead in soil, we suggest that a target level in the range of 1,000 to 2,000 mg/kg is probably appropriate for soils at the DRMO site. The 1,000 mg/kg level is consistent with the 500 to 1,000 mg/day target levels that have been used by ATSDR and EPA for protection of children. A target level of 2,000 mg/kg falls at the midpoint of the range derived using different exposure assumptions and models. Such a target level would be protective of workers if incidental ingestion of soil amounts to 100 mg/day using either of the dose-response models.

Lead in soils at DRMO appears to be limited to a few locations. If this contamination is addressed on a location-specific basis, average and maximum values elsewhere at the site are expected to be well within the target levels suggested above.

Target Level for Beryllium in Soils

No numerical limits have been developed for this metal. Risks are much less than those associated with other contaminants described above. In addition, it appears that remediation of soils for PCBs, PAH, and lead will address any risk reduction objectives for beryllium.

Site: Area A and Downstream Watercourse

Synopsis: Risks were identified in connection with the presence of PCBs in surface soils and DDTR in streambeds and wetlands. Receptors include workers involved in moving pallets and children that may play in and around the streambeds and wetlands.

Target Levels for PCBs in Surface Soils

Workers involved in moving pallets may come into contact with surface soils over long periods of time and be exposed to PCBs present within these surface soils. A Risk Reduction Objective has been identified to, "*Reduce exposure of workers to PCBs in surface soils of the Area A Landfill*".

A ***maximum*** value of 10 mg/kg is selected because it is consistent with levels that have been used elsewhere - including within Connecticut - to guide remediation efforts. A maximum concentration of 10 mg/kg will ensure that there are no "hot spots" for exposure to soils within the Area A Landfill area.

An ***average*** value of 4 mg/kg can be considered for the area as a whole and would be consistent with the target level identified for DRMO. At this average level the residual risks to receptors are as follows: less than 1 E-6 for utility workers, between 1 E-6 and 1 E-5 for children, and between 1 E-5 and 1 E-4 for workers involved in moving pallets. All these residual risks fall in the 1 E-6 to 1 E-4 target range identified by EPA.

Based on a review of the data for the Area A Landfill, it appears that all risk reduction objectives would be met by using a 10 mg/kg level as a maximum value. By remediating the few areas that may exceed this value, the overall average concentration should be well below the average target level of 4 mg/kg.

Target Level for DDTR in Sediments and Streambeds

Risks associated with exposure to DDTR were for children who might play in these areas. An average target level of 25 mg/kg for DDTR was estimated at a risk level of 1 E-6

assuming a soil ingestion rate of 200 mg/day. If a lower soils ingestion rate of 100 mg/day is assumed (as suggested by EPA's reviewers), then the target level becomes 33 mg/kg.

A target level of 25 mg/kg DDTR in sediments and soils appears to be appropriate for protection of human health at a risk level of 1 E-6.

No target levels have been developed at this time for protection of ecological receptors. EPA and U.S. FWS have indicated a need for additional data in order to identify appropriate risk reduction objectives and target levels.

The rationale for the proposed cleanup levels are based on a worker scenario rather than a residential scenario. This was the case because the receptor group for which some risk was identified was the worker. Under the assumptions used for the risk calculations, there were no risks calculated for the resident, either offsite or onsite. We believe that the target cleanup levels should be based on the risk calculations for the site and the associated site use.

We have included the equations and associated calculations that were used for determining the target levels in soils. As per guidance, we have calculated cleanup levels based upon the 10^{-4} to 10^{-6} risk range.

CALCULATIONS FOR SOILS CLEAN-UP LEVELS FOR PAHS

Clean-up Level Calculations for PAHs for the worker at DRMO

Parameters	Values	Values	Values	Values
Soil Target Level (mg/kg) based on ingestion	3.89E-01	3.89E+01	4.89E-01	4.89E+01
Soil Target Level (mg/kg) based on dermal contact	2.11E+00	2.11E+02	2.66E+00	2.66E+02
Soil Target Level (mg/kg) based on Inhalation of Fugitive Dust	1.08E+02	1.08E+04	1.36E+02	1.36E+04
Target Risk Level for cancer	1.00E-06	1.00E-04	1.00E-06	1.00E-04
CPF	7.30	7.30	5.80	5.80
Averaging period (days/yr)	365	365	365	365
Lifetime	70	70	70	70
No. of Years	35	35	35	35
days per year	180	180	180	180
Body wt	70	70	70	70
Ingestion of soil				
Soil Ingestion Rate	100	100	100	100
contaminant /soil absorption factor	1	1	1	1
conversion factor (mg/kg)	1.00E-06	1.00E-06	1.00E-06	1.00E-06
Dermal Contact with Soil				
Soil Adherence Factor	0.5	0.5	0.5	0.5
Total Skin Area	19400	19400	19400	19400
fraction of Skin area exposed	0.19	0.19	0.19	0.19
dermal absorption	1.00E-02	1.00E-02	1.00E-02	1.00E-02
Inhalation of Fugitive Dust				
Pulmonary absorption	1	1	1	1
Inhalation rate	20	20	20	20
PM10 fugitive dust	0.018	0.018	0.018	0.018

EQUATIONS USED IN CALCULATIONS FOR PAH CLEANUP LEVELS

	A	B
1	Clean-up Level Calculations for PAHs for the worker at DRMO	
2		
3		
4	**Parameters**	**Values**
5		
6		
7	**Soil Target Level (mg/kg)**	**=(B16*B19*B20*B23)/(B17*B21*B22*B26*B27*B28)**
8	**based on ingestion**	
9		
10	**Soil Target Level (mg/kg)**	**=(B16*B19*B20*B23)/(B17*B21*B22*B27*B28*B31*B32*B33*B34)**
11	**based on dermal contact**	
12		
13	**Soil Target Level (mg/kg)**	
14	**based on inhalation of Fugitive Dust**	**=(B16*B19*B20*B23)/(B17*B21*B22*B27*B28*B37*B38*B39)**
15		
16	**Target Risk Level for cancer**	**0.000001**
17	CPF	7.3
18		
19	Averaging period (days/yr)	365
20	Lifetime	70
21	No. of Years	35
22	days per year	180
23	Body wt	70
24		
25	**Ingestion of soil**	
26	Soil Ingestion Rate	100
27	contaminant /soil absorption factor	1
28	conversion factor (mg/kg)	0.000001
29		
30	**Dermal Contact with Soil**	
31	Soil Adherence Factor	0.5
32	Total Skin Area	19400
33	fraction of Skin area exposed	0.19
34	dermal absorption	0.01
35		
36	**Inhalation of Fugitive Dust**	
37	Pulmonary absorption	1
38	Inhalation rate	20
39	PM10 fugitive dust	0.018
40		

EQUATIONS USED IN CALCULATIONS FOR PAH CLEANUP LEVELS

	C	D
1		
2		
3		
4	Values	Values
5		
6		
7	=(C16*C19*C20*C23)/(C17*C21*C22*C26*C27*C28)	=(D16*D19*D20*D23)/(D17*D21*D22*D26*D27*D28)
8		
9		
10	=(C16*C19*C20*C23)/(C17*C21*C22*C27*C28*C31*C32*C33*C34)	=(D16*D19*D20*D23)/(D17*D21*D22*D27*D28*D31*D32*D33*D34)
11		
12		
13		
14	=(C16*C19*C20*C23)/(C17*C21*C22*C27*C28*C37*C38*C39)	=(D16*D19*D20*D23)/(D17*D21*D22*D27*D28*D37*D38*D39)
15		
16	0.0001	0.000001
17	7.3	5.8
18		
19	365	365
20	70	70
21	35	35
22	180	180
23	70	70
24		
25		
26	100	100
27	1	1
28	0.000001	0.000001
29		
30		
31	0.5	0.5
32	19400	19400
33	0.19	0.19
34	0.01	0.01
35		
36		
37	1	1
38	20	20
39	0.018	0.018
40		

EQUATIONS USED IN CALCULATIONS FOR PAH CLEANUP LEVELS

	E
1	
2	
3	
4	Values
5	
6	
7	=(E16*E19*E20*E23)/(E17*E21*E22*E26*E27*E28)
8	
9	
10	=(E16*E19*E20*E23)/(E17*E21*E22*E27*E28*E31*E32*E33*E34)
11	
12	
13	
14	=(E16*E19*E20*E23)/(E17*E21*E22*E27*E28*E37*E38*E39)
15	
16	0.0001
17	5.8
18	
19	365
20	70
21	35
22	180
23	70
24	
25	
26	100
27	1
28	0.000001
29	
30	
31	0.5
32	19400
33	0.19
34	0.01
35	
36	
37	1
38	20
39	0.018
40	

CALCULATIONS FOR CLEAN-UP LEVELS FOR PCBs

Clean-up Level Calculations for PCBs for the worker at DRMO		
Parameters	**Values**	**Values**
Soil Target Level (mg/kg) based on ingestion	**3.69E-01**	**3.69E+01**
Soil Target Level (mg/kg) based on dermal contact	**2.00E+00**	**2.00E+02**
Soil Target Level (mg/kg) based on Inhalation of Fugitive Dust	**1.02E+02**	**1.02E+04**
Target Risk Level for cancer	**1.00E-06**	**1.00E-04**
CPF	7.70	7.70
Averaging period (days/yr)	365	365
Lifetime	70	70
No of Years	35	35
days per year	180	180
Body wt	70	70
Ingestion of soil		
Soil Ingestion Rate	100	100
contaminant /soil absorption factor	1	1
conversion factor (mg/kg)	1.00E-06	1.00E-06
Dermal Contact with Soil		
Soil Adherence Factor	0.5	0.5
Total Skin Area	19400	19400
fraction of Skin area exposed	0.19	0.19
dermal absorption	1.00E-02	1.00E-02
Inhalation of Fugitive Dust		
Pulmonary absorption	1	1
Inhalation rate	20	20
PM10 fugitive dust	0.018	0.018

EQUATIONS USED IN THE CALCULATIONS FOR PCB CLEAN-UP LEVELS

	A	B
1	Clean-up Level Calculations for PCBs for the worker at DRMO	
2		
3		
4	**Parameters**	**Values**
5		
6		
7	**Soil Target Level (mg/kg)**	**=(B16*B19*B20*B23)/(B17*B21*B22*B26*B27*B28)**
8	**based on ingestion**	
9		
10	**Soil Target Level (mg/kg)**	**=(B16*B19*B20*B23)/(B17*B21*B22*B27*B28*B31*B32*B33*B34)**
11	**based on dermal contact**	
12		
13	**Soil Target Level (mg/kg)**	
14	**based on inhalation of Fugitive Dust**	**=(B16*B19*B20*B23)/(B17*B21*B22*B27*B28*B37*B38*B39)**
15		
16	**Target Risk Level for cancer**	0.000001
17	CPF	7.7
18		
19	Averaging period (days/yr)	365
20	Lifetime	70
21	No. of Years	35
22	days per year	180
23	Body wt	70
24		
25	**Ingestion of soil**	
26	Soil Ingestion Rate	100
27	contaminant /soil absorption factor	1
28	conversion factor (mg/kg)	0.000001
29		
30	**Dermal Contact with Soil**	
31	Soil Adherence Factor	0.5
32	Total Skin Area	19400
33	fraction of Skin area exposed	0.19
34	dermal absorption	0.01
35		
36	**Inhalation of Fugitive Dust**	
37	Pulmonary absorption	1
38	Inhalation rate	20
39	PM10 fugitive dust	0.018
40		

EQUATIONS USED IN THE CALCULATIONS FOR PCB CLEAN-UP LEVELS

	C
1	
2	
3	
4	Values
5	
6	
7	=(C16*C19*C20*C23)/(C17*C21*C22*C26*C27*C28)
8	
9	
10	=(C16*C19*C20*C23)/(C17*C21*C22*C27*C28*C31*C32*C33*C34)
11	
12	
13	
14	=(C16*C19*C20*C23)/(C17*C21*C22*C27*C28*C37*C38*C39)
15	
16	0.0001
17	7.7
18	
19	365
20	70
21	35
22	180
23	70
24	
25	
26	100
27	1
28	0.000001
29	
30	
31	0.5
32	19400
33	0.19
34	0.01
35	
36	
37	1
38	20
39	0.018
40	