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NSB NEW LONDON
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FINAL

DESIGN WORK PLAN
INTERIM REMEDIAL DESIGN

AREA A LANDFILL

Prepared For:

Northern Division
Naval Facilities Engineering Command
10 Industrial Highway
Lester, PA 19113-2090

Navy Contract No.: N62472-88-C-1294

Prepared By:

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1.0 INTRODUCTION

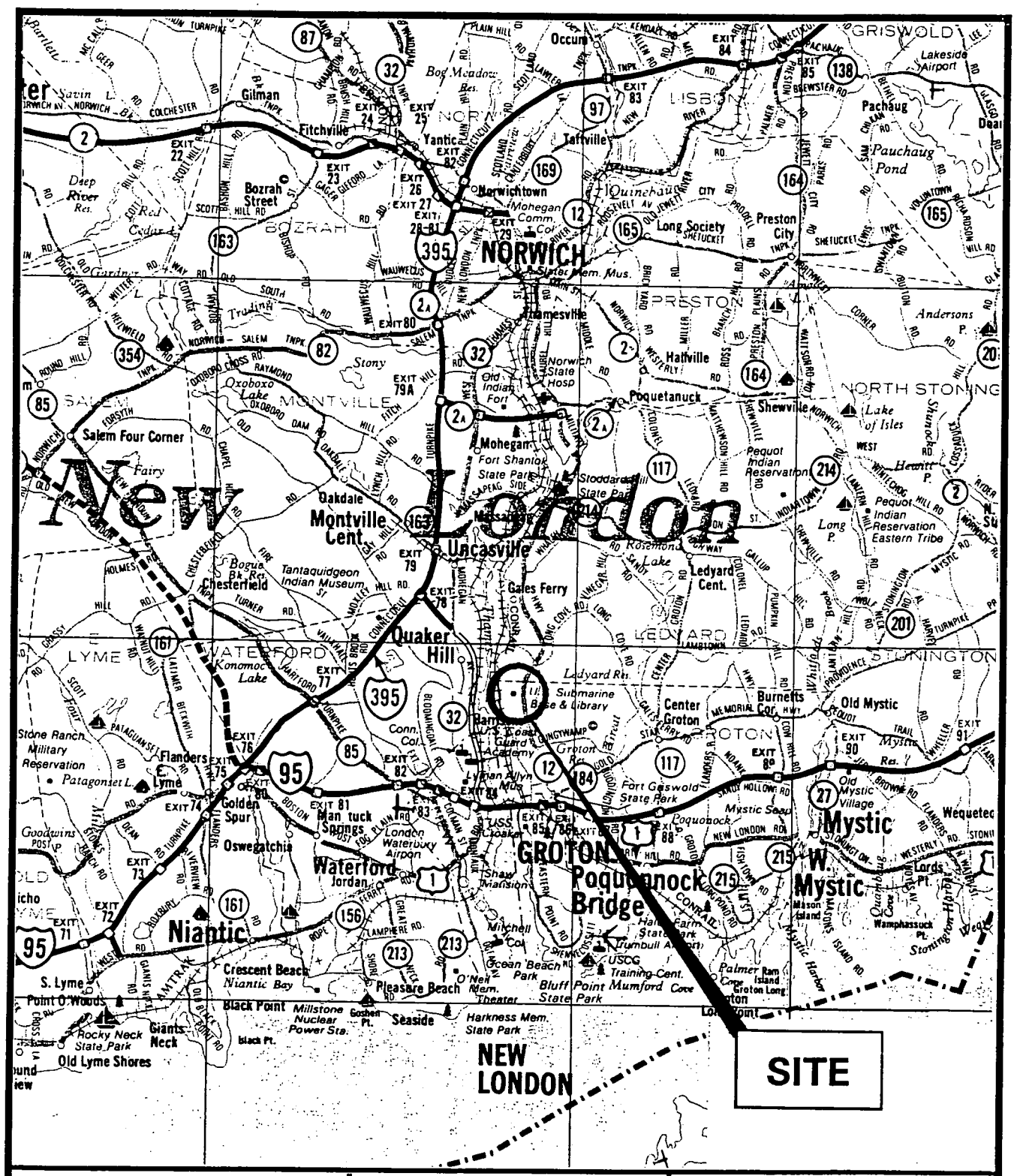
1.1 Purpose and Scope

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 6.0 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 30, 1990 by the U.S. Environmental Protection Agency (U.S. EPA) pursuant to the comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980.

The purpose of this design work plan is to present proposed interim remedial designs for the Area A Landfill at NSB-NLON in Groton, Connecticut. This interim remedial action consists of the final capping of the Area A Landfill. In addition to the interim remedial action which is the subject of this document, the following interim action design work plans have been submitted as separate documents.

- Spent Acid Storage and Disposal Area A Landfill/Concrete Pad Area
- Defense Reutilization Maintenance Office (DRMO) - Soil Remediation

The interim remedial actions for the Area A Downstream/Over Bank Disposal Area (OBDA) sediment remediation will be presented in a separate document. Collectively, these items represent the actions necessary to prevent the release of contaminants into the environment and prevent human exposure to contaminants. 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). Pursuant to this goal, this design work plan has been prepared concurrently with conducting portions of the



INSTALLATION RESTORATION STUDY

NAVAL SUBMARINE BASE - NEW LONDON

GROTON, CT

SOURCE: Marshall Penn-York Co. Inc.

Miles

0 1 2 3

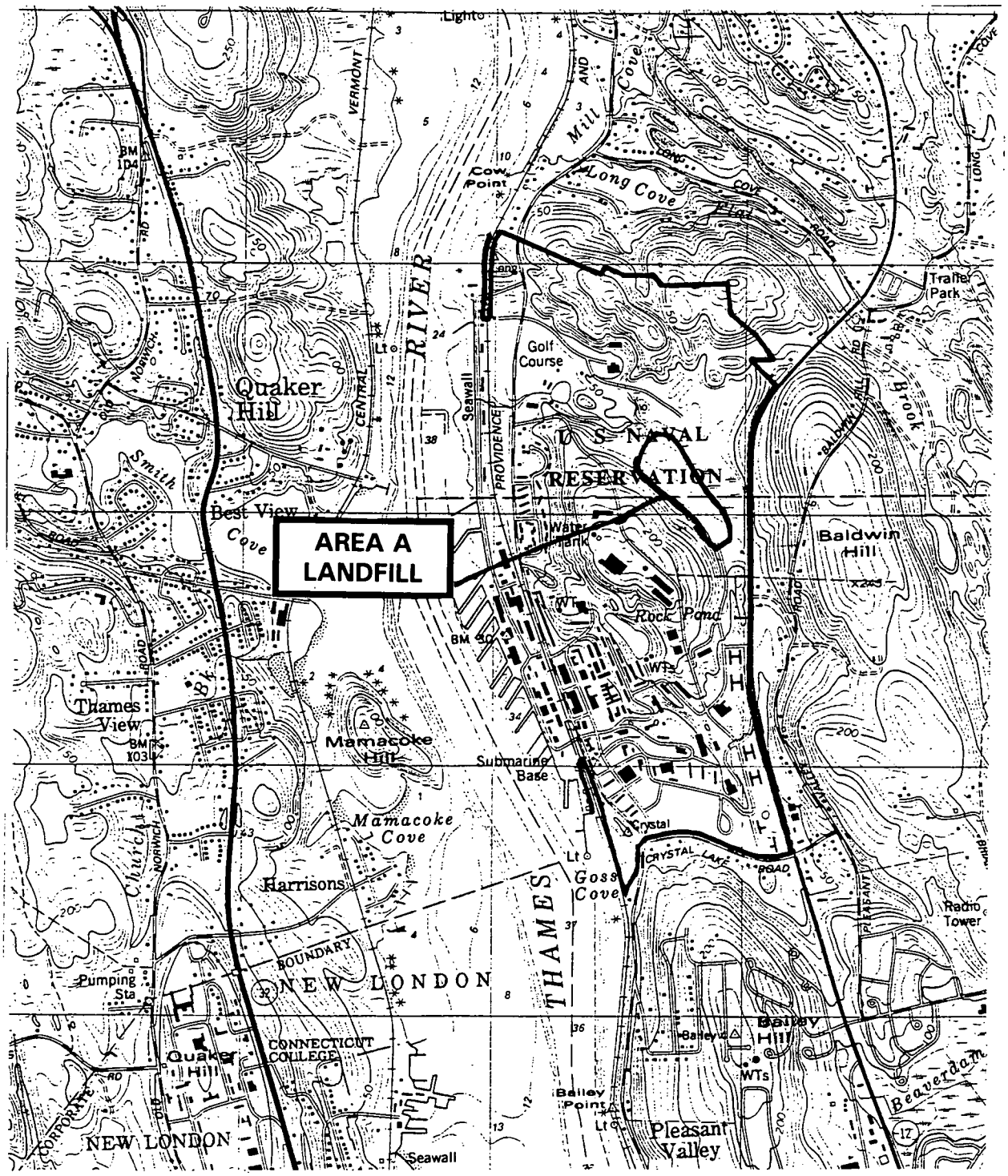
APPROXIMATE SCALE

N

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	FIGURE 1-2 SITE LOCATION ATLANTIC ENVIRONMENTAL SERVICES, INC.

Phase II Remedial Investigation (RI) Work Plan (Atlantic, May 1993) to collect design data required to finalize these interim remedial designs.

This preliminary design document provides the following information for the Area A Landfill:

- Site Characteristics
- Interim Remedial Action Objectives
- Final Remediation Action
- Evaluation of Interim Remedial Design Alternatives
- Description of Work Items Required to Support the Remedial Action

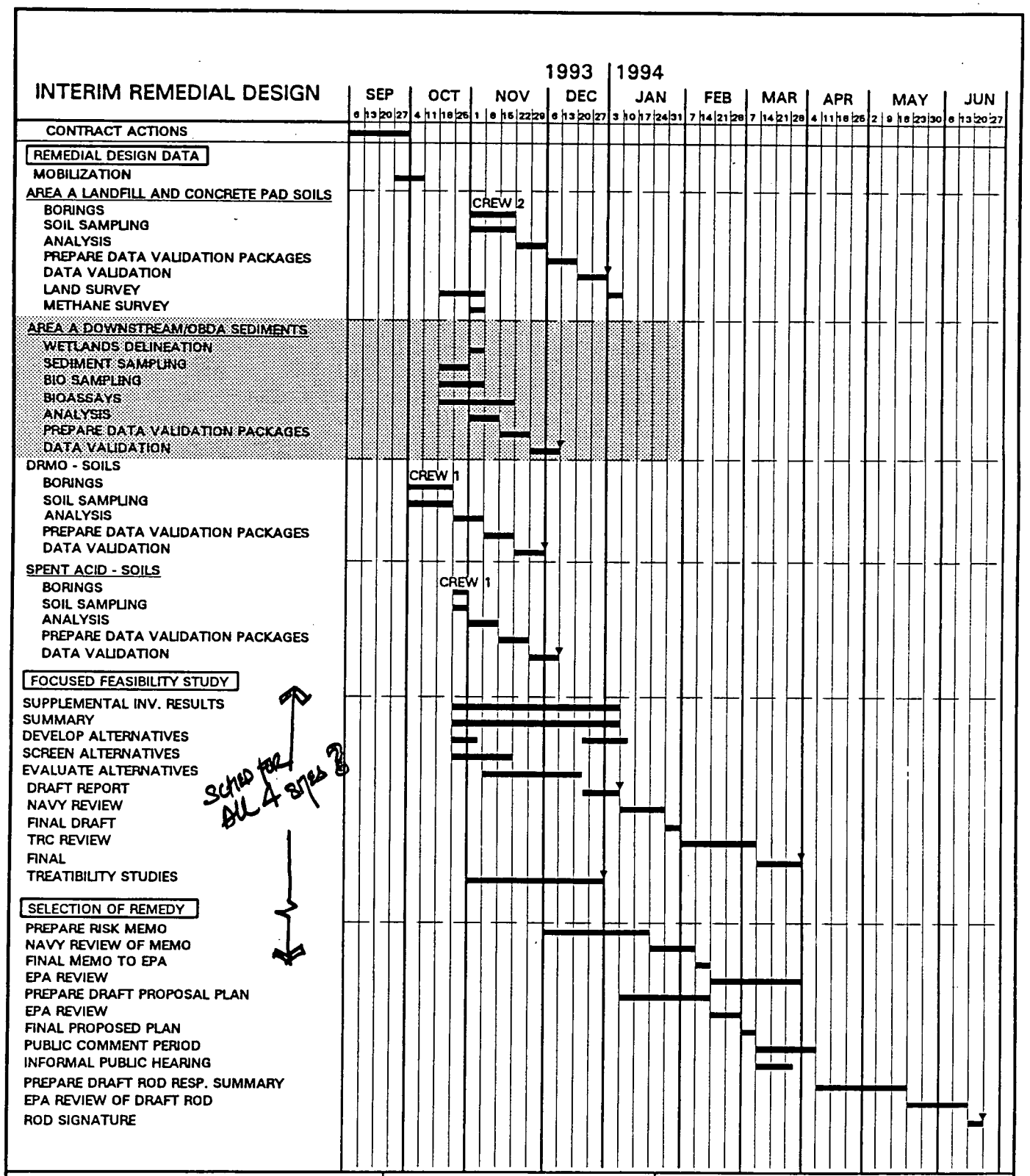
The overall process of proceeding with the interim remedial actions is as follows:

- initiate remedial design and collection of supplemental data (laboratory analysis and engineering);
- complete focused feasibility study, including an evaluation of collected data and remedial alternatives;
- develop proposed plan and record of decision (ROD);
- participate in ongoing public relations activities;
- complete design; and
- implement approved, interim remedial actions.

This document is the first phase of remedial design. Supplemental design data are currently being collected. Generalized schedules, showing all the tasks to complete interim remedial actions for this project along with other interim remedial actions currently being implemented, are provided in Tables 1-1 and 1-2.

Input from the Technical Review Committee (TRC) and regulatory agencies regarding the proposed interim remediation designs is hereby requested. FINAL? DRAFT?

FINAL FOR DISCUSSION W/ EPA 02-01-94.
PREVIOUS SUBM WAS INTERNAL DRAFT. DRAFT SUBM MISSING?
NO OPPORTUNITY FOR COMMENTS FROM EPA, EPPA, TRC.



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

LEGEND

TASK TIME LINE

▼ ENDING MILESTONE

TABLE 1-1
SUPPLEMENTAL DESIGN DATA/
FOCUSED FEASIBILITY STUDY/
PROPOSED PLANS/RODS
INTERIM REMEDIAL ACTIONS

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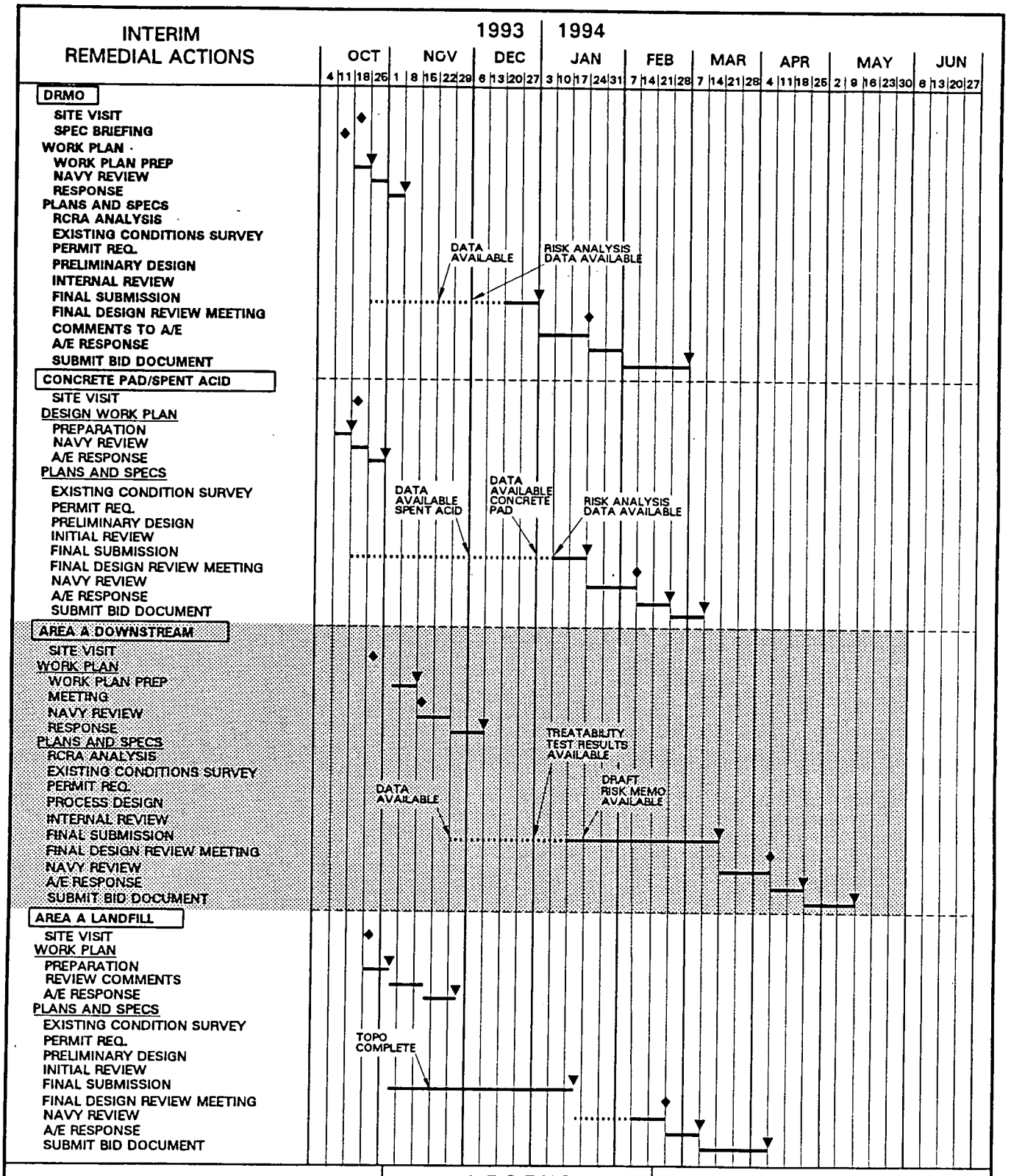

INSTALLATION RESTORATION STUDY
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT

LEGEND

- TASK TIME LINE
- PART TIME TASK TIME LINE
- MILESTONE/DELIVERABLE
- MEETING

TABLE 1-2
SCHEDULE
DESIGN INTERIM REMEDIAL ACTIONS

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2.0 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. A summary of site background-specific geology and hydrology, and the nature and extent of contamination is presented herein.

2.1 Site Background

The Area A Landfill is located in the northeastern and north-central section of NSB-NLON. The area is approximately 9.5 acres in area. 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 along the southern limit of the wetland. Run-off from the landfill drains as overland flow 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 associated wetland, which includes sample locations performed during the Phase I RI, soil borings currently being performed under the Phase II RI, geotechnical borings to support design efforts and monitoring wells to be installed at a later date under the Phase II investigation, is provided as Figure 2-1.

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 nonsalvageable materials generated by submarines and base operations were disposed of in the Area A Landfill.

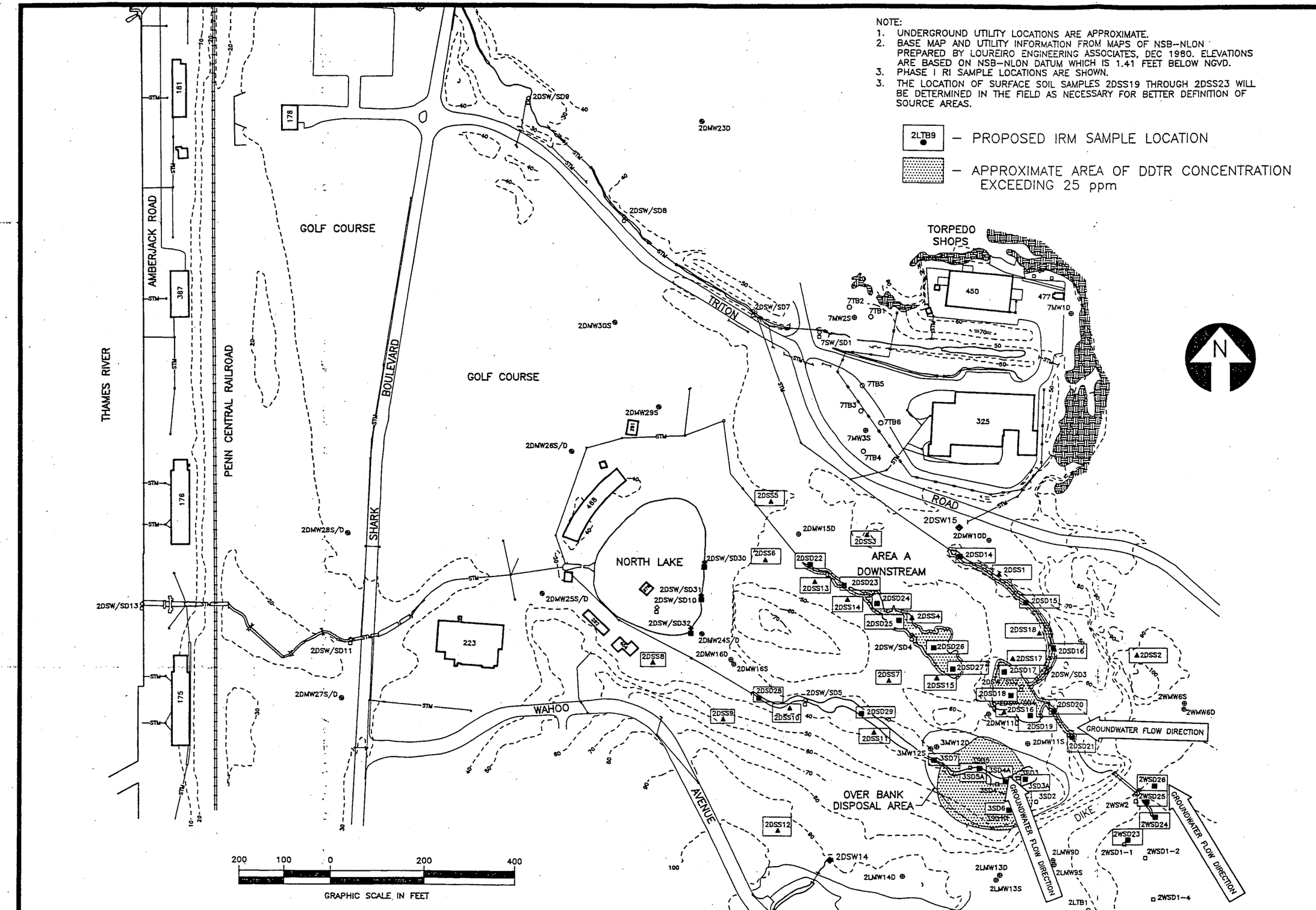


FIGURE 2-1
SITE PLAN AREA A
LANDFILL, WETLAND, WEAPONS CENTER, DOWNSTREAM AND OBDA

ATLANTIC ENVIRONMENTAL SERVICES, INC.

LEGEND

10 EXIST CONTOUR
123 BUILDING No.
WATERCOURSE
STM STORM SEWER
CATCH BASIN

EXIST. PROP.
6MW1 7MW5 MONITORING WELL
6TB1 7TB5 TEST BORING
2DSD1 2DSD5 SEDIMENT SAMPLE
6SS1 7SS5 SURFACE SOIL SAMPLE
2DSW1 5DSW5 SURFACE WATER SAMPLE

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

Landfill operations ceased in 1973. After closure, a bituminous concrete pad was constructed in the southwest portion of the landfill for the aboveground 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 of 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.

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.

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

The 1960 USGS Surficial Geology Map shows nonstratified 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.

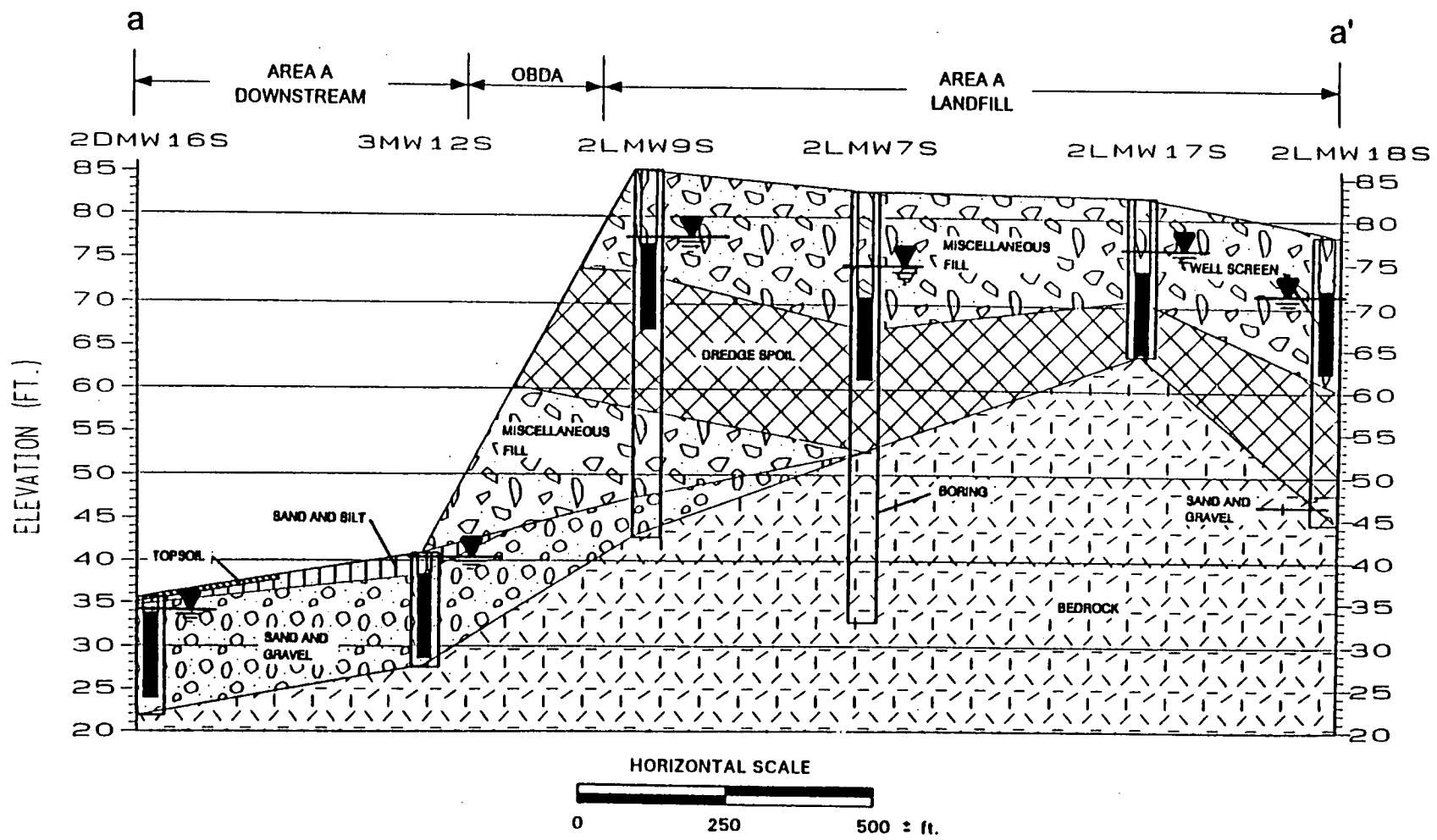
Subsurface investigations indicate that the Area A Landfill is underlain by 10 to 20 feet of miscellaneous fill material, which is generally underlain by 10 to 20 feet of dredge spoil. On the southwestern side, fill material is underlain by compact sand, silt, and gravel, which extend down to bedrock.

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 two monitoring well locations within the Area A Landfill. The mineralogy and texture of the bedrock cores are 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 into 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 a hydraulic gradient of approximately 0.004. Figure 2-2 represents 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.



INSTALLATION RESTORATION STUDY NAVAL SUBMARINE BASE - NEW LONDON GROTON, CT	GROUND WATER ELEVATION DATA: MARCH 21, 1991	FIGURE 2-2 GEOLOGIC CROSS SECTION A-A' AREA A ATLANTIC ENVIRONMENTAL SERVICES, INC.

2.3 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 to-be-concerned (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. Semivolatile organic compounds (SVOCs), principally polycyclic 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 polychlorinated biphenyls (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 two surface-soil sample locations, the extent of the PCBs in this area was not defined at this time.

Pesticides were detected at three 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.

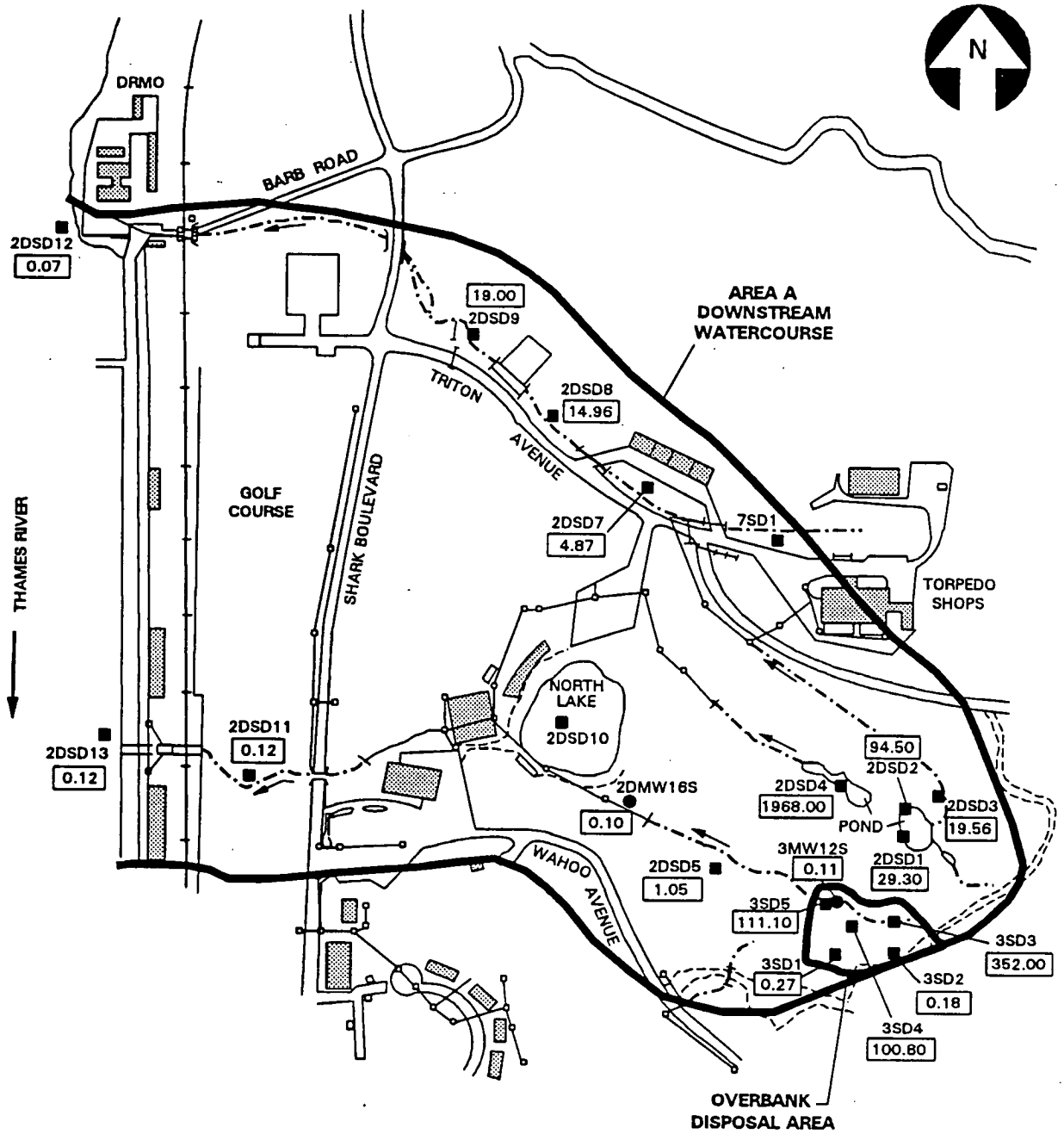
Of the 12 subsurface samples analyzed by TCLP, 10 contained one or more metals exceeding TBC values. Metals exceeding TBC values included arsenic, cadmium, lead, and selenium. Characteristic values of TCLP hazardous waste were not exceeded for any samples. Several inorganic constituents (including beryllium, 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 human health risks associated with the Area A Landfill. Figure 2-3 provides a summary of the PCB and pesticide concentrations detected in soils and solvents in this area.

2.4 Nature and Extent of Groundwater Contamination

Groundwater within Area A contains VOCs and cadmium above ARAR and TBC drinking water standards/guidance values, indicating a potential health risk if the water were to be consumed. No potable water supply wells exist, or are planned by the Navy, in the suspected potentially affected downgradient area. Additional monitoring wells will be installed southeast of the Area A Landfill during the Phase II RI. Should the monitoring wells indicate that groundwater migrates in a southeasterly direction, several residential wells could be affected downgradient of this site. Under existing projected future land-use conditions, no exposure pathways exists for human consumption of degraded groundwater unless it is determined



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 280 - Total DDTR (ppm) ND - Indicates Not Detected ▒ - Building —·—·· - Watercourse Approximate Scale 0 200'	FIGURE 2-3 SUMMARY OF TOTAL PESTICIDES DATA IN SOILS/SEDIMENTS AREA A DOWNSTREAM WATERCOURSE ATLANTIC ENVIRONMENTAL SERVICES, INC.

that there is a southeasterly component of groundwater flow. This scenario will be evaluated based on the results of the Phase II RI. The following paragraphs describe the groundwater contamination detected at the Area A Landfill.

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 three 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 monitoring wells are both bedrock wells. This finding suggests that a low-concentration plume of solvents exists within the bedrock aquifer, extending 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 a review of the groundwater-specific conductivity data 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, the data do 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.

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 three 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. These data suggest 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 hydrocarbon 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). Higher concentrations of cadmium possibly 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; these results indicate a source of these inorganics within the Area A Landfill material and wetland sediments.

3.0 INTERIM REMEDIAL DESIGN

3.1 Interim Remedial Action Objectives

Risk to human health at the Area A Landfill pertains to workers within the landfill and to subase personnel and their dependents who may enter Area A, being exposed to PCBs in surface soil from the Area A Landfill/ Concrete Pad area. The PCBs in the surface soils at the Area A Landfill/Concrete Pad area will be excavated and disposed of during a separate, initial, interim remedial action addressed in the Spent Acid Storage and Disposal Area and Area A Landfill/Concrete Pad Interim Remedial Design Work Plan (Atlantic, October 1993).

The groundwater within Area A contains VOCs and cadmium above ARAR and TBC values, which are based on drinking water standards, guidance values, and health advisories. The objectives of the interim remediation for the Area A Landfill are to reduce infiltration through the landfill, to prevent erosion of landfill surface soils, and to prevent direct contact with landfill materials.

3.2 Final Remediation Actions

The interim remediation for the Area A Landfill consists of the installation of a cap and passive control of surface water and overburden upgradient overburden groundwater to prevent transport of contaminants from landfill soils. Long-term maintenance and groundwater monitoring will be conducted at this site after the interim remediation. The remainder of the work in the Phase II RI work plan for the Area A Landfill consists of the installation of groundwater monitoring wells. The location of the monitoring wells is illustrated in Figure 2-1. The monitoring wells will be sampled periodically to assess site groundwater quality and evaluate groundwater hydrology.

The results of the groundwater chemical analysis will be evaluated to determine if there

is a southeasterly component of groundwater flow from the landfill towards the residential wells and to determine whether any further action is required to remediate groundwater at this site. A groundwater pump-and-treat system may be required at this site to address contaminants detected in groundwater downgradient of the Area A Landfill.

3.3 Evaluation of Alternatives

To document the rationale for selecting the proposed interim remedial action, a focused feasibility study (FFS) will be performed. Additional remedial design data currently are being collected to support the FFS and remedial design efforts. The preliminary evaluation of alternatives presented herein are based on data currently available from the Phase I RI and preliminary work done in preparing a feasibility study based on the Phase I RI. Work on this feasibility study was put on hold, pending completion of the Phase II RI.

Based on the initial screening of technologies and a risk assessment, it was determined that the interim remedial action at this site would consist of the excavation of "hot spots" (i.e., an area of PCB-contaminated soils) and capping of the entire landfill. Remediation of soils containing concentrations of PCBs above the remediation target levels are discussed in a separate design work plan.

Installation of the cap, which is the subject of this work plan, will reduce surface water infiltration through the landfill, prevent erosion of landfill surface soils, and prevent direct contact with landfill materials. Run-on to the landfill will be prevented and runoff from the landfill will be promoted by regrading the surface. A groundwater interceptor trench is being evaluated as part of the design to be constructed upgradient of the landfill to collect any groundwater in the overburden soils to further prevent contact with landfill materials. However, this design will not completely isolate all landfill material from contact with the groundwater

(refer to Figure 2-2).

An evaluation of capping options is presented in the following subsection.

3.3.1 Evaluation of Capping Alternatives

The proposed area to be capped on this site is illustrated in Figure 2-1. This area consists of the known limits of the landfill based on an evaluation of aerial photographs, boring logs, chemical analyses of soils, and the limits of wetlands. The goal is to cap all areas of known contamination located outside of the wetland limits. The landfill is approximately 9.5 acres in area. This area will be better defined after the wetland limits are delineated and the additional geotechnical borings completed. Four capping options were evaluated, based the following parameters:

- cost;
- ability to maintain integrity under current work loads at the site;
- controlling surface water runoff;
- preventing surface erosion;
- preventing infiltration; and
- compliance with ARAR.

The cap design must be consistent with the future, continued operation of the site which includes use for deployed persons parking and lay-down or storage areas. The cap must be capable of supporting heavy equipment while maintaining its structural integrity in some areas. Therefore, all of the evaluated capping alternatives have a surface layer that will vary to suit potential site usage. For example, the upper cap layers will vary among vegetated open spaces, parking areas, driveways, or lay-down areas.

Based on an evaluation of applicable, relevant, and appropriate requirements (ARARs), it was determined that this site, based on its usage and detected contaminants, has been used as a solid waste disposal area. Therefore, any cap at this site should, at a minimum, meet the RCRA guidance regarding closure of solid waste disposal areas. It should be noted that two of

the four alternative cap designs also meet RCRA guidance regarding closure of hazardous waste disposal areas, although we believe they are not an ARAR.

The following capping alternatives were evaluated and are illustrated in Figures 3-1 through 3-4. The advantages, disadvantages, and approximate unit costs for each alternative are also listed in Figures 3-1 through 3-4.

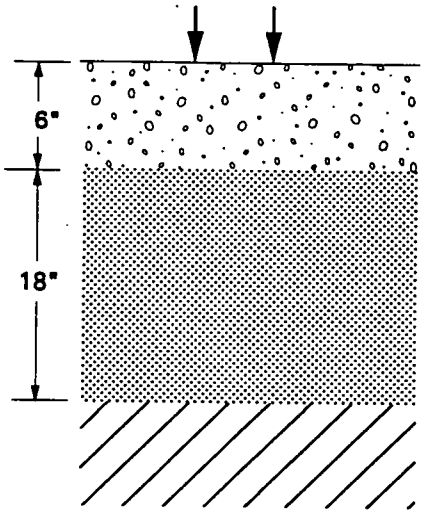
- Alternative #1 (Figure 3-1): RCRA Nonhazardous Waste Landfill Cap.
- Alternative #2 (Figure 3-2): RCRA Hazardous Waste Landfill Cap.
- Alternative #3 (Figure 3-3): Geo-Composite Clay Liner.
- Alternative #4 (Figure 3-4): Bentonite/Flexible Membrane Liner (FML) Composite Liner.

3.3.2 Recommended Capping Design Concept

Atlantic recommends that Alternative 3 be used for capping the site. Alternative 1 does not have an impervious layer to completely prevent infiltration and leachate generation. Alternative 2 uses a recompacted clay layer. Borrow areas for clay meeting the permeability specifications for this recompacted clay layer are not available in Connecticut. Alternatives 3 and 4 are both applicable technologies for capping the site. Alternative 3 is slightly less expensive than Alternative 4 and it is easier to install and repair.

FIGURE 3-1

Evaluation Of Capping Options - Alternative #1
RCRA Non-Hazardous Waste Landfill Cap



EROSION LAYER. EARTHEN MATERIAL CAPABLE OF SUSTAINING NATIVE PLANT GROWTH.

LOW PERMEABILITY LAYER (SILT) < 1×10^{-5} cm/sec

ON-SITE SOILS

ADVANTAGES

- COST
- MEETS RCRA NONHAZARDOUS WASTE LANDFILL CAPPING REQUIREMENTS

DISADVANTAGES

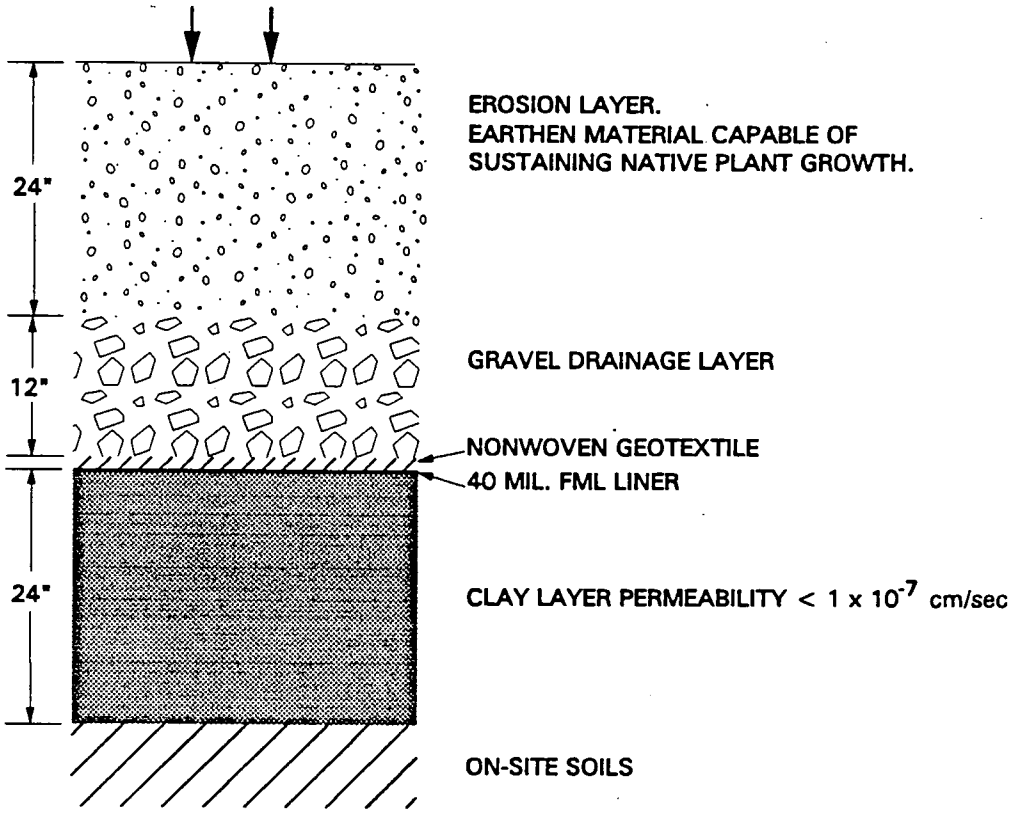
- ALLOWS INFILITRATION TO THE CONTAMINATED SOILS

APPROXIMATE UNIT COST

- $1.20 / SQUARE FOOT
- WITH ASPHALT SURFACE: $2.20 / SQUARE FOOT

FIGURE 3-2

Evaluation Of Capping Options - Alternative #2
RCRA Hazardous Waste Landfill Cap



ADVANTAGES

- MEETS RCRA REQUIREMENTS FOR HAZARDOUS WASTE LANDFILL
- PROVIDES DOUBLE BARRIER FOR INFILTRATION

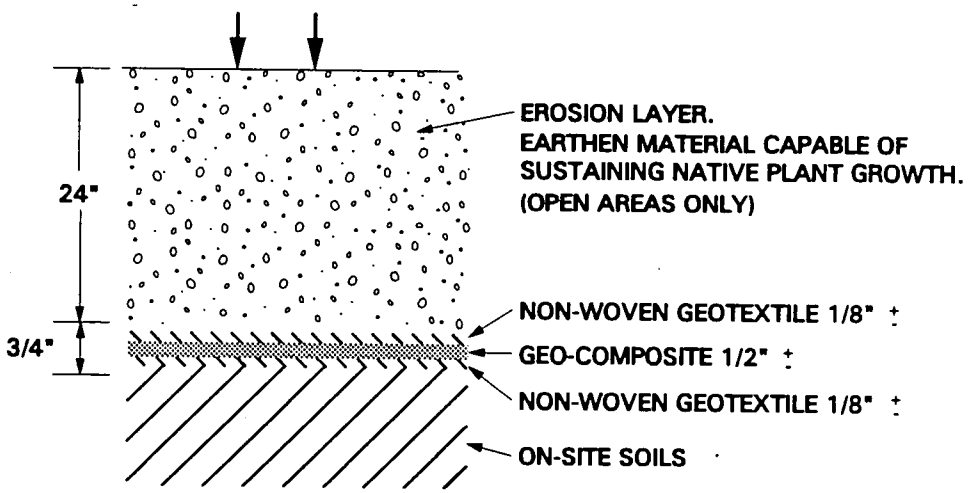
DISADVANTAGES

- COST
- CAP THICKNESS = 48"; REQUIRES SIGNIFICANT GRADING
  MAY NOT BE ABLE TO MEET CURRENT CONDITIONS AND GRADES
- AVAILABILITY OF CLAY IS LIMITED

APPROXIMATE UNIT COST

- $15.30 / SQUARE FOOT
- WITH ASPHALT SURFACE: $16.30 / SQUARE FOOT

FIGURE 3-3
Evaluation Of Capping Options - Alternative #3
Geo-Composite Clay Liner



NOTE: Geo Composite - Clay liner consists of a sodium bentonite clay between woven polypropylene fabric.

ADVANTAGES

- CLAY LINER OFFERS AN IMPERMEABLE LAYER AND IS SELF SEALING FOR SMALL PUNCTURES. (PERMEABILITY = 2×10^{-10} cm/sec)
- EASE OF INSTALLATION
- MEETS RCRA PERFORMANCE CRITERIA
- COST
- EASE OF REPAIR

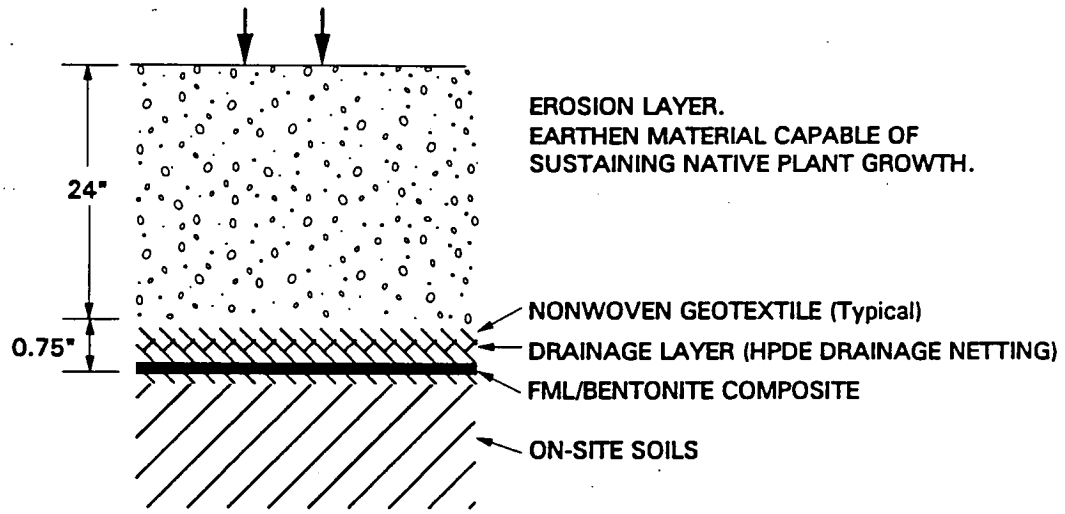
DISADVANTAGES

- DOES NOT CONTAIN DOUBLE BARRIER
- NOT AS STRONG AS FML
- DRAINS LESS EFFICIENTLY THAN WITH DRAINAGE NET AND MEMBRANE

APPROXIMATE UNIT COST

- $2.30 / SQUARE FOOT
- WITH ASPHALT SURFACE: $3.30 / SQUARE FOOT

FIGURE 3-4
Evaluation Of Capping Options - Alternate #4
Bentonite/FML Composite Liner



NOTE: FML / Bentonite Composite Liner consists of a layer of sodium bentonite attached to an Flexible Membrane liner with a non-toxic adhesive. The liner is installed with the bentonite as the upper layer.

ADVANTAGES

- LINER OFFERS IMPERMEABLE LAYER PLUS PUNCTURE PROTECTION WITH BENTONITE LAYER
  (PERMEABILITY; HDPE: 2.7×10^{-13} cm/sec, BENTONITE: 3.7×10^{-10} cm/sec)
- EASE OF INSTALLATION - NO MAJOR REGRADING
- COST
- CONTAINS DOUBLE BARRIER

DISADVANTAGES

- NOT MOST COST EFFECTIVE

APPROXIMATE UNIT COST

- $2.80 / SQUARE FOOT
- WITH ASPHALT SURFACE: $3.80 / SQUARE FOOT

4.0 INTERIM REMEDIATION WORK ITEMS

The interim remediation for this site consists of the excavation and off-site disposal of a small area of PCB-contaminated soils, followed by the placement of a cap over the entire landfill area. The cap design will incorporate grading to promote runoff and prevent run-on, and the design may include the installation of a trench upgradient of the landfill to intercept any groundwater in the overburden materials to prevent this water from contacting landfill materials. Currently, 20 borings are being performed at the limits of the landfill to determine the need for an interceptor trench and aid in the design of runoff collection systems. In addition, to aid in the design of a cap, consolidation tests are being performed on three subsurface soil samples to predict potential settlement of the cap, and a methane gas survey is being performed to determine if methane gas generation is a design concern.

Prior to the start of capping, underground utilities will be located to determine if any conflicts exist or if any rerouting of utilities is required. It is anticipated that, at a minimum, rerouting of existing storm drainage utilities will be required.

The work at the site will be coordinated with the Navy to minimize any interferences with Submarine Base operations. This coordination is particularly important regarding the deployed parking area, existing structures, and existing lay-down areas. Phasing of the construction may be required to allow for the continued operation of this area.

The area where the cap is to be installed will be graded to allow proper drainage of surface runoff and to meet required final surface elevations. The FML liner seams must be sealed during liner installation.

The following design work items will be completed for this interim remedial action.

- Topographical Survey of Existing Conditions
- Utility Locations

- Permit Requirements Investigation
- Geotechnical Borings
- Methane Gas Survey
- Preliminary Design Plans

  - Existing Conditions
  - Final Grades
  - Boring Logs
  - Cap Details
  - Storm Sewer Rerouting Plans and Profiles

- Finalization of Limits of Cap
- Design of Pavement and Site Restoration
- Preparation of Contract Plans and Specifications for Bidding