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SITE MANAGEMENT PLAN NSB NEW LONDON CT  
08/01/2009  
TETRA TECH NUS

# **Site Management Plan**

for

## **Naval Submarine Base New London Groton, Connecticut**



### **Naval Facilities Engineering Command Mid-Atlantic**

**Contract Number N62472-03-D-0057**

**Contract Task Order 134**

August 2009

REVISION 1  
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**SITE MANAGEMENT PLAN  
FOR  
NAVAL SUBMARINE BASE - NEW LONDON  
GROTON, CONNECTICUT**

**COMPREHENSIVE LONG-TERM  
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT**

**Submitted to:  
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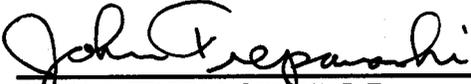
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## ACRONYM LIST

µg/kg	Microgram per kilogram
µg/L	Microgram per liter
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
AS	Air sparging
Atlantic	Atlantic Environmental Services, Inc.
AVS	Acid volatile sulfide
AWQC	Ambient Water Quality Criterion
B&RE	Brown & Root Environmental
BERA	Baseline Ecological Risk Assessment
BGOURI	Basewide Groundwater Operable Unit RI
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CBU	Construction Battalion Unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	Chemical of concern
CTDEP	Connecticut Department of Environmental Protection
CTO	Contract Task Order
DDD	1,1-Dichloro-2,2-bis(4-chlorophenyl)ethane
DDE	1,1-Dichloro-2,2-bis(4-chlorophenyl)ethene
DDT	1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane
DDTR	Total DDT isomers (DDT, DDD, and DDE)
DGI	Data gap investigation
DRMO	Defense Reutilization and Marketing Office
ECC	Environmental Chemical Corporation
EE/CA	Engineering Evaluation/Cost Analysis
Envirodyne	Envirodyne Engineers, Inc.
EPA	United States Environmental Protection Agency
ER	Environmental Restoration
ESD	Explanation of Significant Difference
ESQD	Explosive Safety Quantity Distance
FFA	Federal Facility Agreement
FFS	Focused FS
FS	Feasibility Study
FWEC	Foster Wheeler Environmental Corporation

GMR	Groundwater Monitoring Report
GZA	Goldberg-Zoino & Associates
HI	Hazard Index
HNUS	Halliburton NUS
HQ	Hazard Quotient
IAG	Interagency Agreement
IAS	Initial Assessment Study
ICR	Incremental Cancer Risk
IR	Installation Restoration
LIR	Landfill Inspection Report
LNAPL	Light non-aqueous phase liquid
LTMgt	Long-Term Management
LUC	Land Use Control
MCL	Maximum Concentration Level
mg/kg	Milligram per kilogram
mg/L	Milligram per liter
MWR	Morale, Welfare, and Recreation
NACIP	Naval Assessment and Control of Installation Pollutants
NAVFAC	Naval Facilities Engineering Command
NEESA	Naval Energy and Environmental Support Activity
NESO	Naval Environmental Support Office
NEX	Naval Exchange
NFA	No Further Action
NFESC	Naval Facilities Engineering Service Center
NPL	National Priorities List
NSA	New Source Area
NSB-NLON	Naval Submarine Base - New London
NTCRA	Non-time-critical removal action
O&M	Operations and maintenance
OBDA	Overbank Disposal Area
OBDANE	Overbank Disposal Area Northeast
OHM	OHM Remediation Services Corp.
OU	Operable Unit
OVA	Organic vapor analyzer
PA	Preliminary Assessment
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl

PCE	Tetrachloroethene
PRG	Preliminary remediation goal
QA/QC	Quality Assurance/Quality Control
RA	Remedial Action
RAB	Restoration Advisory Board
RAC	Remedial Action Contractor
RAO	Remedial Action Objective
RC	Response Complete
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RG	Remedial goal
RI	Remedial Investigation
RIP	Remedy in Place
RME	Reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SAIC	Science Application International Corporation
SASDA	Spent Acid Storage and Disposal Area
SEM	Simultaneously extracted metals
SI	Site Inspection
SIAS	Supplement to the Initial Assessment Study
SMP	Site Management Plan
SOPA	Standard Operating Procedure - Administrative
SVE	Soil vapor extraction
SVOC	Semivolatile organic compound
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TCRA	Time-critical removal action
TIE	Toxicity Identification Evaluation
TPH	Total petroleum hydrocarbons
TtECI	Tetra Tech EC, Inc.
TtNUS	Tetra Tech NUS, Inc.
UST	Underground storage tank
VOC	Volatile organic compound
Wehran	Wehran Engineering, Inc.

## 1.0 INTRODUCTION

This Site Management Plan (SMP) for the Naval Submarine Base - New London (NSB-NLON), Groton, Connecticut, was prepared for the United States Department of the Navy by Tetra Tech NUS, Inc. (TtNUS) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract, Contract Number N62467-03-D-0057, Contract Task Order (CTO) 134. The SMP serves as a management tool for planning, reviewing, and setting priorities for environmental investigative and remedial response activities to be conducted at NSB-NLON under the Navy's Installation Restoration (IR) Program, now part of the Environmental Restoration Program (ER) (Navy, 2006a). Ultimately, the SMP serves as the schedule for implementation of the IR Program at NSB-NLON. The SMP is updated regularly to revise priorities and schedules of activities as additional information (including funding availability) becomes available.

This version of the SMP presents the rationale for the sequence of future investigation and remediation activities and the estimated schedule for completion of these activities, with detailed schedules presented through Fiscal Year 2012. The use of an SMP allows for adjustment of scheduled activities for reasons such as federal budgetary constraints, changes in scope of investigation/remediation activities, or other unanticipated events. A Federal Facility Agreement (FFA) has been developed for NSB-NLON that establishes the roles and responsibilities of the Navy, United States Environmental Protection Agency (EPA), and State of Connecticut Department of Environmental Protection (CTDEP) and serves as an Interagency Agreement (IAG) for the completion of all necessary investigation and remedial actions at NSB-NLON (EPA, 1995).

### 1.1 NSB-NLON BACKGROUND

As detailed in the FFA and subsequent documents, NSB-NLON includes approximately 687 acres of real property located on the eastern bank of the Thames River in the Towns of Groton and Ledyard, Connecticut, approximately 6 miles north of Long Island Sound as depicted on Figure 1-1. In addition, NSB-NLON includes the Nautilus Memorial and Navy family housing plans commonly known as Polaris Park, Nautilus Park, Trident Park, Conning Towers, and Dolphin Gardens. These housing plans cover approximately 534 additional acres in Groton and Ledyard.

#### 1.1.1 Base Description

NSB-NLON is bounded on the east by Connecticut Route 12, on the south by Crystal Lake Road, and on the west by the Thames River. The northern border is a low ridge that trends approximately east-southeast from the Thames River to Baldwin Hill.

NSB-NLON currently provides a base command for submarine activities in the Atlantic Ocean. It also provides housing for Navy personnel and their families, support submarine training facilities, military offices, medical facilities, and facilities for submarine maintenance, repair, and overhaul.

Currently, NSB-NLON consists of over 300 buildings on 687 acres. The density of buildings is high along the central bedrock high, in the southern valley, and along the Thames River. In the northern valley are streams, a wetland, and a golf course. The northern bedrock high is not heavily developed except along the southern face at the Area A Weapons Center and Torpedo Shops. The areas on top of northern ridges are wooded and undeveloped.

Land use adjacent to the base is residential and commercial. Residential development along Military Highway, Sleepy Hollow, Long Cove Road, and Pinelock Drive borders the site to the north and extends northward into the Gales Ferry section of Ledyard. Property along Route 12 east of NSB-NLON consists of widely spaced private homes and open, wooded land. Development is mixed commercial and residential farther south on Route 12. This area includes a church, automobile sales and repair facilities, convenience stores, restaurants, and a gas station. Private residences, an automobile service station, and a former dry cleaner are located along the southern side of Crystal Lake Road. Housing for Navy personnel exists farther south of Crystal Lake Road.

### **1.1.2 Base History**

In 1867, the State of Connecticut donated a 112-acre parcel of land on the eastern bank of the Thames River to the Navy. The Navy did not use the property until 1868 when it officially designated the property a Navy Yard. The site was then used to moor small craft and obsolete warships, and served as a coaling station for the Atlantic fleet. The Department of the Navy designated the site a Submarine Base in 1916. During World War I, facilities were expanded extensively; 6 piers and 81 buildings were added. In 1917, a submarine school was established, and in 1918 the Submarine Medical Center was founded.

NSB-NLON underwent another period of growth during World War II. Between 1935 and 1945, the Navy built more than 180 buildings and acquired adjacent land to expand NSB-NLON from 112 to 497 acres. The growth of NSB-NLON continued after World War II. A Medical Research Laboratory was established at the base in 1946.

In 1968, the status of the Submarine School was changed from an activity to a command and became the largest tenant on the base. The Naval Submarine Support Facility was established in 1974, and the Naval Undersea Medical Institute was established the following year.

### 1.1.3 Environmental History

The Navy initiated the Naval Assessment and Control of Installation Pollutants (NACIP) Program on September 11, 1980 to identify and control environmental contaminants from past use and disposal of hazardous substances. Subsequently, the Initial Assessment Study (IAS), [Envirodyne Engineers, Inc. (Envirodyne), 1983], completed in March 1983, identified several potential disposal areas. The results of the IAS lead to the inclusion of NSB-NLON on the Federal Agency Hazardous Waste Compliance Docket on February 12, 1988, the formation of a Technical Review Committee, EPA's proposal for inclusion of NSB-NLON on the National Priorities List (NPL) on October 25, 1989, and finally, the placement of NSB-NLON on the NPL on August 30, 1990.

Previous investigations and enforcement histories for NSB-NLON are summarized as follows:

- Final IAS (Envirodyne, 1983). The purpose of the IAS was to identify and evaluate past waste disposal practices at NSB-NLON and to assess the potential for environmental impacts.
- Installation Restoration (IR) Program, 1986. In response to the growing awareness of the potential effects of hazardous materials on human health and the environment, the United States Department of Defense (DoD) developed the IR Program to investigate and clean up potential problem areas created by past events at federal facilities. The IR Program was the catalyst for environmental investigations at the NSB-NLON. The IR Program was renamed the ER Program in August 2006.
- Verification Study, [Wehran Engineering, Inc. (Wehran), 1988]. The purpose of the Verification Study was to determine whether toxic and hazardous materials identified during the IAS were present on site and to recommend whether additional study was warranted.
- Placement of NSB-NLON on the NPL by the EPA, 1990.
- Phase I Remedial Investigation (RI) NSB-NLON [Atlantic Environmental Services, Inc. (Atlantic), 1992]. In May 1990, Atlantic initiated an IR study of NSB-NLON for the Navy. The scope of work for this IR study included a Phase I RI of the following 11 sites located at NSB-NLON:

Site 1 - Construction Battalion Unit (CBU) Drum Storage Area

Site 2 - Area A (Area Landfill, Area A Wetland, and Area A Downstream Watercourses)

Site 3 - Overbank Disposal Area (OBDA)

Site 4 - Rubble Fill at Bunker A-86

Site 6 – Former Defense Reutilization and Marketing Office (DRMO)

Site 7 - Torpedo Shops

Site 8 - Goss Cove Landfill  
Site 13 - Lower Subbase  
Site 14 - Overbank Disposal Area Northeast (OBDANE)  
Site 15 - Spent Acid Storage and Disposal Area (SASDA)  
Site 18 - Former Gasoline Station

The sites were initially identified and assigned site numbers in the IAS (Envirodyne, 1983).

Elements of this RI report included a review of the physical characteristics of each study area, characterization of the nature and extent of contamination within each study area, characterization of contaminant fate and transport within each study area, and human health and ecological risk assessments of contaminants contained within each of the 11 sites.

- Supplement to IAS (SIAS) (Draft Final) [Naval Facilities Engineering Service Center (NFESC), 1995]. The IAS, prepared for the Naval Energy and Environmental Support Activity (NEESA) by Envirodyne, investigated potential hazardous substance release sites at NSB-NLON (Envirodyne, 1983). An SIAS was prepared in April 1995 by the NFESC following completion of the Phase I and Phase II RIs and a Verification Study (NFESC, 1995). The purpose of the SIAS was to update the IAS for the period between 1983 and 1995. The scope of the SIAS included identification of all hazardous waste storage areas and all releases of hazardous substances within NSB-NLON.

The field team for the SIAS used on-base record searches, site visits, and employee interviews to develop information for the report. The following sites were included in the evaluation:

DRMO, Building 355  
Building 450, OTTO Fuel Wastewater Tank  
Building 450, Drum Storage Area  
Pesticide Use: Golf Course  
Pesticide Use: Public Works  
Transformer at Building 157, Vault 31  
Paint Residue from Repainting Potable Water Tank 99  
Paint Residue from Repainting Potable Water Tank 326  
Paint Residue from Repainting Potable Water Tank 444  
Paint Residue from Repainting Potable Water Tank 452  
Paint Residue from Repainting Potable Water Tank 480  
DRMO Scrap Metal Storage Area  
Hazardous Waste Accumulation Areas

- FFA for NSB-NLON (EPA, 1995). The Navy entered into an FFA with EPA and CTDEP regarding the cleanup of environmental contamination at NSB-NLON. The document was signed by all three parties and became effective on January 11, 1995. The FFA established the roles and responsibilities of each agency, set deadlines for the investigation and cleanup of hazardous waste sites, and established a mechanism for the resolution of disputes among the agencies.
- Phase II RI [B&R Environmental (B&RE), 1997b]. A Phase II RI for 13 sites at NSB-NLON was completed by B&RE for the Navy. The 13 sites included 10 of the 11 sites investigated during the Phase I RI, the Thames River, and the Area A Weapons Center (Site 20). Site 18, the Former Gasoline Station, was not investigated in the Phase II RI, but it was generally discussed for informational purposes. According to the Navy, the designation for Site 18 was changed to refer to the Solvent Storage Area (Building 33), as presented in the Phase II RI Report, and not to the Former Gasoline Station, as presented in the Phase I RI Report (Atlantic, 1992).

The Phase II RI was conducted to further develop the elements of the Phase I RI, including the physical characteristics, nature and extent of contamination, contaminant fate and transport, and risk assessments (human health and ecological) for each of the sites. Remedial Action Objectives (RAOs) were identified for each of the sites in the Phase II RI Report. These objectives were used to support No Further Action (NFA), further characterization, or Feasibility Study (FS) recommendations for sites.

- Lower Subbase RI (TtNUS, 1999b). The Lower Subbase RI was completed by TtNUS for the Navy on seven distinct zones of the Lower Subbase at NSB-NLON. Each zone included various IR Program sites. The zones and sites included in the investigation are as follows:
  - Zone 1: Site 10 - Fuel Storage Tanks and Tank 54-H; Site 11 - Power Plant Oil Tanks; Building 89 UST; and the Fuel Pipeline and Steam and Condensate Lines
  - Zone 2: Fuel Pipeline and Steam and Condensate Lines
  - Zone 3: Site 17 - Hazardous Materials/Solvent Storage Area (Building 31) and the Fuel Pipeline and Steam and Condensate Lines
  - Zone 4: Site 13 - Building 79 Waste Oil Pit; Site 19 - Solvent Storage Area (Building 316); the Quay Wall Study Area; and the Fuel Pipeline and Steam and Condensate Lines

- Zone 5: Site 22 - Pier 33, Building 175 (Battery Acid Aboveground Storage Tanks) and adjacent property
- Zone 6: Site 24 - Central Paint Accumulation Area (Building 174)
- Zone 7: Site 21 - Berth 16; Site 25 - Classified Materials Incinerator; Transformers at Building 157, Vault 31.

The objectives of the investigation, performed in October and November 1997, were to characterize the subsurface conditions at the Lower Subase, to further characterize the quality of the sediment in the Thames River adjacent to the Lower Subase, and to provide data pertinent to identifying site-specific remedial alternatives.

The data collected during this RI, in conjunction with data collected from previous investigations, were used to identify sources of soil and groundwater contamination, define major contaminant migration pathways, define the nature and extent of contamination within groundwater and soils at seven zones of investigation within the Lower Subase, to define the nature and extent of contamination in sediments of the adjacent Thames River, to provide supplemental data to develop a revised human health risk assessment, to provide supplemental data to develop a revised screening-level ecological risk assessment for the Thames River, and to provide sufficient information to identify proper recommendations for future action at each zone under the IR Program.

- Basewide Groundwater Operable Unit RI (BGOURI) (TtNUS, 2002a). The BGOURI was conducted by TtNUS for the Navy. Ten IR Program sites (Sites 2, 3, 7, 8, 14, 15, 16, 18, 20, and 23) were included in the BGOURI, and the fieldwork for the BGOURI was conducted from June to August 2000. The objectives of the investigation were to further characterize the nature and extent of contamination and hydrogeologic conditions within the groundwater aquifers at each site, to further characterize the nature and extent of soil contamination at Site 7, to perform preliminary investigations at two sites (Sites 16 and 18), to determine background groundwater conditions, to determine human health risks associated with each site, to identify and evaluate the factors affecting organic and inorganic contaminant migration, and to provide data pertinent to identifying potential site-specific remedial alternatives (e.g., natural attenuation).

The following recommendations were made in the BGOURI Report:

- NFA is required for Site 7 soil and for Sites 16 and 18.
  - An FS should be completed for groundwater at Sites 3, 7, 14, 15, and 20.
  - The existing groundwater monitoring programs for Sites 2, 8, and 23 should continue until sufficient data are collected to characterize the sites.
- 
- BGOURI Update/FS (TtNUS, 2004). The BGOURI Update/FS included a data gap investigation (DGI), an update of the RI based on the results of the DGI, and FSs for Site 3 soil, Sites 3 and 7 groundwater, and Site 7 soil and groundwater. Although Site 7 soil was not recommended for an FS in the BGOURI, subsequent discussions between the Navy and regulators resulted in the decision to evaluate both soil and groundwater as part of the Site 7 FS to verify that migration from soil to groundwater was not occurring. The DGI was conducted by TtNUS for the Navy in October 2002 at Sites 3, 15, and 20 prior to proceeding with FSs for these and other sites. One objective of the DGI was to collect additional data to address unresolved nature and extent of contamination issues identified in the BGOURI. Another objective was to characterize Site 3 - New Source Area (NSA), a new site identified during the remediation of contaminated sediment in Stream 5 of the Area A Downstream Watercourses. The results of the updated BGOURI indicated that there was no need to modify the existing Records of Decisions (RODs) for soil at Sites 15 and 20. In addition, the report recommended NFA for groundwater at Sites 14, 15, and 20, preparation of FSs for soil at Site 3 - NSA and Site 7, and preparation of an FS for groundwater associated with Sites 3 and 7. The FSs for Site 3 soil, Sites 3 and 7 groundwater, and Site 7 soil and groundwater were subsequently completed as part of the BGOURI Update/FS.
  
  - Investigation of the Thames River. Battelle conducted an investigation of Thames River sediment that included sampling and ecological risk evaluations for Zones 4 and 7 and a new site at Pier 1. The Pier 1 site was identified based on the results of sampling conducted in the area by SAIC in 1999 and by the Navy in association with the siting of the Controlled Industrial Facility Building. Battelle completed a Rapid Sediment Characterization Pilot Study in 2003 to supplement existing data in the area, and a Validation Study was completed in 2008 to evaluate potential ecological impacts due to contaminant migration from onshore source areas or activities associated with the berthing of submarines and ships in the pier areas. The results of the Validation Study were used to develop a Baseline Ecological Risk Assessment (BERA). The results of the BERA were used to develop cleanup goals for remedial alternatives being developed as part of the Lower Subbase FS. The Pier 1 site will be incorporated into Zone 4 of the Lower Subbase, the zone in closest proximity, for future evaluations.

In addition to these investigation documents, numerous other documents have been generated for the ER Program at NSB-NLON. Because of the large number of documents, they are not discussed in detail in this section. Appropriate references to these additional documents are provided in Sections 2.0.

## **1.2 SMP SITES**

Although various site designation numbers have been used in the past, an updated site designation list has been established for NSB-NLON. These designations were originally defined during the Phase II RI and have been used during subsequent activities, including this SMP. The site number does not imply that the site is an Area of Concern (AOC). The following sites are addressed in this SMP (see Figure 1-2):

- Site 1 - CBU Drum Storage Area
- Site 2 - Area A Landfill and Area A Wetland
- Site 3 - Area A Downstream Water Courses/OBDA Pond and OBDA
- Site 4 - Rubble Fill Area at Bunker A-86
- Site 6 – Former DRMO
- Site 7 - Torpedo Shops
- Site 8 - Goss Cove Landfill
- Site 9 - Oily Wastewater Tank (OT-5)
- Site 10 - Lower Subbase - Fuel Storage Tanks and Tank 54-H
- Site 11 - Lower Subbase - Power Plant Oil Tanks
- Site 13 - Lower Subbase - Building 79 Waste Oil Pit
- Site 14 - OBDANE
- Site 15 - SASDA
- Site 16 - Hospital Incinerators
- Site 17 - Lower Subbase - Hazardous Materials/Solvent Storage Area (Building 31)
- Site 18 - Solvent Storage Area (Building 33)
- Site 19 - Lower Subbase - Solvent Storage Area (Building 316)
- Site 20 - Area A Weapons Center
- Site 21 - Lower Subbase - Berth 16
- Site 22 - Lower Subbase - Pier 33
- Site 23 - Fuel Farm
- Site 24 - Lower Subbase - Central Paint Accumulation Area (Building 174)
- Site 25 - Lower Subbase - Classified Materials Incinerator

Site 5 (Hazardous Waste Storage Facility at Bunker A-85) is not addressed in this SMP because activities at the site were conducted under the Resource Conservation and Recovery Act (RCRA) Part A Permit for

NSB-NLON. Site 12 (Building 428 Gas Tanks) is also not addressed in this SMP because it is not a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site and was evaluated under the CTDEP's RCRA Underground Storage Tank (UST) Program.

Soil and groundwater at Site 23 (Fuel Farm) are addressed in Section 2.0 of this SMP. However, the soil was investigated and remediated under CTDEP's RCRA UST Program and is not discussed in subsequent sections of this SMP. Groundwater at Site 23 was investigated under CERCLA as part of the BGOURI and is therefore included in the remaining sections of this SMP. The groundwater at Site 9, which is located within Site 23, is being collectively investigated with the Site 23 groundwater.

Medium-specific Operable Units (OUs) have also been defined for ER Program sites, as listed in Table 1-1.

Because of the investigations and remedial actions completed at NSB-NLON under the ER Program, the sites are in various phases of the Site Closeout process [e.g., NFA, Remedy in Place (RIP), or Response Complete (RC)]. An RIP determination requires that RA construction is complete for a site and that the remedy is functioning as designed. An RC designation signifies that cleanup goals have been met. Sites classified as RC are those for which a DOD component deems that NFA is required, with the possible exception of long-term management (LTMgt). An RC determination requires that one of the following apply: (1) there is no evidence that contaminants were released at the site, (2) no contaminants were detected at the site other than at background concentrations, (3) contaminants attributable to the site are less than action levels used for risk screening, (4) the results of a baseline risk assessment demonstrate that cumulative risks posed by the site are less than established thresholds, or (5) removal and/or RAOs at a site have been implemented, completed, and are the final action for the site. Activities for LTMgt include operations, maintenance and monitoring. The Site Closeout phase for each ER Program site is provided in Table 1-1.

### **1.3 REPORT ORGANIZATION**

The SMP is organized as follows:

- Section 1.0 consists of this introduction.
- Section 2.0 describes the history and status of each site at NSB-NLON.
- Section 3.0 presents the sequence of activities and target dates for primary and secondary documents along with a discussion of their development.
- Section 4.0 provides the names and responsibilities of cleanup team members.

References for in-text citations are provided in the reference section following Section 4.0.

A description of Appendix A is as follows:

- Appendix A presents the Summary and Detailed Schedules.

**TABLE 1-1**

**SITE CLOSEOUT STATUS OF IR PROGRAM SITES  
2009 SITE MANAGEMENT PLAN  
NSB-NLON, GROTON, CONNECTICUT  
PAGE 1 OF 2**

<b>Site/Zone</b>	<b>Medium</b>	<b>Operable Unit</b>	<b>Site Closeout Phase</b>
Site 1 – CBU Drum Storage Area	Soil	OU1	RC, NFA
Site 2 – Area A Landfill and Wetland	Soil	OU1	RIP, LTMgt
	Groundwater	OU9	RIP, LTMgt
	Wetland Sediment	OU12	RI/FS
Site 3 – Area A Downstream Watercourses and OBDA	Soil and Sediment	OU3	RC
	OBDA Debris	OU3	RC
	NSA Soil	OU3	RC, NFA <sup>(1)</sup>
	Groundwater	OU9	RIP, LTMgt
Site 4 – Rubble Fill at Bunker A-86	Soil	OU10	RC, NFA
Site 6 – DRMO	Soil	OU2	RIP, LTMgt
	Groundwater	OU2	RIP, LTMgt
Site 7 – Torpedo Shops	Soil	OU8	RC
	Groundwater	OU9	RC
Site 8 – Goss Cove Landfill	Soil	OU5	RIP, LTMgt
	Sediment and Surface Water	OU5	RC, NFA
	Groundwater	OU5	RIP, LTMgt
Site 9 – Oily Wastewater Tank OT-5	Soil	ND	RC
	Groundwater	OU9	RIP, LTMgt
Site 10/Zone 1 – Lower Subbase – Fuel Storage Tanks and Tank 54-H	Soil	OU4	RI/FS
	Groundwater	OU4	RI/FS
	Thames River Sediment	OU4	RI/FS
Site 11/Zone 1 – Lower Subbase – Power Plant Oil Tanks	Soil	OU4	RI/FS
	Groundwater	OU4	RI/FS
	Thames River Sediment	OU4	RI/FS
Site 13/Zone 4 – Lower Subbase – Building 79 Waste Oil Pit	Soil	OU4	RI/FS
	Groundwater	OU4	RI/FS
	Thames River Sediment	OU4	RI/FS
Site 14 – OBDANE	Soil	OU8	RC, NFA
	Groundwater	OU9	RC, NFA
Site 15 – SASDA	Soil	OU6	RC, NFA
	Groundwater	OU9	RC, NFA
Site 16 – Hospital Incinerators	Soil	OU11	RC, NFA

**TABLE 1-1**

**SITE CLOSEOUT STATUS OF IR PROGRAM SITES  
2009 SITE MANAGEMENT PLAN  
NSB-NLON, GROTON, CONNECTICUT  
PAGE 2 OF 2**

<b>Site/Zone</b>	<b>Medium</b>	<b>Operable Unit</b>	<b>Site Closeout Phase</b>
Site 17/Zone 3 – Lower Subbase – Hazardous Materials/Solvent Storage Area (Building 31)	Soil	OU4	RI/FS
	Groundwater	OU4	RI/FS
	Thames River Sediment	OU4	RI/FS
Site 18 – Solvent Storage Area (Building 33)	Soil	OU11	RC, NFA
	Groundwater	OU9	RC, NFA
Site 19/Zone 4 – Lower Subbase – Solvent Storage Area (Building 316)	Soil	OU4	RI/FS
	Groundwater	OU4	RI/FS
	Thames River Sediment	OU4	RI/FS
Site 20 – Area A Weapons Center	Soil and Sediment	OU7	RC
	Groundwater	OU9	RC, NFA
Site 21/Zone 7 – Lower Subbase – Berth 16	Soil	OU4	RI/FS
	Groundwater	OU4	RI/FS
	Thames River Sediment	OU4	RI/FS
Site 22/Zone 5 – Lower Subbase – Pier 33	Soil	OU4	RI/FS
	Groundwater	OU4	RI/FS
	Thames River Sediment	OU4	RI/FS
Site 23 - Fuel Farm	Groundwater	OU9	RIP, LTMgt
Site 24/Zone 6 – Lower Subbase – Central Paint Accumulation Area (Building 174)	Soil	OU4	RI/FS
	Groundwater	OU4	RI/FS
	Thames River Sediment	OU4	RI/FS
Site 25/Zone 7 – Classified Materials Incinerator	Soil	OU4	RI/FS
	Groundwater	OU4	RI/FS
	Thames River Sediment	OU4	RI/FS

FS – Feasibility Study.

GM – Groundwater monitoring.

LTMgt – Long-Term Management.

NFA – No Further Action.

OU – Operable Unit.

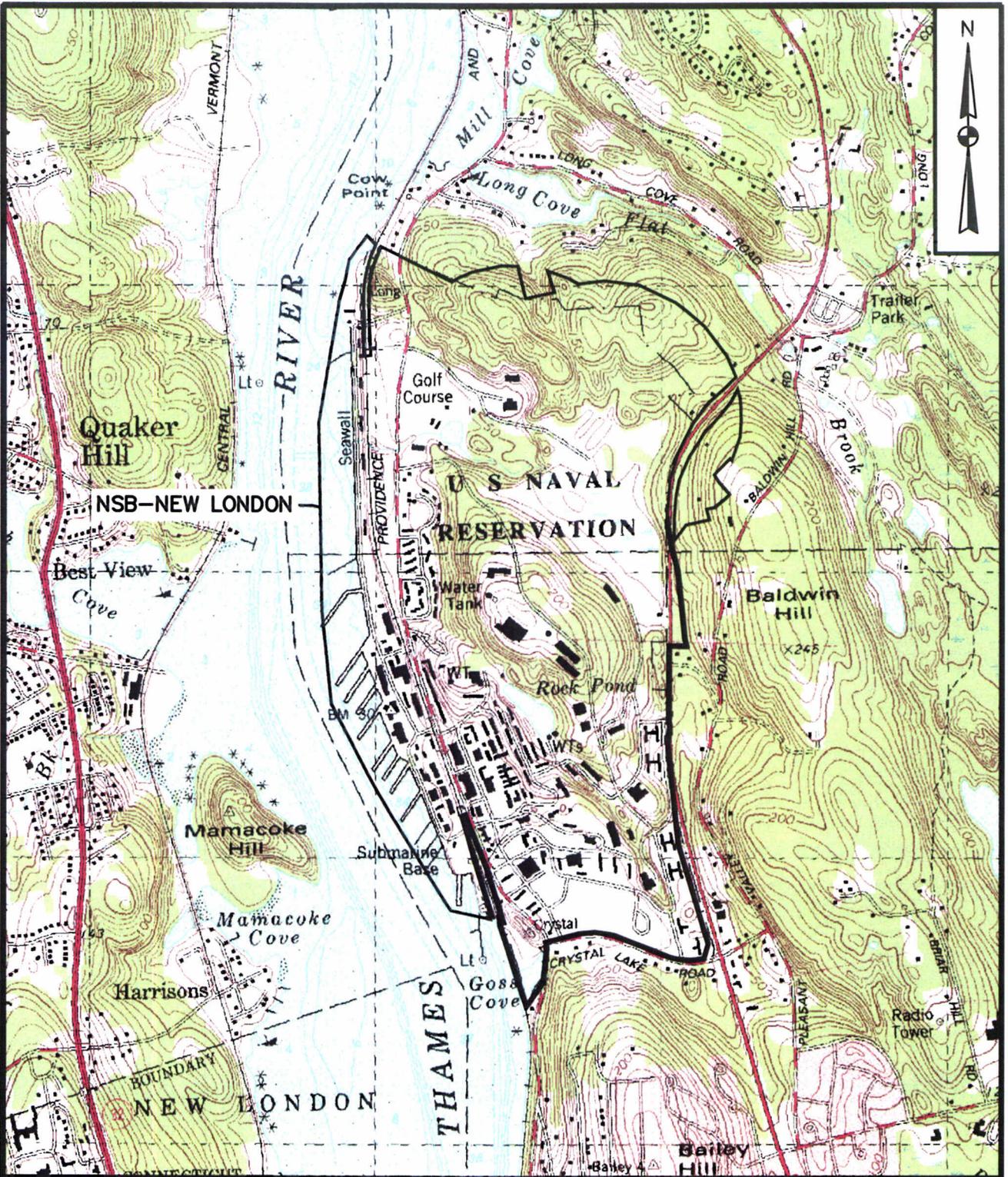
RC – Response Complete.

RI – Remedial Investigation.

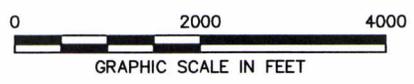
RIP – Remedy In Place.

ND – Not determined.

1 Petroleum-contaminated soil being addressed under applicable Connecticut Department Environmental Protection regulations.



SOURCE: USGS QUADRANGLE MAP UNCASVILLE, CONNECTICUT, 1984

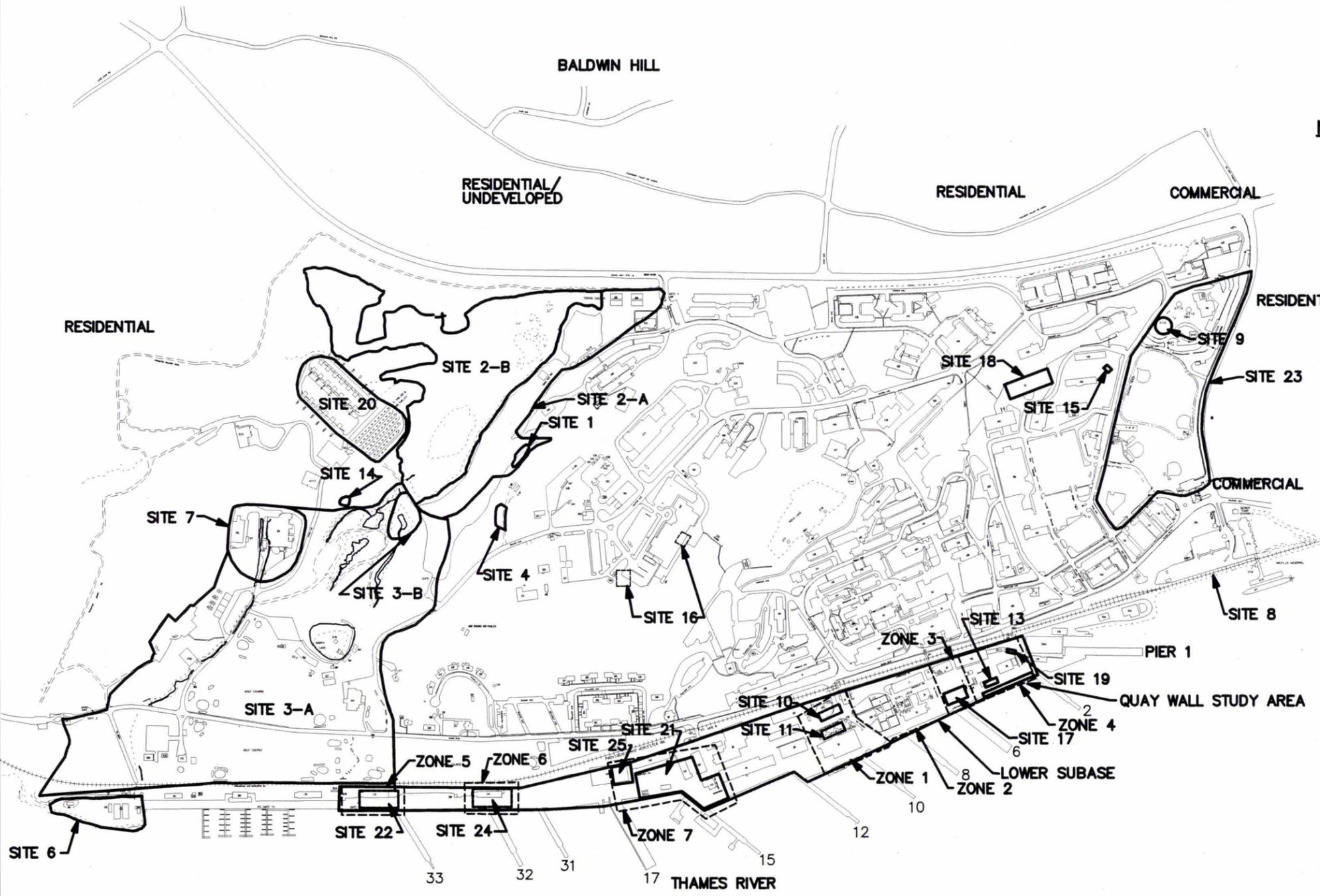


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NUS, Inc.

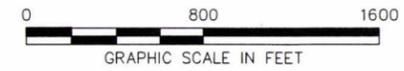
FACILITY LOCATION MAP  
NSB-NLON, GROTON, CONNECTICUT

CONTRACT NO. 0811	
OWNER NO.	
APPROVED BY <i>CAC</i>	DATE 11/4/08
DRAWING NO. FIGURE 1-1	REV. 0



**NOTES:**

1. SITE AND STUDY AREA LOCATIONS WERE TAKEN FROM THE FOLLOWING REPORTS:
  - FEDERAL FACILITY AGREEMENT UNDER CERCLA 120, NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT
  - FINAL INITIAL ASSESSMENT STUDY (ENVIRODYNE, MARCH 1983)
  - HYDROGEOLOGIC INVESTIGATION UNDERGROUND STORAGE TANKS OT-4, OT-7, OT-8, OT-9, AND 54-H (FUSS & O'NEILL, SEPTEMBER 1989)
  - PHASE I REMEDIAL INVESTIGATION (ATLANTIC, AUGUST 1992)
  - SITE CHARACTERIZATION REPORT FOR OT-10, BUILDING 325, AND BUILDING 89 (HNUS, APRIL 1995)
  - DRAFT FINAL SUPPLEMENT TO INITIAL ASSESSMENT STUDY (NAVAL FACILITIES ENGINEERING SERVICE CENTER, APRIL 1995)
  - REMOVAL SITE EVALUATION FOR QUAY WALL (HNUS, MAY 1995)
2. SITE AND STUDY AREA BOUNDRIES ARE APPROXIMATE.
  - SITE 1 - CONSTRUCTION BATTALION UNIT (CBU) DRUM STORAGE AREA
  - SITE 2 - (A) AREA A LANDFILL AND (B) AREA A WETLAND
  - SITE 3 - (A) AREA A DOWNSTREAM WATER COURSES AND (B) OVERBANK DISPOSAL AREA (OBDA)
  - SITE 4 - RUBBLE FILL AREA AT BUNKER A-86
  - SITE 6 - FORMER DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO)
  - SITE 7 - TORPEDO SHOPS
  - SITE 8 - GOSS COVE LANDFILL
  - SITE 9 - OILY WASTEWATER TANK (OT-5)
  - SITE 10 - LOWER SUBBASE-FUEL STORAGE TANKS AND TANK 54-H
  - SITE 11 - LOWER SUBBASE-POWER PLANT OIL TANKS
  - SITE 13 - LOWER SUBBASE-BUILDING 79 WASTE OIL PIT
  - SITE 14 - OVERBANK DISPOSAL AREA NORTHEAST (OBDANE)
  - SITE 15 - SPENT ACID STORAGE AND DISPOSAL AREA (SASDA)
  - SITE 16 - HOSPITAL INCINERATORS
  - SITE 17 - HAZARDOUS MATERIALS/SOLVENT STORAGE AREA (BUILDING 31)
  - SITE 18 - SOLVENT STORAGE AREA (BUILDING 33)
  - SITE 19 - SOLVENT STORAGE AREA (BUILDING 316)
  - SITE 20 - AREA A WEAPONS CENTER
  - SITE 21 - BERTH 16
  - SITE 22 - PIER 33
  - SITE 23 - FUEL FARM
  - SITE 24 - CENTRAL PAINT ACCUMULATION AREA (BUILDING 174)
  - SITE 25 - LOWER SUBBASE-CLASSIFIED MATERIALS INCINERATOR



BASE MAP SOURCE: PREPARED BY THE NAVAL SUBMARINE BASE PUBLIC WORKS DEPT., ENGINEERING DIVISION. MARCH 2006, DRAWING NO. A-667.

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SCALE	AS NOTED



SITE LOCATION MAP  
NSB-NLON, GROTON, CONNECTICUT

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## 2.0 SITE DESCRIPTIONS AND GROUPINGS

This section presents a brief history and status for each site addressed in this SMP. Site-specific information is provided in text form, and site maps are provided as Figures 2-1 through 2-21.

### 2.1 SITE DESCRIPTIONS

#### 2.1.1 Site 1 - Construction Battalion Unit Drum Storage Area

The CBU Drum Storage Area was an unpaved area located in the northern section of NSB-NLON, adjacent to the deployed personnel parking lot and within the boundary of the Area A Landfill. Figure 2-1 provides the general arrangement of the previous site location. The previous site location with respect to other IR sites at NSB-NLON is shown on Figure 1-2. The site was situated on a flat, open area at the base of a wooded hillside that sloped to the northeast toward the site at a 25 percent grade. The site was approximately 15 feet in width by 30 feet in length.

Twenty-six 55-gallon drums of waste oil, lubricating oil, and paint materials were observed at the site during the 1982 IAS (Envirodyne Engineers, Inc. [Envirodyne], 1983). Some of the drums were reportedly leaking at that time. The IAS report concluded that the site had not been used for several years. The site was inspected on October 20, 1988, and two 55-gallon drums labeled as engine oil were observed. No surface soil staining or stressed vegetation was evident. The drums noted in the IAS report were reportedly removed and properly disposed by the Navy; the two drums observed in 1988 were also subsequently removed.

Phase I and Phase II RIs were conducted at Site 1. During the Phase II RI (B&RE, 1997b), it was determined that soil and groundwater samples collected in the vicinity of the site had relatively low concentrations of contaminants. Volatile organic compounds (VOCs) were detected in soil samples at concentrations less than or equal to 380 micrograms per kilograms ( $\mu\text{g}/\text{kg}$ ). Only two VOCs (chlorobenzene and total xylenes) were detected in groundwater at concentrations of 12 and 24 micrograms per liter ( $\mu\text{g}/\text{L}$ ), respectively. All semivolatile organics compounds (SVOCs) in groundwater were detected at concentrations less than or equal to 31  $\mu\text{g}/\text{L}$ .

The human health risk assessment (B&RE, 1997b) concluded that the Incremental Cancer Risks (ICRs) for the stated exposure scenario did not exceed the EPA acceptable risk range ( $1 \times 10^{-4}$  to  $1 \times 10^{-6}$ ). The evaluation of noncarcinogenic risk potential revealed that adverse effects were unlikely for the stated exposure scenarios.

It was also determined during the Phase II RI that the potential for this site to impact ecological receptors was low. Although the ecological risk assessment (B&RE, 1997b) concluded that contaminants associated with this site could adversely impact terrestrial vegetation, soil invertebrates, and terrestrial vertebrates, the calculations were performed using highly conservative estimates. Furthermore, the site was relatively small in areal extent and was characterized by compacted soil that supports limited vegetation and terrestrial species. Therefore, Site 1 did not provide a significant habitat for ecological receptors.

Historically, surface drainage from the CBU Drum Storage Area flowed northeast across the unpaved deployed parking lot [which covered a portion of the Area A Landfill (Site 2A)] and into the Area A Wetland (Site 2B) via a catch basin and storm sewer located approximately 40 feet northeast of the CBU Drum Storage Area. Groundwater in this area flows in a northeasterly direction toward Area A Wetland (B&RE, 1997b). Because of the relatively low concentrations of detected contaminants, immobile nature of these contaminants within the soil matrix, and lack of contamination detected in groundwater, NFA was recommended for this site. The groundwater at this site was investigated as part of the Area A Landfill Groundwater Monitoring Program and the BGOURI (TtNUS, 2002a).

An NFA Decision Document for this site was signed by the Navy and regulators in September 1996 (EPA, 1996). This document removed the CBU Drum Storage Area from further consideration under the IR Program process and changed the status of this site to RC. Although no Remedial Actions (RAs) were implemented specifically for Site 1, the site was covered by a low-permeable cap that was constructed over the Area A Landfill (Site 2A), which encompasses Site 1. Construction of this cap system was completed in September 1997.

A well inventory was conducted at NSB-NLON in 2007. This inventory included one Site 1 well (TtNUS, 2007a). The Site 1 well was not part of an active monitoring program and was abandoned in December 2007 (ECC, 2007).

### **2.1.2 Site 2 - Area A Landfill and Area A Wetland**

#### **Site 2A - Area A Landfill**

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. Figure 2-2 shows the location of the Area A Landfill. The location of Site 2 relative to other IR sites is shown on Figure 1-2.

According to the IAS Report (Envirodyne, 1983), the landfill opened sometime before 1957. However, a 1957 aerial photograph shows no apparent landfiling, which may indicate a somewhat later start-up date.

All combustible materials generated by base operations that were not salvageable were incinerated, and the residues were disposed in the Site 6 (former DRMO), Site 8 (Goss Cove), and Site 2 (Area A) Landfills. The base incinerator, which was located in the Lower Subbase along the waterfront at the present location of Building 478, ceased operation in 1963. From 1963 to 1973, refuse and debris were disposed in the Area A Landfill. Landfilling operations ceased in 1973. The thickness of the landfill materials is estimated to range from 10 to 20 feet based on test boring data.

The area fill method was reportedly used in landfill operations. New refuse was dumped along the face of previously deposited refuse and covered with earth. The cover material used on the landfill was sand and gravel obtained from the Groton water supply reservoir. After closure, a concrete pad was constructed in the southwestern portion of the landfill, adjacent and to the northeast of Building 373, for above-ground storage of industrial wastes. Up to the time of the remedial action (RA) at the Area A Landfill, the pad was still in existence. In the early 1980s, 42 steel drums, 87 transformers [mineral oil and polychlorinated biphenyl (PCB)], and 60 to 80 electrical switches were found to be stored on the pad. Two transformers and several electrical switches were reported to be leaking in the IAS, and past leakage of oil was also evident. Most drums were stacked on wooden pallets, and those having PCB labels were covered and bound with plastic sheeting. All these materials were subsequently properly disposed off site.

The IAS report indicated that refuse, including steel drums, oxygen candles, wood and metal scrap, concrete, and tires, was exposed at the edge of the landfill adjacent to the wetland. The IAS report also stated that petroleum compounds had recently been poured from containers at two locations in the northwestern portions of the landfill and had flowed into the Area A Wetland. According to the report, when batteries were overhauled, spent sulfuric acid solution was transferred to barrels and transported to the Area A Landfill for disposal. The acid was poured into trenches dug with a bulldozer and subsequently covered with soil. Based on records, established policy, and interviews, the potential for radioactive material having been disposed on site is considered to be effectively zero.

During a 1988 inspection of the site, iron floc was observed along the toe of the slope of the landfill, extending from the dike to the eastern end of the deployed parking lot. Iron floc occurs when groundwater with high concentrations of iron discharges to an oxygen-rich environment. Bacteria use the iron and oxygen to form the orange iron floc. The slope of the landfill had been covered with fill, and waste material in the landfill was not visible. Sand bags, salt, supplies, and equipment were stored on top of the landfill. Several transformers, USTs, crane weights, and other equipment were previously stored on the concrete pad in the southwestern portion of the landfill.

A two-phase RI was conducted to determine the nature and extent of contamination at the Area A Landfill. The Phase I RI field investigation was conducted from 1990 to 1992 (Atlantic Environmental

Services, Inc. [Atlantic], 1992) and consisted of test borings, monitoring well installation, and soil and groundwater sampling. Landfill materials encountered included glass, brick, wood, plastic, and ash intermixed with sand and gravel material used as cover. The Phase I RI concluded that several risk exposure scenarios exceeded acceptable regulatory levels and that a FS should be performed for the Area A Landfill site.

The Phase II RI field investigation was conducted from 1993 to 1995 (B&RE, 1997b) and consisted of test borings, monitoring well installation, and soil and groundwater sampling. The Phase II RI concluded that shallow groundwater contamination (i.e., VOCs, PCBs, and inorganics) exists at the site, that landfill soil may pose a threat to human receptors due to concentrations of PCBs, and that chemicals in soil could adversely impact ecological receptors. The Phase II RI recommended that, in addition to the installation of the landfill cover system, institutional controls including access/use restrictions and groundwater monitoring should be implemented at the site.

A Focused FS (FFS) for the Area A Landfill (Atlantic, 1995c) was completed in response to the recommendations of the Phase I and Phase II RIs. The FFS evaluated several remedial alternatives and concluded that the off-site disposal and off-site incineration alternatives would provide superior protection of the environment but that the capping alternative would be more cost effective than the incineration alternative. The capping alternative was selected as the preferred remedial alternative for the Area A Landfill soil OU. The alternative was presented in the Proposed Plan for the Area A Landfill soil OU in June 1995 (Atlantic, 1995d) and was formally selected in the ROD signed in September 1995 (Atlantic, 1995e).

An RA, which involved the construction of a low-permeability cover system over the landfill area, was performed at the Area A Landfill. The final cover system was constructed from March 3, 1997 through September 5, 1997 (B&RE, 1996b and 1998b). The CBU Drum Storage Area (Site 1) and the Rubble Fill Area at Bunker A-86 (Site 4) were also addressed during the RA at the Area A Landfill. Site 1, formerly located within the boundary of the Area A Landfill, was capped at the same time as the landfill. Site 4 was located along the southern boundary of the Area A Landfill. Construction debris and contaminated soil and sediment from the site were removed as part of a time-critical removal action (TCRA) and incorporated into the Area A Landfill subgrade.

The analytical results from Year 1, Round 4 of the post-RA monitoring program were evaluated in the BGOURI Report (TtNUS, 2002a), and the report recommended that the monitoring program be continued to gather data to evaluate long-term trends in contaminant concentrations and that the decision to proceed to an FS should be made after sufficient data have been collected and evaluated. The Site 2 human health risk assessment performed during the BGOURI evaluated potential risks from exposures to

groundwater by construction workers. The risk assessment determined that risks for construction workers were within acceptable levels. The risk assessment was updated in a 2008 memorandum to account for current risk assessment guidance and Year 7 sampling results. The assessment confirmed that risks to construction workers exposed to groundwater would be acceptable; however, the assessment showed that there are potential risks to hypothetical residents that would exceed EPA and CTDEP acceptable levels if groundwater is used as a drinking water supply. These risks are mitigated by the existing institutional controls that prohibit residential development of Site 2. Potential risks resulting from volatilization of chemicals from groundwater and the migration through building foundations into indoor air were also evaluated. Using the EPA and CTDEP screening criteria, concentrations of chloroform, tetrachloroethene (PCE), and trichloroethene (TCE) exceeded the EPA screening criteria and they were further evaluated using EPA's Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks and hazard indices for residential and industrial scenarios were within EPA and CTDEP acceptable levels and vapor intrusion is not an issue at Site 2 (Navy, 2008b).

Over time, VOCs, pesticides, and PCBs have been eliminated from the groundwater and surface water monitoring program due to lack of detection of these compounds. Temporal plots of dissolved arsenic, chromium, copper and zinc concentrations in the Year 8 Groundwater Monitoring Report (GMR) indicated that the concentrations of these chemicals of concern (COCs) have remained relatively constant through time in the downgradient wells (ECC, 2008m). The results of the statistical analysis in the Year 8 GMR confirmed the results of the Year 3 geochemical investigation and showed that the concentrations of arsenic, chromium, and zinc detected in downgradient monitoring wells completed in dredge spoil are related to the dredge spoil and not the landfill (ECC, 2008m). In the downgradient wells that were not installed in dredge spoil, that is, those wells west of the dike, the only exceedances of groundwater criteria during Years 1 through 8 were dissolved zinc in Year 1 and phenanthrene in Year 2. There have been no exceedances of surface water criteria in the downgradient seep west of the dike since Year 3. Overall, the results of 8 years of monitoring indicate that the cap system is working properly and that significant contaminant migration from the site to surrounding areas is not occurring.

In the Year 9 GMR, the most recent year for which data is available, temporal plots showed a surprising and anomalous increase in arsenic and lead concentrations for Year 9. A possible cause for the anomalous metals results was that the chemical analysis method used in the past to avoid the possible matrix interference effects of salinity was not implemented (ECC, 2008n).

The ROD for OU9, Basewide Groundwater (groundwater at Sites 2A, 2B, 3, 7, 9, 14, 15, 18, 20, and 23), was signed in September 2008 (Navy, 2008b). The OU9 ROD determined that groundwater monitoring at Sites 2A and 2B will continue as required by the OU1 ROD and the Operations and Maintenance (O&M) Manual (TtNUS, 2008c). Volume II (Groundwater Monitoring Plan) of the O&M Manual was

revised in 2008 to address EPA comments on the 2006 O&M Manual and update site information for Site 2.

Based on the Final ROD for OU9, a Basewide Groundwater Remedial Design (RD) for Land Use Controls (LUCs) was prepared to provide the details of the LUCs for groundwater. The RD includes LUCs for Site 2A (TtNUS, 2008e).

Cover system O&M and groundwater monitoring at the Area A Landfill have been performed in accordance with the O&M Manual for IR Program sites (TtNUS, 2006a). The O&M process includes annual inspections, reporting of results, and correcting any identified problems. The findings of the inspections are documented in the field on inspection checklists and summarized in Annual Landfill Inspection Reports (LIRs) for 2003 through 2007 (ECC, 2004a; 2005d; 2005g; 2008d; and 2008k). Volume III (Site 2 O&M) of the O&M Manual was revised in 2008 (TtNUS, 2008c) to address EPA comments on the 2006 O&M Manual and update site information for Site 2.

A well inventory was conducted at NSB-NLON in 2007. This inventory included 47 Site 2A wells (TtNUS, 2007a). As a result of the inventory, 41 Site 2A wells that were not part of an active monitoring program were abandoned in 2007 (ECC, 2007; TtNUS, 2008a).

To meet the LUC requirements in the ROD, the Navy implemented an updated instruction [SOPA (ADMIN) New London Instruction 5090.18D] to restrict the use of IR sites at NSB-NLON (Navy, 2008c). The Instruction defines the Navy's policy regarding ground surface disturbance of soils/sediments, subsurface disturbance of soils/sediments and/or groundwater extraction, and disturbance of any remedial infrastructure at IR sites. The site use restrictions document was updated in 2006 to address allowable loading pressures for the Area A Landfill asphalt and again in 2008 to include maps of existing and abandoned wells and an updated map of soil and groundwater LUCs.

The status of the Area A Landfill is considered RIP. A majority of the Area A Landfill is paved and is currently used for storage of equipment and vehicles. Site 2B - Area A Wetland.

The Area A Wetland is located north of the Area A Landfill (see Figure 2-3). The location of the Area A Wetland was undeveloped, wooded land and possibly wetland until the late 1950s. In the late 1950s, 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 southern side of the Area A Weapons Center.

The Area A Wetland is underlain by dredge spoils that consist of silt and clay with traces of fine sand and shell fragments. The thickness of dredge spoils ranges from 25 to 35 feet on the southern side of the

wetland, adjacent to the landfill, and from 10 to 15 feet on the northeastern side of the wetland. The total volume of dredged material in the wetlands is approximately 1.2 million cubic yards.

A small pond is located at the southern portion of the wetland, within which 1 to 3 feet of standing water is present during all seasons. Phragmites is the predominant type of vegetation. It was reported that pesticide "bricks" were placed on the wetland ice during winter and allowed to dissolve as a mosquito control measure. These "bricks" consisted of formulated (water-soluble) 1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane (DDT) and were used in the 1960s prior to the 1972 ban on DDT.

A two-phase RI was conducted to determine the nature and extent of contamination at the Area A Wetland. The Phase I RI field investigation was conducted from 1990 to 1992 (Atlantic, 1992) and consisted of test borings, monitoring well installation, and soil, sediment, and groundwater sampling. The Phase I RI concluded that several risk exposure scenarios exceeded acceptable regulatory levels and that an FS should be performed for the Area A Wetland site.

The Phase II RI field investigation conducted from 1993 to 1995 (B&RE, 1997b) consisted of test borings, monitoring well installation, and sediment, surface water, and groundwater sampling. The Phase II RI concluded that little evidence of surface water or groundwater contamination exists at the site, that the site may pose a risk to construction workers due to potential exposure to manganese in the groundwater, and that significant pesticide, PCB, and polynuclear aromatic hydrocarbon (PAH) concentrations exist in site soil and sediment. The recommendations in the Phase II RI indicated that an FS should be conducted for this site that evaluates a limited action alternative, and it was indicated that the alternative should include groundwater monitoring and access/use restrictions. Based on a recommendation in the Second Five-Year Review, the Navy is currently pursuing further investigation of the site and preparation of an FS.

The Phase II RI human health risk assessment was updated in a 2008 memorandum to account for current risk assessment guidance and Year 7 sampling results. The assessment confirmed that risks to construction workers exposed to groundwater would be acceptable; however, the assessment showed that there are potential risks to hypothetical residents that would exceed EPA and CTDEP acceptable levels if groundwater is used as a drinking water supply. These risks are mitigated by the existing institutional controls that prohibit residential development of Site 2. Potential risks resulting from exposure to chemical volatilization from groundwater and the migration to indoor air through building foundations were also evaluated in a separate memorandum. TCE and PCE exceeded EPA and CTDEP screening criteria and they were further evaluated in the EPA Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks and hazard indices for residential and industrial scenarios were within EPA and CTDEP acceptable levels and vapor intrusion is not an issue at Site 2 (Navy, 2008b).

An RI is currently being prepared for sediments in OU 12, and the completion of a FS is expected in 2009. A Phase III investigation of the sediments at the Area A Wetland was conducted in October 2007. The major objectives of the investigation were to further refine the nature and extent of contamination in sediments and to provide sufficient data to determine potential risks to ecological receptors from contaminated sediments. A secondary objective of the investigation was to determine the thickness of the overlying organic layer that has formed above the dredge spoils. A Phase IV Investigation of the sediments at the Area A Wetland was conducted in October 2009. The objective of that investigation was to collect sediment samples for chemical analysis and toxicity testing to determine whether the sediment were toxic to sediment invertebrates. That data will then be used to develop site-specific cleanup goals, if necessary.

The groundwater and surface water at the Area A Wetland (dredge spoil) is currently being monitored under the Site 2 long-term groundwater monitoring program. A summary of the Site 2 groundwater and surface water monitoring results is presented in the Site 2A discussion.

The ROD for OU9, Basewide Groundwater (groundwater at Sites 2A, 2B, 3, 7, 9, 14, 15, 18, 20, and 23), was signed in September 2008 (Navy, 2008b). The OU9 ROD determined that groundwater monitoring at Sites 2A and 2B will continue as required by the OU1 ROD (Atlantic, 1995e) and the O&M Manual. Volume II (Groundwater Monitoring Plan) of the O&M Manual was revised in 2008 to address EPA comments on the 2006 O&M Manual and update site information for Site 2 (TtNUS, 2008c).

A well inventory was conducted at NSB-NLON in 2007. This inventory included 24 Site 2B wells (TtNUS, 2007a). As a result of the inventory, three Site 2B wells that were not part of an active monitoring program were abandoned (ECC, 2007; TtNUS, 2008a).

Based on the Final ROD for OU9, a Basewide Groundwater RD for LUCs was prepared to provide the details of the LUCs for groundwater. The RD includes LUCs for Site 2B (TtNUS, 2008e).

### **2.1.3 Site 3 - Area A Downstream Watercourses and Overbank Disposal Area**

#### **Site 3A - Area A Downstream Watercourses/OBDA Pond**

Site 3 covers approximately 75 acres and receives surface water and groundwater recharge from the Area A Landfill (Site 2A), Area A Wetland (Site 2B), Site 7, Site 14, and surrounding areas and conveys them to the Thames River. Site 3 includes Upper Pond, Lower Pond, OBDA Pond, and Streams 1 through 6. The major sources of contamination to Site 3 included historical application of pesticides, abandoned disposal areas, and the septic system leach fields at Site 7. The general configuration of the

Area A Downstream Watercourses and adjacent areas is shown on Figure 2-4. The location of this site relative to other IR sites at NSB-NLON is shown on Figure 1-2.

The primary water discharge point from the Area A Wetland to the Area A Downstream Watercourses is through four 24-inch-diameter metal culvert pipes located within the dike that separates the Area A Wetland from the Area A Downstream Watercourses. The discharge from these culverts forms a small stream (Stream 4) that flows westward for approximately 200 feet into Upper Pond. Upper Pond discharges to Stream 3, which flows northward and then westward toward Triton Avenue (past the OBDANE site) to the entrance of the Torpedo Shops. At this location, it meets the drainage channel from the Torpedo Shops and forms Stream 5. Stream 5 flows westward along Triton Avenue through the Small Arms Range and under Shark Boulevard and eventually discharges to the Thames River at the DRMO outfall. A second pond (Lower Pond), northwest of Upper Pond, is a natural depression and is recharged by groundwater inflow. The outlet of the pond forms Stream 2, which enters a storm sewer and flows to the west around North Lake.

Groundwater passing beneath the Area A Landfill/Wetland dike discharges to a small pond (the OBDA Pond) located at the base of the dike and the OBDA. Stream 1 flows from this pond westward toward North Lake, a recreational swimming area for Navy personnel. Under normal flow conditions, the stream enters a culvert that by-passes North Lake and discharges to a stream (Stream 6) below the outfall of the lake. Stream 6, which is formed by Stream 1, Stream 2, and the outflow of North Lake, flows westward under Shark Boulevard and through the golf course to the Thames River. North Lake is filled with potable water every year and drained at the end of the season. Surface water levels in North Lake do not appear to coincide with groundwater levels in adjacent monitoring wells, indicating little hydraulic connection between the surface water of North Lake and shallow groundwater.

Most of the area is within designated Explosive Safety Quantity Distance (ESQD) arcs of the Area A Weapons Center; therefore, further development is not planned for this area. Navy regulations prohibit construction of inhabited buildings or structures within these arcs and, although existing buildings operate under a waiver of these regulations, no further construction is planned.

The main cause of contamination at the Area A Downstream Watercourses was the application of pesticides. These pesticides were reportedly applied on the surface of water bodies to control mosquito proliferation adjacent to nearby base recreational facilities (North Lake and golf course). Additional contaminants are inorganic constituents of the river dredge spoil and Area A Landfill material that have been carried over from adjacent sites. Samples of surface soil and sediment contained mainly DDT, 1,1-dichloro-2,2-bis(4-chlorophenyl)ethane (DDD), and 1,1-dichloro-2,2-bis(4-chlorophenyl)ethene (DDE), collectively referred to as total DDT isomers (DDTR), and small amounts of other pesticides such as

dieldrin. Samples of sediment also contained relatively high levels of several metals such as arsenic, beryllium, cadmium, lead and zinc compared to less contaminated reference areas outside the site.

A two-phase RI/FS was conducted to investigate and determine appropriate remedial alternatives for Site 3. The Phase I RI field investigation was conducted from 1990 to 1992 (Atlantic, 1992) and consisted of test borings, monitoring well installation, and soil, surface water, sediment, and groundwater sampling. The RI concluded that several risk exposure scenarios exceeded acceptable regulatory levels and that an FS should be performed for the site. A draft FFS (Atlantic, 1994c) was completed for soil and sediment at the site. Additional soil and sediment samples were collected and analyzed during the FFS to further define the extent of contamination. The FFS concluded that off-site landfilling and on-site thermal desorption provide superior protection of the environment and that the landfilling alternative would be more cost effective than the on-site thermal desorption alternative.

The Phase II RI field investigation conducted from 1993 to 1995 (B&RE, 1997b) included test borings, monitoring well installation, and soil, surface water, sediment, and groundwater sampling. A soil gas survey and an extensive ecological investigation were also completed during the Phase II RI. The Phase II RI concluded that VOCs were present in groundwater at Site 3, that the site poses noncarcinogenic risks to the site worker and older child trespasser, and that notable concentrations of pesticides exist in site soil and sediments. The Phase II RI recommended that the FS for this site should be revisited to focus on pesticides in soil and sediment, that more sampling should be conducted to delineate pesticide contamination and determine the origin of VOCs in groundwater, and that debris associated with the OBDA should be removed. The RA for the debris and contaminated soil at the site was completed in October 2007.

Following the Phase II RI, an FS was completed in 1997 for soil and sediment at Site 3 (B&RE, 1997j). An alternative that included dredging, on-site dewatering, off-site disposal of sediment and soil, restoration of wetlands and waterways, and monitoring was selected for the site, and the selected remedy was documented in the ROD signed in March 1998 (B&RE, 1998c). An RD was completed for soil and sediment at Site 3 in 1998 and 1999 [Foster Wheeler Environmental Corporation (FWEC), 2000], and the RA for Site 3 soil and sediment was completed in 1999 and 2000 (FWEC, 2001). During the RA excavation activities, contaminated soil and sediment were discovered in and around two abandoned pipes at the headwaters of Stream 4. Because this contaminated material could not be removed without seriously compromising the integrity of the Area A Dike, the ends of the pipes were isolated and encapsulated with poured concrete.

A post-construction restoration and monitoring program was conducted for 3 years to verify the success of site restoration activities. Wetlands functions and values and survival rates of vegetation were two of

the key elements monitored. Some replanting of vegetation has been conducted based on the recommendations of the monitoring program.

A previously unknown source of petroleum contamination was detected during the RA at Site 3. The source, found during the remediation of Stream 5, is located on the northern side of the stream just east of the Small Arms Range. Petroleum product was discovered emanating from the northern side of the excavation. Upon further investigation, a small disposal area (i.e., buried drums, cable, etc.) was discovered upgradient of the location where petroleum was discovered. The site was named the Site 3 – New Source Area (NSA). The Site 3 – NSA was not remediated at the time of the RA because the nature and extent of contamination were unknown; however, absorbent booms and hay bales were put in place during construction activities to minimize the migration of contamination downstream, and plastic sheeting was placed along the stream bank prior to backfilling to minimize further contaminant migration to Stream 5.

Based on the recommendations of the Phase II RI, further investigation of groundwater at Site 3 was completed during the BGOURI (TtNUS, 2002a). The field work for the BGOURI was completed prior to the identification of the Site 3 – NSA. The scope of the investigation included the installation of temporary monitoring wells and sampling of groundwater in temporary and existing permanent monitoring wells. Chlorinated VOCs similar to those detected during the Phase II RI were detected at lower concentrations during the BGOURI. It was hypothesized that the Site 3 – NSA or an upgradient source such as the leach fields at Site 7 may have been the source of the VOCs.

A DGI was conducted at Site 3 in the fall of 2002 to investigate the NSA and to confirm the groundwater results of the BGOURI. The results of the DGI were presented in the BGOURI Update/FS (TtNUS, 2004). The soil sampling program and a portion of the groundwater sampling program were concentrated on determining the overall nature and extent of contamination at the Site 3 – NSA. The remaining portion of the groundwater sampling program was focused on confirming the nature and magnitude of the groundwater contamination identified during the BGOURI. Petroleum contamination was identified at the Site 3 – NSA during the DGI; however, no significant source of VOC contamination was identified at the Site 3 – NSA. The groundwater data collected during the DGI indicated that the VOC contamination was originally released upgradient in the Site 7 area and is in the process of migrating through Site 3. It is likely that the primary original compound released was TCE. There were detections of VOCs along Stream 5 from Site 7 to the Thames River. Comparisons of results from the Phase II RI, BGOURI, and DGI showed that VOC concentrations in groundwater were decreasing steadily and that degradation products from the dechlorination of TCE have been detected, indicating that natural attenuation was occurring.

An FS (TtNUS, 2004) was completed to identify and evaluate appropriate remedial alternatives for soil at Site 3 – NSA and for groundwater at Site 3. A ROD was signed for the Site 3 – NSA soil in September 2004 (Navy, 2004a). The ROD called for NFA for the petroleum-contaminated soil under CERCLA because petroleum is excluded from consideration under CERCLA; however, the Navy's cleanup plan to address the petroleum-contaminated soil under other applicable regulations was detailed in an appendix to the ROD. The Site 3 – NSA soil corrective action was completed to meet Connecticut regulations in October 2007.

Institutional controls and monitoring were selected as the remedy for Site 3 groundwater in the Interim ROD in 2004 (Navy, 2004d). A LUC RD was subsequently completed for Site 3 groundwater in June 2005 (TtNUS, 2005) and updated as the Basewide Groundwater RD for Land Use Controls (Navy, TBD). To meet the LUC requirements in the ROD, the Navy implemented an updated instruction [SOPA (ADMIN) New London Instruction 5090.18D] to restrict the use of IR sites at NSB-NLON (Navy, 2008c). The Instruction defines the Navy's policy regarding ground surface disturbance of soils/sediments, subsurface disturbance of soils/sediments and/or groundwater extraction, and disturbance of any remedial infrastructure at IR sites.

A well inventory was conducted at NSB-NLON in 2007. This inventory included 22 Site 3A wells (TtNUS, 2007a). As a result of the inventory, 11 Site 3A wells that were not part of an active monitoring program were abandoned (ECC, 2007). SOPA (ADMIN) 5090.18D includes current mapping of existing and abandoned wells (Navy, 2008c).

The Navy began implementation of the groundwater monitoring program as described in the Remedial Action Work Plan (TtNUS, 2006b) and Site 3 Groundwater Monitoring Plan (TtNUS, 2006a) in April 2006. Site 3 wells were sampled quarterly and data was evaluated annually during 2006 (TtNUS, 2007b) and 2007 (ECC, 2008g). Both TCE and vinyl chloride were detected in excess of remedial goals (RGs) in at least one well during Round 9, the most recent round available (TtNUS, 2008d). It was recommended that monitoring at wells where TCE or vinyl chloride have been detected continue until remedial goals are met and that Site 3 monitoring wells 2DMW25S, 2DMW28D, 3MW15I, and 3MW15S should be abandoned by the Navy if they are no longer needed for other programs because there were no detections of COCs during Rounds 1 through 9 (ECC, 2008g; TtNUS, 2008d).

Potential risks resulting from exposures to chemicals that have volatilized from groundwater and migrated through building foundations into indoor air were also evaluated in a 2008 memorandum by comparing concentrations of volatile chemicals detected in groundwater to EPA and CTDEP screening criteria from vapor intrusion. Concentrations of chloroform, TCE, and vinyl chloride exceeded the EPA screening criteria and they were further evaluated using EPA's Johnson and Ettinger Model. Modeling results

showed that cancer risks and hazard indices for residential and industrial scenarios did not exceed EPA acceptable levels. Cancer risks for chloroform and VC for residential exposures exceeded CTDEP acceptable risk levels. Cancer risks for TCE based on California Environmental Protection Agency toxicity criteria (as recommended by EPA Region 1) were within CTDEP acceptable levels for residential and industrial scenarios, but cancer risks based on draft EPA toxicity criteria exceeded CTDEP acceptable levels (Navy, 2008b). As a result, SOPA (ADMIN) New London Instruction 5090.18D requires that all proposed building projects in Site 3 must be coordinated through the IR program manager (Navy, 2008c).

Based on the discovery and encapsulation of contaminated material during the Site 3 soil RA, an Explanation of Significant Difference (ESD) was prepared to document the change in the remedy as presented in the 1998 ROD (Navy, 2007). The selected remedy described in the ROD included excavation and off-site disposal of contaminated soil. The RA, which included excavation and disposal of approximately 18,050 tons of contaminated soil and sediment, was completed in 2000. However, as described above, an area of contaminated soil and sediment in and around two abandoned pipes could not be excavated without compromising the integrity of the Area A Dike, and this area was encapsulated with concrete rather than excavated. The estimated volume of sediment within the pipes, based on assumptions that the two pipes are completely filled with sediment and that the pipes are 18 inches in diameter and 100 feet long, is 13 cubic yards. The estimated volume of contaminated soil left in place around the pipes is a few cubic yards. Because contaminated material was left in place instead of removed (as was planned based on the remedy detailed in the ROD), institutional controls are now required as part of the remedy. The ROD for OU9, Basewide Groundwater was completed in September 2008 (Navy, 2008b). The final selected remedy for groundwater at Site 3 is Institutional Controls with Monitoring. The Site 2 Inspection Checklist in Volume III of the O&M Manual was revised in 2008 to include inspection of the Site 3 ESD concrete cover and institutional controls document (TtNUS, 2008c). Volume II (Groundwater Monitoring Plan) of the O&M Manual was revised in 2008 to address EPA comments on the 2006 O&M Manual and update site information for Site 3 (TtNUS, 2008c).

### **Site 3B - OBDA Debris**

The OBDA was located on the slope of an earthen dike below and adjacent to the Area A Landfill (Figures 2-2 and 2-4). It was located on the southwestern end of the dike where the angle of the slope approaches 45 degrees. A small wetland at the base of the dike has been designated as the OBDA Pond. The OBDA was used as a disposal site after the earthen dike was constructed in 1957. The IAS report (Envirodyne, 1983) indicated that the material had been there for many years. The IAS report also indicated that the materials were not covered and included 30 partially covered 200-gallon metal fuel tanks and scrap lumber. The site was inspected in 1998, and it was observed that the tanks were still present at the site, and old creosote telephone poles, several empty unlabeled 55-gallon drums, and rolls

of wire were also present at the site. Orange iron floc was observed in the sediments in the area where water was discharging from the base of the dike embankment.

The OBDA Pond, located downgradient of the OBDA, was investigated as part of the Area A Downstream Watercourses during the Phase I and II RIs and the FFS and FS for that site. No investigative activities were completed within the limits of the disposal area. All of the debris from the OBDA area was removed and disposed off site as part of a non-time-critical removal action (NTCRA) in 1997. This removal action was completed during the Area A Landfill RA because the sites are located adjacent to one another. An Engineering Evaluation/Cost Analysis (EE/CA) and Action Memorandum were prepared in 1997 to document the decision process for the NTCRA (Navy, 1997b). The soil resulting from the decontamination of debris and concrete debris was incorporated into the subgrade of the Area A Landfill. Two gas cylinders were removed from the OBDA; one of the tanks (i.e., acetylene) was disposed as hazardous waste. All other debris was disposed off site as clean waste in permitted landfills or at metal recycling facilities. Because the debris has been removed, the status of this site is RC.

A well inventory was conducted at NSB-NLON in 2007. This inventory included four Site 3B wells (TtNUS, 2007a). As a result of the inventory, two Site 3B wells that were not part of an active monitoring program were abandoned (ECC, 2007; TtNUS 2008a).

#### **2.1.4 Site 4 - Rubble Fill Area at Bunker A-86**

Site 4 was a 25-foot by 60-foot plot located in the north-central section of NSB-NLON, approximately 80 feet west of Former Bunker A-86 and just south of the Area A Landfill. The site map is included as Figure 2-5. The previous site location with respect to other IR sites at NSB-NLON is shown on Figure 1-2. According to the IAS report (Envirodyne, 1983), waste materials, including an electric motor, concrete, asphalt, tar buckets, wood, and gravel, were discarded at the site in the early 1970s. In addition to wood and concrete construction debris, previous investigations located an empty 5-gallon container of monothanolamine (labeled as a corrosive), an empty 5-gallon container of thorite (labeled as nonshrinking compound for patching concrete), and a 55-gallon drum of lubricating oil that was approximately 10 percent full at the site (Atlantic, 1992).

A low-permeability cover system was installed over the Area A Landfill in 1997. In conjunction with the construction of this cover system, an interception trench was constructed into the hillside between the Area A Landfill and Site 4. Grading required for the construction of the interception trench involved excavating the soil at Site 4 and the hillside between Site 4 and the Area A Landfill to a depth of approximately 8 feet. This excavation constituted a TCRA for Site 4, and an Action Memorandum was written for this site in September 1997 (Navy, 1997d).

Site 4 soil and construction debris were excavated during the removal action and incorporated into the Area A Landfill subgrade, except wood debris, which was sampled and disposed off site (FWEC, 1997a). Following excavation, verification sampling was conducted in an area of about 17,000 square feet to determine the extent of residual contamination. The Verification Sampling Report (B&RE, 1997c) concluded that, if the human health risk assessment conducted for the Phase II RI was revised using the verification sampling data, the cumulative ICR would exceed the upper limit of the EPA target risk range (i.e.,  $1 \times 10^{-4}$ ). Based on this information, the Navy decided to remove the remaining soil at Site 4, leaving only exposed bedrock. The Navy prepared a risk evaluation memorandum in March 1998 to document the negligible remaining risks associated with the site. An NFA Proposed Plan (Navy, 1998c) and ROD (Navy, 1998d) were prepared for this site. The status of this site is considered to be RC. The groundwater in this area is being monitored in conjunction with the Site 2 long-term groundwater monitoring plan.

A well inventory was conducted at NSB-NLON in 2007. This inventory included five Site 4 wells (TtNUS, 2007a). Three of these wells had been documented as previously abandoned. Of the two remaining Site 4 wells, one is part of the active monitoring program for Site 2 and the other is idle.

#### **2.1.5 Site 6 - Former Defense Reutilization and Marketing Office**

Site 6 is located adjacent to the Thames River in the northwestern section of NSB-NLON. The site map is included as Figure 2-6. The site's location relative to other IR sites is located on Figure 1-2. The site is located between a bedrock outcrop that runs roughly parallel to the Providence and Worcester Railroad to the east and the Thames River to the west. The site covers approximately 3 acres that gently slopes toward the Thames River. A majority of the site is paved with an asphalt layer, and the site included buildings, a weighing scale, and miscellaneous storage piles. Currently, the former DRMO site is used as a yacht club boat storage area.

From 1950 to 1969, the DRMO was used as a landfill and waste-burning area. Non-salvageable waste items including construction materials and combustible scrap were burned along the Thames River shoreline, and the residue was pushed to the shoreline and partially covered.

During the review of archived aerial photographs of the DRMO area, the 1934 photographs show fill in the southern portion of the site. Fill for bulkheads and docks south of the DRMO did not exist at that time. Aerial photographs from 1951 show the land in its present configuration, except for the northwestern portion, which was not filled at that time.

During a site inspection on September 30, 1988, it was noted that metal and wood products were stored throughout most of the site. Buildings 355 and 479 are located in the southern, paved portion of the site

and are primarily used for storage. A large scrap yard is located north of Building 479. Building 491, located in the northern, unpaved portion of the site was used to store miscellaneous items including batteries. Metal scrap bailing operations are performed adjacent to Building 491 on a gravel surface. Building 491 formerly housed a battery-acid-handling facility. Submarine batteries were previously stored in the southeastern portion of the site, adjacent to the railroad tracks. No evidence of leaks was observed. An in-ground, rubber-lined tank and associated pumping facilities were noted on the plans. DRMO personnel indicated that the tank actually may have been installed directly adjacent to the building to the east.

A Conforming Storage Facility Report [Goldberg-Zoino & Associates (GZA), 1988] for the DRMO was prepared in 1988 as a requirement for the siting of a hazardous waste storage facility in the northern portion of the DRMO. The study performed for the report indicated the presence of PCBs and other contaminants at the DRMO.

A two-phase RI was conducted to determine the nature and extent of contamination at the DRMO. The Phase I RI field investigation conducted from 1990 to 1992 (Atlantic, 1992) consisted of test borings, monitoring well installation, and soil, surface water, and groundwater sampling. Some evidence of the former landfill was encountered during the drilling, including wood fragments, brick, and metal but predominately earthen fill material. The depth of the fill varied from 0 to 8 feet. Human health risks were determined for Navy workers due to exposure to PCBs, PAHs, and beryllium in the surface soil and due to elevated lead levels in soil at the northern portion of the site. In addition, groundwater quality exceeded drinking water standards; however, no drinking water wells were located within the affected area nor could they be due to the proximity of the brackish Thames River. Risks to fish in the Thames River estuary were determined to be low from contaminants contained in groundwater discharged from the site. It was recommended that the site proceed to the FS phase. It was also recommended that specific health and safety provisions be made for all subgrade construction projects at the site. The risks were primarily related to incidental oral and dermal exposure of site workers to contaminated surface soils (Atlantic, 1992).

A field investigation in support of the draft FFS was performed at the DRMO in October 1993 to better define the extent of soil contamination. Surface and subsurface soil samples were collected from 17 borings, and one of the borings was completed as a monitoring well. The soil borings indicated that the depth of fill ranged from approximately 1.5 to 20 feet. Fill material consisted of wood, glass, and metal scrap in a predominately sand and gravel matrix (Atlantic, 1994a).

A TCRA was completed at the site in January 1995 at generally the same time as the Phase II RI. Initial activities at the site included pre-excavation sampling and analysis focused on better defining the limits of PCB-contaminated soils in the areas to be excavated. Confirmatory soil sampling and analysis were conducted on the sidewalls of the excavations. Human health and ecological risks associated with the soil

left in place after the removal action were evaluated during the Phase II RI. Approximately 2,500 cubic yards of lead-, PAH-, and PCB-contaminated soils were excavated from the northern portion of the DRMO as part of a TCRA. The excavated area was backfilled with clean soil, and the excavated soil was transported off site to a RCRA landfill (B&RE, 1997b). The backfilled area was then capped with woven geotextile liner, a geosynthetic clay liner, a nonwoven geotextile liner and approximately 9 inches of crushed stone, and 3 inches of asphalt. The remaining portion of the DRMO was repaved. An Action Memorandum was prepared in March 1995 (Atlantic, 1995b) to document the removal action completed at the DRMO.

The Phase II RI field investigation was conducted from 1993 to 1995 (B&RE, 1997b) and consisted of the installation of five new monitoring wells, two rounds of groundwater sampling, and subsurface soil sampling. The Phase II RI concluded that the majority of contaminated soil had been removed, that groundwater was not significantly affected, and that relatively low human health and ecological risks were associated with the DRMO. The Phase II RI recommended that an FS be prepared for DRMO soil and groundwater and that groundwater monitoring be conducted to verify that significant contamination is not leaching to groundwater.

An FS (B&RE, 1997g) was completed for soil and groundwater at the DRMO, and the selected remedial alternative (institutional controls and monitoring) was documented in an interim ROD (Navy, 1998a). As part of the FS, volumes of soil remaining at the site after the 1995 TCRA that exceed preliminary remediation goals (PRGs) were estimated based on the current industrial land use scenario and a future residential land use scenario. The majority of remaining contaminated soil is below the water table. Soil with contaminant concentrations greater than industrial PRGs remains in three areas totaling 11,230 square feet to depths from 6 to 10 feet, resulting in a total volume of 3,150 cubic yards. Soil with contaminant concentrations greater than residential PRGs remains in six areas totaling 107,780 square feet to depths from 3 to 10 feet, resulting in a total volume of 13,572 cubic yards.

O&M of the cover system at the DRMO is being performed in accordance with the O&M Manual for Installation Restoration Program Sites (TtNUS, 2006a). The O&M process includes annual inspections, reporting of results, and correcting any identified problems. Site 6 has been inspected annually since 2003. The findings of the inspections are documented in the field on inspection checklists and summarized in Annual LIRs (ECC, 2004b; 2005e; 2005h; 2008e; and 2008i). Volume IV (Site 6 O&M) of the O&M Manual was revised in 2008 to address EPA comments on the 2006 O&M Manual and update site information for Site 6 (TtNUS, 2008c).

A groundwater monitoring program began at the DRMO in April 1998 in accordance with the Groundwater Monitoring Plan (B&RE, 1998a) and is ongoing (TtNUS, 2006a). The results of the program are being used to verify the effectiveness of the cap in reducing infiltration and leaching of contaminants and to

confirm that contamination is not migrating from soil to groundwater and eventually to the Thames River. To date, the monitoring results have not shown any significant contaminant migration issues (ECC, 2008h). Based on the results of the monitoring program, a final ROD for Site 6 was signed in December 2006 (Navy, 2006). The selected remedial alternative is similar to the interim remedy selected in 1998 and includes institutional controls, monitoring, and five-year reviews.

Site 6 has been monitored for 9 years (TtNUS, 1999e; 2000a; 2002b; 2003b; ECC, 2004f; 2005c; 2006a; 2008c; 2008h). Statistical comparisons between upgradient and downgradient data sets were made with cumulative data set collected over a 9-year period (ECC, 2008h). Analysis of data indicated that nine of the COCs (1,2-dichloroethane, vinyl chloride, bis (2-ethylhexyl) phthalate, fluoranthene, pyrene, arsenic, barium, chromium, and copper) had downgradient results statistically greater than upgradient concentrations. However, the levels and history of these COCs do not indicate that significant concentrations of COCs are migrating from Site 6. None of these nine COCs exceeded primary monitoring criteria, six of these COCs (1,2-dichloroethane, vinyl chloride, fluoranthene, pyrene, arsenic, barium, and chromium) have not exceeded secondary monitoring criteria, and one of these COCs (copper) has not exceeded its background concentrations (TtNUS, 2008c). The results of 9 years of monitoring indicate that the TCRA at the site removed sufficient contaminant source material and reduced infiltration of precipitation through any remaining source material so that significant contaminant migration from the site to the Thames River is not occurring. No significant increasing contaminant trends have been noted in the downgradient wells in 9 years of monitoring (ECC, 2008h).

Volume II (Groundwater Monitoring Plan) of the O&M Manual was revised in 2008 to address EPA comments on the 2006 O&M Manual and update site information for Site 6 (TtNUS, 2008c).

A well inventory was conducted at NSB-NLON in 2007. This inventory included 15 Site 6 wells (TtNUS, 2007a). As a result of the inventory, seven Site 6 wells that were not part of an active monitoring program were abandoned (ECC, 2007).

To meet the land use control requirements in the ROD, the Navy implemented an updated instruction [SOPA (ADMIN) New London Instruction 5090.18D] to restrict the use of IR sites at NSB-NLON. The Instruction defines the Navy's policy regarding ground surface disturbance of soils/sediments, subsurface disturbance of soils/sediments and/or groundwater extraction, and disturbance of any remedial infrastructure at IR sites. SOPA (ADMIN) 5090.18D includes current mapping of existing and abandoned wells (Navy, 2008c).

An RA Completion Report was prepared to document implementation of the soil and groundwater remedies at the site. The status of the site is RIP.

### 2.1.6 Site 7 - Torpedo Shops

The Torpedo Shops (Site 7) are located in the northern portion of NSB-NLON on the northern side of Triton Road. Figure 2-7 shows the general site arrangement. The site location with respect to other IR sites at NSB-NLON is shown on Figure 1-2. The site covers approximately 7 acres and is bordered on the east and north by 60-foot-high bedrock cliffs. The remainder of the site slopes to the southwest toward the Area A Downstream Watercourses (Site 3). An earthen berm extends along the base of the eastern portion of the exposed rock face. Three buildings (325, 450, and 477) exist at the site.

Building 325, a torpedo overhaul facility, was built in 1955 and had an on-site sanitary septic system until 1983, when all the building's plumbing facilities were connected to sanitary sewers. The original septic leach field for Building 325 is located southwest of the building, adjacent to Triton Road. This leach field became clogged in 1975 and was abandoned. A new leach field (south leach field) was constructed next to the original leach field and was used until sanitary sewers were installed in 1983.

A visual inspection of Building 325 was performed on March 20, 1989. According to interviews with on-site personnel, a variety of fuels, solvents, and petroleum products have been used in the building. Otto Fuel II [which is comprised of propylene glycol dinitrate (76 percent), 2-nitrodiphenylamine (1.5 percent), and di-n-butyl sebacate (22.5 percent) and produces hydrogen cyanide when burned], high-octane alcohol (190-proof grain alcohol), and TH-Dimer (jet rocket fuel) were observed in maintenance areas. Solvents including mineral spirits, alcohol, and 1,1,1-trichloroethane, as well as petroleum products such as motor oil and grease, were used in this building. A sink in one area was previously used for film development, and another sink was used for the overhaul of alkaline batteries. These sinks drained into the on-site septic system until 1983. A maintenance area has a shallow sump covered with a flush-mounted steel grating. The area surrounding this sump was previously a washdown/blowdown area for weapons. This sump drains to the storm sewer system on the western side of Building 325. Two No. 2 fuel oil USTs were located on the southern side of this building. One of the tanks was closed in 1995. A third tank, which was located above ground adjacent to the building, was used for temporary storage of No. 2 fuel oil but, based on field reconnaissance, had been removed as of March 15, 1995.

A smaller building attached to the eastern side of Building 325 was previously used as an assembly shop for torpedoes and as a paint shop. During a previous inspection at the building, a storage closet was found to include containers of 1,1,1-trichloroethane and methyl ethyl ketone (2-butanone). Drums and cylinders were stored outside on the eastern side of this building. The vessels were labeled as containing propane, isobutane, 2-butanone, xylot, methylene chloride, propellant, and zinc chromate. An addition to the northern side of Building 325 was under construction at the time of the 1989 inspection and has since been completed. This addition is also used as a torpedo shop.

Building 450 is the primary MK-48 torpedo overhaul/assembly facility. It was built in 1974 and was served by its own septic system until 1983 when it was connected to sanitary sewers. Only domestic wastewater from toilets, lavatories, and showers in Building 450 was directed to the septic field (north leach field). Torpedo overhaul/assembly operations in Building 450 generate fuels, solvents, and petroleum products as wastes. An Otto fuel and seawater mixture is drained from the torpedoes, which are then replenished with fresh fuel. The IAS report indicated that Building 450 generates approximately 3,000 gallons of Otto fuel wastewater per month. This building was constructed with a waste collection system that collected waste products from floor drains and then discharged to an underground waste tank/sump with a capacity of approximately 1,500 gallons. The waste tank was pumped periodically and the contents were disposed off site. Otto fuel product was previously stored in a 4,000-gallon underground tank south of Building 450.

Building 477, approximately 65 feet east of Building 450, was formerly used to store drums of Otto fuel. On-site personnel report that solvents including 1,1,1-trichloroethane, TCE, toluene, mineral spirits, alcohol, and bulk freon have been used at this facility. Petroleum products including TL-250 motor oil and hydraulic fluid have also been used in this building for torpedo maintenance. In the past, only domestic wastewater from toilets, lavatories, and showers in Building 450 was directed to the septic field (north system).

Atlantic performed a site inspection of Building 450 on March 20, 1989. The former septic leach field is located southwest of this building in a flat, elevated area. The hazardous waste sump was no longer in use and reportedly was decommissioned in 1987. It was replaced with three 1,000-gallon above-ground tanks located south of the building. The floor drains were sealed and replaced with a new system for pumping waste products to the new tanks. A 4,000-gallon above-ground Otto fuel storage tank replaced the previous tank and is located south of the building. No construction is planned for the immediate future at Building 450.

The Phase I RI (Atlantic, 1992) for Site 7 focused primarily on subsurface soil because the sources being investigated at that time were the subsurface leach fields. The investigation began with a soil gas survey of the area surrounding Buildings 450 and 325. These results were used to guide the installation of monitoring wells and the collection of soil samples from well and test borings. The Phase I RI concluded that there were negligible health risks associated with the Torpedo Shops and that this site should proceed to Step II of the IR Program (Phase II RI).

During the Phase II RI (B&RE, 1997b), several matrices were investigated (i.e., soil, groundwater, surface water, and sediment), and contamination was detected in soil and groundwater at the site that required

further characterization; however, relatively low human health and ecological risks were estimated for the site. Minimal exceedances of State criteria were observed for sediment, and no chemicals detected in surface water exceeded State human health Ambient Water Quality Criteria (AWQCs) for the consumption of organisms and/or water and organisms.

Phase II RI sampling results included notable detections of contamination in soil and groundwater near the abandoned leach field. A human health risk assessment showed that non-cancer risks were less than acceptable levels except for the construction worker and future resident, and cancer risks were less than acceptable levels except for a hypothetical future resident. The Phase II RI recommended that further characterization of the Torpedo Shops be completed before determining whether or not the site should proceed to the FS stage.

A removal action was completed within the Site 7 along the southern side of Building 325 in December 1995. This action was completed under the CTDEP UST Program. The focus of the effort was to remove soil contaminated with total petroleum hydrocarbons (TPH) in excess of the direct exposure remediation standard for residential use. Approximately 12 cubic yards of soil were removed from the site and disposed at an approved landfill (B&RE, 1996a).

The BGOURI (TtNUS, 2002a) was completed based on the recommendation of the Phase II RI. The objectives of the BGOURI at Site 7 were to further characterize the nature and extent of soil and groundwater contamination in the vicinity of the abandoned septic system and to quantify risks to human receptors from soil and groundwater contamination. Organic contaminant detections in soils were scattered and were primarily PAHs. Metals detections were scattered and were in general only slightly greater than background concentrations. Groundwater sampling results from the BGOURI indicated that there are only sporadic, low concentrations of contaminants in groundwater. A small plume of chlorobenzenes was detected west of Building 325, but there were no other discernable contaminant plumes of any size, indicating that there are no significant sources leaching contamination to groundwater at Site 7. Chemical concentrations [bis(2-ethylhexyl)phthalate and TCE] in several wells located within the western portion of Site 7 exceeded Maximum Contaminant Levels (MCLs); however, the exceedances varied from well to well. The human health risk assessment showed that risks posed by exposure to contaminated soil at Site 7 were generally low; however, risks posed by two chemicals exceeded CTDEP's target level for individual chemicals, and there were several chemicals detected at concentrations greater than CTDEP's direct exposure criteria. The risk assessment also determined that risks to current receptors from exposure to groundwater at Site 7 are within acceptable levels, but future residential groundwater usage could result in unacceptable risks.

An FS (TtNUS, 2004) was completed to identify and evaluate appropriate remedial alternatives for soil and groundwater at Site 7. The ROD for Site 7 and Site 14 soil (OU8) was signed in September 2004 (Navy 2004b), and the Interim ROD for Sites 3, 7, 14, 15, 18, and 20 groundwater (OU9) was signed in December 2004 (Navy, 2004d). The remedy selected for soil was excavation and off-site disposal. A Remedial Action Work Plan [Tetra Tech EC, Inc. (TtECI), 2006a] was prepared for Site 7 soil in 2006, and the RA for the soil was completed in May 2006 (TtECI, 2006b). Approximately 1,150 tons of soil and 125 tons of asphalt were removed during the RA. The remedy selected for groundwater was institutional controls and monitoring. A LUC RD was completed for Site 7 groundwater in June 2005 (TtNUS, 2005), and the Navy began implementation of the groundwater monitoring program as described in the Remedial Action Work Plan and Site 7 Groundwater Monitoring Plan (TtNUS, 2006a) in May 2006. The COCs that were identified in Site 7 groundwater and precipitated the need for groundwater LUCs are 1,4-dichlorobenzene, benzene, chlorobenzene, TCE, and hexachlorobenzene. The RGs for these COCs were identified in the Interim ROD (Navy, 2004c) and revised in Final ROD to include CTDEP volatilization criteria. The results of the 2008 vapor intrusion evaluation indicated that NFA is required for vapor intrusion issues at Site 7 (Navy, 2008b).

The monitoring results presented in the Round 9 Groundwater Monitoring Report (TtNUS, 2008d) indicate that the selected remedial action for Site 7 groundwater successfully reduced COC concentrations to levels below RGs. This data, therefore, supports the discontinuation of LUCs at Site 7, as documented in the Basewide Groundwater RD for Land Use Controls (Navy, TBD). No further action was recommended for Site 7 in the RD. Volume II (Groundwater Monitoring Plan) of the O&M Manual was revised in 2008 to remove Site 7 from the groundwater monitoring program (TtNUS, 2008c).

A well inventory was conducted at NSB-NLON in 2007. This inventory included 22 Site 7 IR program wells and one non-IR program well (TtNUS, 2007a). As a result of the inventory, 11 Site 7 wells that were not part of an active monitoring program were abandoned (ECC, 2007).

It was recommended in the Round 9 GMR that all remaining Site 7 monitoring wells should be abandoned by the Navy if they are no longer needed for other programs because there were no detections of COCs during Rounds 1 through 9 (TtNUS, 2008d).

### **2.1.7 Site 8 - Goss Cove Landfill**

The Goss Cove Landfill (Site 8) is located in the southwestern corner of NSB-NLON, adjacent to the Thames River. It is west of Shark Boulevard and the intersection of Crystal Lake Road and Military Highway, east of the Thames River, and north of Goss Cove. Figure 2-8 displays the general site arrangement. The site location with respect to other IR sites at NSB-NLON is shown on Figure 1-2. The landfill encompasses approximately 3.5 acres. The Nautilus Museum and a paved parking lot are

constructed directly over the site of the former landfill. The Nautilus Museum is a submarine museum operated by the Navy and open to the public.

The IAS report (Envirodyne, 1983) indicated that the Goss Cove Landfill was operated from 1946 through 1957. Incinerator ash and inert rubble were disposed at the site in what was then the northern portion of Goss Cove. It is not known if any other materials were disposed in the former landfill. It has been reported that several large compressed gas cylinders were uncovered during the excavation of a utility trench in the parking area north of the Nautilus Museum building. One of the cylinders was leaking propane, one was filled with ammonia, and the others were empty.

In a 1934 aerial photograph, the limits of Goss Cove appeared to be open water with no evidence of fill. Railroad tracks are shown in the photograph at the same location as they are currently, between the cove and the Thames River. In 1951 aerial photographs, fill extended to the south to approximately the current location of an access driveway to the museum. The 1965 aerial photographs show the landfill extending to the present limit of encroachment on Goss Cove. Aerial photographs from 1965, 1970, 1975, and 1980 show cars parked on the landfill surface. In 1986 photographs, the Nautilus Museum is present on the southern limits of the landfill, and a paved parking area extends over the remaining portion of the landfill to the north. Construction of the Nautilus Museum was completed in 1985. Construction of an addition to the Nautilus Museum was completed in 2000.

The boring logs generated during the construction of the Nautilus Museum indicated the presence of fill material consisting of cinders, metal, brick, glass, and sand and gravel to a depth of 15 feet. Beneath the fill is a layer of organic silt that is approximately 10 to 15 feet thick. This material is presumably the sediment bottom of the former cove. The silt is underlain by fine sand to depths ranging from 25 to 100 feet below the surface. The thickness of overburden increases from east to west, toward the river.

A two-phase RI was conducted to determine the nature and extent of contamination at the Goss Cove Landfill. The Phase I RI field investigation, conducted from 1990 to 1992 (Atlantic, 1992), consisted of a soil gas survey, test borings, monitoring well installation, and soil, surface water, and groundwater sampling. Overburden monitoring wells were installed within the former landfill, and groundwater samples were obtained. One surface water sample was collected in the Thames River downstream of the landfill. The RI recommended that the site proceed to Step I of the IR Program and additional investigations be conducted at the site.

The Phase II RI field investigation conducted from 1993 to 1995 (B&RE, 1997b) included the collection of surface and subsurface soil samples from well borings. Surface and subsurface soil samples were also collected from test borings. Shallow and deep monitoring wells were installed, and groundwater samples

were collected from Phase I and Phase II monitoring wells during two rounds of sampling. Surface water and sediment samples were also collected during the Phase II RI from the perimeter of Goss Cove. Additional sediment sampling was conducted in Goss Cove to perform a supplemental Toxicity Identification Evaluation (TIE). Three rounds of air sampling were performed, including the collection of air samples from within and around the Nautilus Museum.

Full-time employees, older child trespassers, construction workers, and future residents were evaluated as potential human receptors in the site-specific human health risk assessment completed during the Phase II RI. The results of the risk assessment showed that no unacceptable human health risks are associated with exposure to various media, based on exposure to average contaminant concentrations. All estimated Hazard Indices (HIs) for incidental ingestion, inhalation, and dermal contact with contaminated media were less than 1.0. All estimated cancer risks for these exposure routes were within the EPA target risk range and less than the cumulative CTDEP target risk of  $1 \times 10^{-5}$ . Human health risks were also calculated under conditions involving exposure to maximum contaminant concentrations [i.e., the reasonable maximum exposure (RME) scenario] for all potential human receptors. Estimated HIs for the construction worker, older child trespasser, and future resident exceeded 1.0. Elevated risks for the construction worker were primarily attributable to PCE in groundwater, and risks for the future resident were primarily attributable to PCBs, arsenic, and antimony in soil. Estimated cancer risks for the full-time employee, older child trespasser, construction worker, and future resident all exceeded Connecticut's cumulative target cancer risk of  $1 \times 10^{-5}$ . Except for the construction worker, elevated risks were associated with soil ingestion resulting from exposure to PAHs and arsenic. An additional exposure route of concern was dermal contact with groundwater for the construction worker. PCE was the main contributor to the carcinogenic risks for dermal contact with groundwater. Quantitative risks associated with exposure to ambient air at the Nautilus Museum were calculated for a full-time employee under RME conditions only. The estimated HI (0.28) was significantly less than unity for a full-time employee. The cumulative cancer risk ( $1 \times 10^{-5}$ ) was within the EPA target risk range and was equal to the CTDEP target risk.

Results of the Phase II RI ecological risk assessment, conducted on samples of surface water and sediment collected in the cove, indicated that several inorganics and organic compounds (i.e., metals and pesticides) were found at concentrations in excess of benchmark values protective of aquatic biota, suggesting that aquatic biota inhabiting the cove could be adversely impacted. In response to the results of the studies conducted during Round I of the Phase II RI, additional sampling was conducted in Goss Cove during the supplemental ecological sampling round. The results indicated that four COCs (aluminum, copper, nickel, and heptachlor) were present in surface water at concentrations that represent a potential risk to aquatic biota. A number of chemicals also had Hazard Quotients (HQs) greater than 1.0, suggesting that benthic macroinvertebrates were potentially at risk. The results of toxicity tests

confirmed that chemicals present were biologically available in concentrations that could adversely impact aquatic biota. Results of the simultaneous extracted metals (SEM)/acid volatile sulfide (AVS) analyses conducted to determine the biological availability of copper, cadmium, nickel, lead, and zinc demonstrated that these five metals are not biologically available.

A DGI was conducted in January 1997 (B&RE, 1997e) to determine the source of the PCE contamination detected in groundwater samples collected during the Phase II RI. The DGI concluded that the source of PCE contamination detected in groundwater is off site and upgradient of the site and is likely a neighboring dry cleaning establishment. The CTDEP conducted a Phase I/II Environmental Site Assessment of the dry cleaners in 1998 (CTDEP, 1999). The assessment involved interviewing the operator of the dry cleaners and collecting medium-specific samples. The results of the investigation conclusively showed that the dry cleaners released PCE to the environment. This information indicates that the dry cleaner is the source of the PCE detected in downgradient groundwater at the Goss Cove Landfill. CTDEP is addressing the source of PCE contamination. They completed injection of an in-situ chemical oxidation agent (permanganate) into the source area and are currently monitoring soil and groundwater concentrations.

An FS for soil/waste and sediment at Site 8 (TiNUS, 1999c) was prepared in 1999. Additional investigations conducted as part of the FS included the following:

- A desktop modeling effort to evaluate the potential for migration of COCs from the former Goss Cove Landfill into Goss Cove. Results of this modeling effort showed that such migration is unlikely to occur in the future.
- A Wetlands Functions and Values Assessment to evaluate if ecological stress in the Goss Cove water body was a result of natural conditions or due to migration of contamination from NSB-NLON sites. This study evaluated the marginal cove vegetation in terms of its ecological functions and values and identified the wetland species associated with the fringing belt. The results of this assessment were that the contrast between the Thames River and cove side is dramatic due to the lack of tidal flushing. Although some tidal action occurs within the cove, it does not appear adequate to aid in supporting a rich, viable, intertidal algal population and invertebrate biota. This may be related to water quality because it appears that estuarine organisms can and have become established in the cove in the past but have failed to thrive.
- Because the Phase II RI ecological risk assessment showed potential risks to ecological receptors from Goss Cove sediment, further investigation and evaluation of the sediment was completed. An Evaluation of Chemical and Toxicological Data study was conducted in 1998 (SAIC, 1998) to

evaluate chemical and toxicological relationships for sediments in Goss Cove. The objectives of the study were to establish toxicological response relationships to contaminants in Goss Cove sediments, to describe the extent of ecological risks associated with chemical contaminants in Goss Cove sediments, and to identify risks for biological effects. Chemical, toxicological, and TIE data were collected at 10 stations. The results supported the conclusion of a lack of correlation between contaminants and observed ecological effects. It may be possible to improve benthic habitat quality by reducing hypoxic conditions in the cove, thereby reducing ammonia concentrations that appear to cause the depauperate aquatic community.

The investigations showed that contaminant levels detected in sediment and surface water in Goss Cove did not pose potential adverse risks to human health or the environment. Based on these findings, NFA was recommended for these media. The two remedial alternatives evaluated for the soil/waste in the FS were no action and installation of an engineered control cap (presumptive remedy) with institutional controls and monitoring. The capping alternative was selected for Site 8, and the ROD for this site was signed by the Navy and regulators in September 1999 (Navy, 1999). Other components of the remedy as detailed in the ROD included institutional controls to prevent disturbance of the cap and site soil, long-term groundwater monitoring to evaluate the effectiveness of the cap and to ensure that contaminants do not migrate to Goss Cove or the Thames River, and five-year reviews.

The RD for Site 8 soil began in October 1999. Additional field work (i.e., field survey, geotechnical field investigation, and geotechnical laboratory testing program) was conducted to collect the necessary data to complete the design. The RD was finalized in November 2000 (TtNUS, 2000b), and construction of the engineered cap system was completed in June 2001.

The BGOURI was completed (TtNUS, 2002a) to further evaluate the potential risks identified in the Phase II RI associated with exposure to groundwater by human receptors. The field work for the BGOURI was completed prior to construction of the engineered cap system. Groundwater samples were collected from existing permanent monitoring wells to further characterize the site. The analytical data from the RI indicated that sources of VOCs, SVOCs, and metals within the fill material are continuing to impact the shallow groundwater at the site. It is likely that these chemicals are mobile and being transported in the groundwater to the Thames River. However, the results of the human health risk assessment showed that all risks for construction workers exposed to groundwater at Site 8 were less than or within target risk ranges. The BGOURI recommended that the Navy complete the RA for the soil, implement land use controls, and begin groundwater monitoring in accordance with the Groundwater Monitoring Plan (TtNUS, 2001a) after finalization of the RA. It was recommended that the decision for preparation of an FS for groundwater at Site 8 be postponed until site conditions stabilize and trends in groundwater contaminant concentrations are determined based on the results of the groundwater monitoring program. However, it

was recently determined that groundwater monitoring as detailed in the ROD is sufficient and that a separate groundwater ROD is not required.

O&M of the cap system at Site 8 and groundwater monitoring are being performed in accordance with the O&M Manual for IR Program Sites (TtNUS, 2006a). The O&M process includes annual inspections, reporting of results, and correcting any identified problems. Site 8 has been inspected annually since 2003. The findings of the inspections are documented in the field on inspection checklists and summarized in Annual LIRs (ECC, 2004c; 2005f; 2005i; 2008f; and 2008j). Volume V (Site 8 O&M) of the O&M Manual was revised in 2008 to address EPA comments on the 2006 O&M Manual and update site information for Site 8 (TtNUS, 2008c).

The groundwater monitoring program for Site 8 began in 2001 (TtNUS, 2001a), and the results of the program are being used to verify the effectiveness of the cap in reducing infiltration and leaching of contaminants and to confirm that contamination is not migrating from the soil to groundwater and eventually to the Thames River. To date, groundwater has been monitored for 7 years (TtNUS, 2003c; ECC, 2004d; 2005a; 2006b; 2008a; 2008l; 2008o). Temporal plots were constructed for Years 1 through 6 for three COCs (PCE, total arsenic, and dissolved arsenic) detected in excess of primary monitoring criteria to evaluate trends (ECC, 2008l). In general, the plots indicated stable or decreasing trends in concentrations over the first 6 years of monitoring. High PCE concentrations in upgradient wells 8MW8D and 8MW10S, which have been attributed to a former neighboring dry-cleaning facility, appear to be decreasing slowly. Trends of total and dissolved arsenic concentrations in shallow downgradient wells appear to be stable or slightly increasing, and trends of total and dissolved arsenic concentrations in deep downgradient wells appear to be slowly decreasing (ECC, 2008l).

In the Year 7 GMR, the most recent year for which data is available, temporal plots showed a surprising and anomalous increase in arsenic and beryllium concentrations for Year 7. A possible cause for the anomalous metals results was that the chemical analysis method used in the past to avoid the possible matrix interference effects of salinity was not implemented (ECC, 2008o).

Volume II (Groundwater Monitoring Plan) of the O&M Manual was revised in 2008 to address EPA comments on the 2006 O&M Manual and update site information for Site 8 (TtNUS, 2008c).

A well inventory was conducted at NSB-NLON in 2007. This inventory included 13 Site 8 wells (TtNUS, 2007a). As a result of the inventory, two Site 8 wells that were not part of an active monitoring program were abandoned (ECC, 2007).

To meet the land use control requirements in the ROD, the Navy implemented an updated instruction [SOPA (ADMIN) New London Instruction 5090.18D] to restrict the use of IR sites at NSB-NLON. The Instruction defines the Navy's policy regarding ground surface disturbance of soils/sediments, subsurface disturbance of soils/sediments and/or groundwater extraction, and disturbance of any remedial infrastructure at IR sites. SOPA (ADMIN) 5090.18D includes current mapping of existing and abandoned wells (Navy, 2008c).

#### **2.1.8 Site 9 - Oily Wastewater Tank (OT-5)**

Site 9, Waste Oil Tank (OT-5), was an underground, concrete storage tank located between Sculpin Avenue and Tang Avenue in the southern portion of NSB-NLON. The investigations at Site 9 were conducted under the CTDEP RCRA UST Program. The site map is included as Figure 2-9. The site's location relative to other IR sites is shown on Figure 1-2. The tank had a diameter of approximately 112 feet and was 11 feet deep. The top of the tank was approximately 5 feet below the ground surface, and the tank had a capacity of approximately 750,000 gallons.

The tank was constructed in the 1940s and was used to store fuel oil. In the late 1970s, the tank was converted to a storage tank for bilge water and other waste solutions. Use of OT-5 stopped in 1993 and all tank contents including floating product and most of the settled sludge were removed. A residual sludge layer of approximately 2 to 3 inches was left in the tank during purging. This sludge contained PCBs at concentrations exceeding 500 milligrams per kilogram (mg/kg) [Halliburton NUS (HNUS), 1994a].

After OT-5 was emptied, groundwater infiltrated through cracks in the concrete surface and partially refilled the tank (HNUS, 1994a). Subsurface contamination of the surrounding soil and groundwater may have been caused by draining of the infiltrated water through the cracks and into the surrounding media.

In 1994, HNUS completed a removal action at OT-5 that included the removal and disposal of PCB-contaminated sludge at OT-5. Removal of OT-5 waste materials from the frac trailers and roll-off containers and off-site disposal of these waste materials was initiated by the Remedial Action Contractor (RAC) on July 21, 1994 and was completed on August 16, 1994. The waste stored inside the two frac trailers and the two roll-off containers was removed in accordance with the procedure described in the Removal Action Work Plan (HNUS, 1994b).

The liquid portion of the waste was aspirated from the frac trailers and roll-off containers into a PCB-dedicated vacuum trailer that was also used to ship the waste for off-site incineration and disposal at the Aptus facility located in Aragonite, Utah. A total of seven vacuum trailer loads were removed from the frac trailers and roll-off containers and shipped to Aptus. The solid portion of the waste was consolidated

into one of the two roll-off containers and shipped in that container for off-site incineration and disposal to the Aptus facility. The empty roll-off container was then returned to the site for decontamination.

Following waste removal, the inside surfaces of the frac trailers and roll-off containers were decontaminated, and wipe samples were collected for verification purposes from inside surfaces. The trailers and containers were decontaminated repeatedly until PCB concentrations in wipe samples were less than the required 10 µg per 100 square centimeter. The Post Removal Action Report (HNUS, 1994b) presents the results of the verification sampling and analysis procedures performed by HNUS to verify that decontamination of the containers used for the temporary on-site storage of the PCB-contaminated sludge removed from OT-5 met cleanup standards.

After the contents of OT-5 were removed, the tank was cleaned and the top of the tank was crushed. The tank was closed in place by filling it with inert material. Based on the results of the RA, no further remedial action is necessary for soil to ensure protection of human health and the environment at Site 9. The status of this site is considered to be RC.

Site 9 is located within the Fuel Farm (Site 23). Groundwater at Site 23 was investigated under CERCLA during the BGOURI (TtNUS, 2002a). Further discussion of the groundwater results for Site 23 is provided in Section 2.1.21.

A well inventory was conducted at NSB-NLON in 2007. This inventory included four Site 9 wells (TtNUS, 2007b). None of these wells could be located. Because these wells were shallow and not part of an active monitoring program, no further action was recommended.

Based on the Final ROD for OU9, a Basewide Groundwater RD for Land Use Controls was prepared. LUCs at Site 9 are to prevent the withdrawal and/or use of groundwater for potable water purposes and ensure that groundwater extracted during construction dewatering activities is properly handled, stored, and disposed (TtNUS, 2008e).

### **2.1.9 Site 10 - Lower Subbase-Fuel Storage Tanks and Tank 54-H**

Six former USTs, including Tank 54-H, are located at the Lower Subbase at the corner of Corvina Road and Amber Jack Road. The site map is included as Figure 2-10. The location of Site 10 in relation to the other IR sites is shown on Figure 1-2.

Concrete USTs E, F, and G had 125,000-gallon capacities and were used to store diesel fuel from 1942 to 1987. Concrete USTs K and L had 25,000-gallon capacities and were used from 1954 to 1989 to store lubrication and hydraulic oil. Tank 54-H had a 30,000-gallon capacity and was used as a reclamation

tank for the other five tanks. Tanks E, F, and G have been decommissioned, and new steel tanks have been installed within the concrete shells of Tanks K and L (EPA, 1995). Tank 54-H has also been decommissioned.

The IAS concluded that there was some measurable leakage from the tanks at Site 10 and recommended monitoring of tank levels to see if the tanks were leaking (Envirodyne, 1983).

In 1989, Fuss & O'Neill conducted a hydrogeologic investigation of two UST areas at NSB-NLON, one at the Tank Farm located southeast of the Lower Subbase and the other in the Lower Subbase (i.e., Site 10). The study was initiated as a result of subsurface soil contamination encountered during construction activities in the two areas. At Site 10, four monitoring wells (FOMW-13 through 16) were installed around Tank 54-H. Soil samples were collected from each well and field screened with an organic vapor analyzer (OVA). Groundwater samples from monitoring wells were analyzed for volatile aromatic hydrocarbons and scanned for petroleum products.

No. 2 fuel oil was detected in monitoring wells at Tank 54-H at concentrations ranging from 21 to 1,100 milligrams per liter (mg/L). In addition, low concentrations (less than 15 µg/L) of benzene and xylenes were detected in FOMW13. Fuss & O'Neill concluded that petroleum contamination had impacted groundwater in the area.

Sites 10 and 11 were evaluated collectively as Zone 1 in the Phase II RI (B&RE, 1997b) and Lower Subbase RI (TtNUS, 1999b). The Thames River adjacent to Zone 1 was also investigated during the Phase II RI and Lower Subbase RI. Because of this approach, the remainder of this section only discusses information in terms of Zone 1.

The investigation found that significant amounts of petroleum contamination (No. 2 fuel oil and waste lubricating oils) remain in the soil of Zone 1; however, the historical sources of petroleum contamination have been eliminated. Petroleum and lead contamination were also identified in groundwater. The human health risk assessment indicated potential risks to receptors from exposure to contaminated site media under current and future scenarios. The ecological risk assessment for the Thames River (sediment and surface water) adjacent to Zone 1 indicated that risks to ecological receptors are minor.

The Lower Subbase RI Report (TtNUS, 1999b) recommended that Zone 1 proceed to an FS for evaluation of appropriate remedial alternatives for soil and limited actions for groundwater. Because of the extensive amount of underground utilities in Zone 1 and the nature of the activities conducted at this location (i.e., national security), it was recommended that the FS for this zone evaluate, to the extent possible, passive and/or in-situ remedial alternatives and the use of institutional controls. In addition, it was

suggested that “hot spot” removal actions, in lieu of full-scale excavation, be evaluated in the Zone 1 FS. It was also recommended that the FS evaluate limited action scenarios for the groundwater and storm sewer system of Zone 1, in conjunction with the soil remedial alternatives. The scenarios evaluated for groundwater should include free-phase product removal from monitoring well 13MW18 and a monitored natural attenuation/tiered groundwater monitoring program. The scenario for the storm sewer system should include cleaning and repair of the system.

The Navy subsequently cleaned the Lower Subase storm sewer catch basins in August 2000. Two Zone 1 catch basins were cleaned by Fleet Environmental using a vacuum truck. The material removed from the catch basins was containerized, tested, and properly disposed off site. The storm sewer lines were not surveyed or repaired during the effort.

A draft FS was prepared and submitted in March 2008 for Zone 1 soil, groundwater and light non-aqueous phase liquid (LNAPL) (TtNUS, 2008b). The draft FS evaluated several remedial alternatives; however, comment resolution was ongoing at the time this document was prepared and changes to the alternatives are likely. It is expected that the FS will be finalized and final remedies for Zone 1 will be selected by the Navy, EPA, and CTDEP in 2009.

A well inventory was conducted at NSB-NLON in 2007. This inventory included seven Site 10 wells (TtNUS, 2007b). No wells were abandoned as a result of the inventory. Although not part of an active monitoring program, it was recommended that these wells be maintained until a decision is reached on the selection of a remedial action at this site.

#### **2.1.10 Site 11 - Lower Subase-Power Plant Oil Tanks**

Site 11 consists of four former underground tanks (A, B, C, and D) located immediately east of Building 29. The site map is included as Figure 2-10. The location of Site 11 in relation to the other IR sites is shown on Figure 1-2. Concrete tanks A and B each had a capacity of 170,000 gallons and were used to store No. 6 grade fuel oil pumped from the Tank Farm located at the southern end of NSB-NLON. Concrete tanks C and D each had a capacity of 170,000 gallons. Tank C was used to store diesel oil, and Tank D was used to store waste oil generated by the bilge water oil recovery system at the power plant. The tanks were installed during World War II and were decommissioned in the mid-1980s. The old concrete tanks were repaired and are now used as containment structures for three new 150,000-gallon steel tanks.

According to the IAS, there was leakage from the tanks and migration of petroleum to groundwater, steam and fuel pipeline tunnels, and underground vaults. The IAS recommended replacing the tanks at Site 11 and implementing oil recovery (Envirodyne, 1982).

In 1987, Wehran Engineering Corporation (Wehran) completed a Final Site Investigation for subsurface oil contamination and identified an area within Site 11 that was contaminated with heavy oil. This area, comprised of electrical conduits and manholes along Corvina Road, contained a mixture of No. 5 and No. 6 fuel oils. Wehran recommended that further review of the operation and distribution of oil in Building 29 be conducted (Wehran, 1987).

Sites 10 and 11 were evaluated collectively as Zone 1 in the Phase II RI (B&RE, 1997b) and Lower Subbase RI (TtNUS, 1999b). The Thames River adjacent to Zone 1 was also investigated during the Phase II RI and Lower Subbase RI. Because of this approach, the remainder of this section only discusses information in terms of Zone 1.

The investigation found that significant amounts of petroleum contamination (No. 2 fuel oil and waste lubricating oils) remain in the soil of Zone 1; however, the historical sources of petroleum contamination have been eliminated. Petroleum and lead contamination were also identified in the groundwater. The human health risk assessment indicated potential risks to receptors from exposure to contaminated site media under current and future scenarios. The ecological risk assessment for the Thames River (sediment and surface water) adjacent to Zone 1 indicated that risks to ecological receptors are minor.

The Lower Subbase RI Report (TtNUS, 1999b) recommended that Zone 1 proceed to an FS for evaluation of appropriate remedial alternatives for soil and limited actions for groundwater. Because of the extensive amount of underground utilities in Zone 1 and the nature of the activities conducted at this location (i.e., national security), it was recommended that the FS for this zone evaluate, to the extent possible, passive and/or in-situ remedial alternatives and the use of institutional controls. In addition, it was suggested that "hot spot" removal actions, in lieu of full-scale excavation, be evaluated in the Zone 1 FS. It is also recommended that the FS evaluate limited action scenarios for the groundwater and storm sewer system of Zone 1, in conjunction with the soil remedial alternatives. The scenarios evaluated for groundwater should include free-phase product removal from monitoring well 13MW18 and a monitored natural attenuation/tiered groundwater monitoring program. The scenario for the storm sewer system should include cleaning and repair of the system.

The Navy subsequently cleaned the Lower Subbase storm sewer catch basins in August 2000. Two Zone 1 catch basins were cleaned by Fleet Environmental using a vacuum truck. The material removed from the catch basins was containerized, tested, and properly disposed off site. The storm sewer lines were not surveyed or repaired during the effort.

A draft FS was prepared and submitted in March 2008 for Zone 1 soil, groundwater and LNAPL (TtNUS, 2008b). The draft FS evaluated several remedial alternatives; however, comment resolution was ongoing at the time this document was prepared and changes to the alternatives are likely. It is expected that the FS will be finalized and final remedies for Zone 1 will be selected by the Navy, EPA, and CTDEP in 2009.

A well inventory was conducted at NSB-NLON in 2007. This inventory included 15 Site 11 wells (TtNUS, 2007b). As a result of the inventory, two Site 11 wells that were not functional were properly abandoned (ECC, 2007). Although not part of an active monitoring program, it was recommended that the five functional Site 11 wells be maintained until a decision is reached on the selection of a remedial action at this site.

#### **2.1.11 Site 13 - Lower Subbase-Building 79 Waste Oil Pit**

Site 13 consists of the waste oil pit located in the northwestern corner of Building 79 on the Lower Subbase. The site map is included as Figure 2-11. Figure 1-2 shows the location of the site relevant to the other IR sites at NSB-NLON. The pit was formerly used as a collection area for waste oil and solvents generated during the cleaning and servicing of diesel train engines. The pit has been filled with concrete (Wehran, 1987), and a recovery well system was installed in approximately 1985. The system operated for a period of several months but was determined to be ineffective and was later abandoned.

Analytical results from soil samples collected from borings in the area of the waste oil pit indicate that subsurface contamination is primarily lubricating/motor oil [Naval Environmental Support Office (NESO), 1979]. The oil was detected at a sample interval of 6 to 9 feet below the ground surface, and the saturated volume of contamination was estimated as approximately 50 feet by 50 feet by 4 feet deep.

In 1987, Wehran completed an investigation to identify and delineate the sources of heavy oils in the subsurface of the Lower Subbase (Sites 10, 11, and 13). Manholes and the area underneath the supporting platform in the vicinity of Building 79 (Site 13) contained No. 6 fuel oil older than 1 year and trace levels of waste oils. Wehran recommended removal of the oil from the manholes near Building 79 using absorption pads and/or excavation of oil-laden soil and inspection of fuel lines within the trench and subsequent cleaning of the trench.

During the Phase I RI, a brown, milky oil was identified west of Building 79. The report indicated this oil potentially originated from the former waste pit in Building 79. An old drawing shows the outlet from the waste oil pit 29 feet south of the northern side of Building 79 (Atlantic, 1992).

The Quay Wall Study Area runs from approximately Pier 2 to Pier 6 (see Figure 2-11). An investigation and removal action were completed in this area to address petroleum contamination. The area was man-

made and consists of a wooden platform and quay wall constructed in 1940. The wooden platform is 4 inches thick and is supported by 10- to 12-inch-square wooden joists and 8-inch timber pilings. A steel bulkhead along the Thames River erected in 1952 was constructed of steel sheet piling and supports. During construction of the bulkhead, the quay wall and wooden platform were covered with approximately 6 to 7 feet of sand and gravel fill, and the area was paved for vehicular access along Albacore Road. The quay wall is located approximately 4 feet east of the steel bulkhead, immediately beneath the paved surface. Fill soil below the wooden platform and quay wall periodically wash out. Void spaces of 3 to 8 feet exist discontinuously beneath the wooden platform. Sand and gravel fill separate the void spaces, and the void spaces are filled with sand poured into a series of manholes along the length of Albacore Road. Natural river deposits of silt and sand underlie the void spaces and sand fill.

Zones of visible petroleum contamination were present in the soil immediately above the wooden platform and in the fill below the wooden platform. Petroleum was found in the area around the storm sewer manhole northeast of Pier 4. Globules of floating product were also present in the standing water in the void spaces below the wooden platform. Releases of petroleum products and oily substances were observed in the Thames River in the vicinity of the storm sewer outfall just north of Pier 4 in November 1994. It was determined that the probable source of the releases was the storm sewer manhole near Pier 4 and Building 79. An expandable rubber plug was placed in the storm sewer outfall in November 1994, and the storm sewer pipe leading to the outfall was filled with sand in late December 1994. These measures appear to have eliminated migration of petroleum product from this outlet because no visible release of petroleum product has been observed in the Thames River near the outlet.

Halliburton NUS (HNUS) prepared a Removal Site Evaluation for the quay wall to summarize the removal actions performed in November and December 1994 to remedy petroleum product releases that occurred along the quay wall of the Lower Subbase. Five subsurface soil samples were collected from five of the six borings. Four of the soil samples (QW-2, QW-3, QW-4, and QW-5) were analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and TPH. The fifth soil sample (QW-1) was analyzed for Target Compound List (TCL) organics, Target Analyte List (TAL) inorganics plus boron, TPH, and Toxicity Characteristic Leaching Procedure (TCLP) metals. Lead was identified as the only COC. Based on current and anticipated land use of the area, direct exposures to lead were not considered likely except during construction activities. Therefore, the Removal Site Evaluation recommended that no further removal action be performed at that time but that further site investigations should focus on lead concentrations. It was estimated that no more than 800 gallons of petroleum were pumped from the void spaces.

A majority of the site is paved or covered with buildings. The site was included in Zone 4 for the Phase II RI and Lower Subbase RI. The Thames River adjacent to Zone 4 was also investigated during the Phase

II RI and Lower Subbase RI. Because of this approach, the remainder of this section only discusses information in terms of Zone 4.

Lead contamination was identified in shallow and deep soil and groundwater in Zone 4. Widespread TPH contamination was identified in deep soil at Zone 4. Some petroleum contamination was also evident in shallow soil and groundwater. The human health risk assessment indicated potential risks to receptors from exposure to contaminated site media under current and future scenarios. The ecological risk assessment for the Thames River (sediment and surface water) adjacent to Zone 4 indicated that risks to ecological receptors were low to moderate.

The Lower Subbase RI recommended that Zone 4, which includes Site 13 - Building 79 Waste Oil Pit, Site 19 - Solvent Storage Area (Building 316), the Quay Wall Study Area, and the fuel distribution pipeline, proceed to an FS to evaluate appropriate remedial alternatives. Because of the extensive amount of underground utilities in Zone 4 and the sensitive nature of the activities conducted at this location (i.e., national security), it was recommended that the FS for this zone focus, to the extent possible, on evaluation of alternatives that rely on institutional controls to limit exposure to contaminated soil and passive and/or in-situ remedial alternatives. In addition, it was suggested that the Zone 4 FS consider "hot spot" removal actions in lieu of full-scale excavation. A tiered groundwater monitoring program and cleaning and repair of the Zone 4 storm sewer system were recommended for evaluation during the FS. The RI also recommended additional characterization of sediment in the Thames River to provide the data necessary to refine the ecological risk assessment prior to proceeding to an FS.

The Navy subsequently cleaned the Lower Subbase storm sewer catch basins in August 2000. Seven Zone 4 catch basins were cleaned by Fleet Environmental using a vacuum truck. The material removed from the catch basins was containerized, tested, and properly disposed off site. The storm sewer lines were not surveyed or repaired during the effort.

Per the recommendations of the Lower Subbase RI, Battelle is conducting an investigation of Thames River sediment that includes sampling and ecological risk evaluations for Zones 4 and 7 and the newly identified site at Pier 1. The Pier 1 site was identified based on the results of sampling conducted in the area by Science Application International Corporation (SAIC) in 1999 and by the Navy in association with the siting of the Controlled Industrial Facility Building. Battelle completed a Rapid Sediment Characterization Pilot Study in 2003 to supplement existing data in the area, and a Validation Study is in progress to evaluate potential ecological impacts due to contaminant migration from onshore source areas or activities associated with the berthing of submarines and ships in the pier areas.

A FS was prepared for Zone 4 soil, groundwater, and sediment (Thames River). The results of the Battelle Validation Study were used to complete a Baseline Ecological Risk Assessment as part of the Lower Subbase FS. The Pier 1 site was incorporated into Zone 4 of the Lower Subbase, the zone in closest proximity, for future evaluations. The draft FS was prepared and submitted in March 2008 for Zone 4 soil, groundwater, and sediment (TtNUS, 2008b). The draft FS evaluated several remedial alternatives; however, comment resolution was ongoing at the time this document was prepared and changes to the alternatives are likely. It is expected that the FS will be finalized and final remedies for Zone 4 will be selected by the Navy, EPA, and CTDEP in 2009.

A well inventory was conducted at NSB-NLON in 2007. Of the 16 wells inventoried at Site 13, 7 were identified as not deficient, 1 was not usable, 4 were not found, and conditions of 4 wells were not able to be determined (TtNUS, 2007a). Although not part of an active monitoring program, it was recommended that the seven functional Site 13 wells be maintained until a decision is reached on the selection of a remedial action at this site.

#### **2.1.12 Site 14 - Overbank Disposal Area-Northeast**

The OBDANE site is located in a heavily wooded area on the edge of a ravine north of Stream 3 of the Area A Downstream, west of the Area A Weapons Center, and south of the Torpedo Shops. At one time, miscellaneous wastes were apparently dumped over the bedrock edge. The site was circular and approximately 80 feet in diameter. A dirt road provides limited access to the wooded site. Figure 2-12 shows the general site arrangement. The location of Site 14 in relation to the other IR sites is shown on Figure 1-2. A nearly vertical 20-foot-high bedrock face is located at the eastern edge of the site. The rest of the site slopes to the southwest.

The IAS Report (Envirodyne, 1983) stated that vegetation at the site indicated that no dumping had occurred within 10 years prior to the 1982 investigation. The IAS report documented the presence of several empty fiber drums. Atlantic personnel inspected the site on September 30, 1988 and verified that the drums were still present. No visual staining or stressed vegetation was observed at this time. No development of this area was planned.

During the Phase I RI (Atlantic, 1992), surface soil samples were collected from within the limits of the identified disposal area. Based on the sample results, the RI concluded that there was negligible risk associated with Site 14 and recommended that a supplemental Step I Investigation be performed. During the Phase II RI (B&RE, 1997b), a single shallow monitoring well was installed downgradient of the site, and two rounds of groundwater samples were collected. Six additional soil samples were also collected within the limits and downgradient of the disposal area. The Phase II RI concluded that all human health risks were within or less than EPA's target range; however, arsenic was found in surface soil samples at

concentrations slightly exceeding State standards, and lead contamination was found in surface soil samples approximately 80 feet south of the site. The RI Report recommended that further characterization of surface soil with respect to arsenic and lead be completed.

An Action Memorandum for an NTCRA was prepared for Site 14 by the Navy in 1999. Removal and off-site disposal of contaminated soil and debris at the site was the recommended alternative in the Action Memorandum. A work plan for the removal action was prepared, and the removal action was completed in May 2001. A post-removal action report was prepared to document the actions taken during removal action. No significant risks from exposure to soil remained at site after the NTCRA; therefore, an NFA ROD for Site 14 soil was signed in September 2004 (Navy, 2004b).

Groundwater at Site 14 was further characterized during the BGOURI (TtNUS, 2002). For the RI, Site 3 and Site 14 were evaluated collectively because Site 14 falls within the boundary of Site 3, and any impacts from Site 14 would be detected in groundwater beneath Site 3. Twenty-six samples were collected from Site 3 wells, but only one groundwater sample from the single Site 14 well was collected during the BGOURI. Groundwater results for Sites 3 and 14 indicated that water quality was generally good, with only sporadic, low-concentration detections of VOCs and metals in site monitoring wells. The VOCs were detected exclusively in Site 3 monitoring wells. Seven metals were the only chemicals detected in the Site 14 groundwater sample, and all concentrations were less than background groundwater concentrations. The human health risk assessment determined that risks posed by exposure of construction workers to groundwater at Sites 3 and 14 are within EPA and CTDEP acceptable levels, assuming that the workers are exposed to the maximum observed concentrations of site contaminants. The human health risk assessment also determined that risks posed by exposure of hypothetical future residents to groundwater at Sites 3 and 14 are outside of EPA and CTDEP acceptable levels, assuming the residents are exposed to the maximum observed concentrations of site contaminants. Arsenic, benzo(a)pyrene, TCE, and vinyl chloride were the major contributors to the ICRs, and thallium was the major contributor to the HIs. All of the chemicals that contributed significantly to the risks were detected in the Site 3 wells. The BGOURI recommended that an FS be prepared to evaluate the groundwater associated with Sites 3 and 14.

Site 14 groundwater was further evaluated in the BGOURI Update/FS Report (TtNUS, 2004). A supplemental human health risk assessment evaluation was performed with Site 14 groundwater data collected during the BGOURI, separate from Site 3 groundwater data. The evaluation indicated no significant risks to potential receptors from exposure to Site 14 groundwater. Based on these results, NFA was recommended for Site 14 groundwater in the BGOURI Update/FS. An interim ROD for OU9 (Navy, 2004d), which includes Site 14, was signed in December 2004 and documented the NFA decision for the site. No VOCs were detected in groundwater samples collected at Site 14 during the BGOURI,

indicating that vapor intrusion is not a concern at Site 14. As a result, NFA was selected for Site 14 in the Final OU9 ROD (Navy, 2008b). The status of Site 14 soil and groundwater is considered RC.

A well inventory was conducted at NSB-NLON in 2007. This inventory included one Site 14 well (TtNUS, 2007a). This well was not part of an active monitoring program and was abandoned in December 2007 (ECC, 2007).

### **2.1.13 Site 15 - Spent Acid Storage and Disposal Area**

The SASDA was located in the southeastern section of NSB-NLON, between the southern side of Buildings 409 and 410. Figure 2-13 displays the general site arrangement. Figure 1-2 shows the location of the site relevant to the other IR sites at NSB-NLON. The site consisted of a concrete storage pad and an UST.

According to previous reports (Atlantic, 1994b), the area was used for storage and disposal of discarded batteries. Acid was removed from the battery housings and temporarily stored in a 4- by 4- by 12-foot, rubber-coated, underground tank. The acid was periodically emptied from the tank by a pumper truck and disposed off site. The battery housings were temporarily stored on the adjacent concrete pad. The former tank and the surrounding soils encompassed approximately 1,000 square feet.

All battery acid and housing storage at the site was terminated. According to documentation (Atlantic, 1994b), the acid storage tank was filled with soil and covered by a concrete pad. Future plans for this area included the demolition of Buildings 409 and 410 and the construction of a warehouse.

Site 15 was investigated during the Phase I RI (Atlantic, 1992) and the FFS (Atlantic, 1994b). Soil and groundwater samples were collected and analyzed during the investigations to characterize the site and to determine appropriate remedial alternatives. The results of the RI and FFS suggested that a removal action should be completed to address the tank and associated contamination. An Action Memorandum was prepared, and a TCRA was completed by OHM Remediation Services Corporation (OHM) in January 1995. The tank, 318 tons (200 cubic yards) of lead-contaminated soil, contaminated pavement, and the tank contents were removed and disposed off site (OHM, 1995b).

The site was further evaluated during the Phase II RI (B&RE, 1997b), which included the collection and analysis of soil and groundwater samples from the site. The field investigation was conducted prior to the TCRA, but the only data evaluated during the RI were associated with sample locations that were not excavated during the TCRA. This approach provided an assessment of post-TCRA conditions at the site. The RI recommended that limited additional sampling be completed to verify that the remaining soil did not contain significant contaminant concentrations that would impact groundwater beneath the site. The

RI also recommended that if sampling results confirmed that soil would not impact groundwater, an NFA decision document should be prepared for soil.

Based on the recommendations of the Phase II RI, CTDEP completed additional sampling and analysis at the site in 1997. The results showed that remaining concentrations of inorganics in soil did not present a contaminant migration concern from soil to groundwater. Using these results, the Navy subsequently prepared an NFA Source Control ROD for the site that was signed in September 1997 (Navy, 1997c).

The groundwater associated with this site was further characterized as part of the BGOURI (TtNUS, 2002a). The objective of the RI was to further characterize the nature and extent of groundwater contamination to determine if the TCRA was successful and to quantify the risks to potential human receptors associated with groundwater at the site. Groundwater samples were collected from four existing groundwater monitoring wells, and the results indicated that residual contamination (i.e., metals in soil) from the former SASDA was impacting groundwater. Because groundwater at the site was found to be relatively acidic, it was hypothesized that the lead and other metals detected in groundwater will be mobile and migrate from the site. The data also indicated that a source of TCE that is unrelated to the site is impacting Site 15 groundwater. The human health risk assessment results from the BGOURI indicated that Site 15 groundwater does not pose any significant risks to construction workers, but it does pose potential risks to hypothetical human receptors. Carcinogenic risks for future adult residents exposed to Site 15 groundwater were less than or within acceptable risk levels, but noncarcinogenic risks for future adult residents exposed to Site 15 groundwater exceeded the acceptable level of 1.0 under the RME scenario. Although not evaluated in the human health risk assessment, potential risks to future child residents resulting from exposures to groundwater would also be expected to marginally exceed acceptable risk levels. Chromium and silver were the major contributors to the noncarcinogenic risks. The BGOURI recommended that an FS be prepared for Site 15 groundwater to address contaminant migration issues and potential risks to hypothetical residential users associated with metals.

A DGI was completed at the site in the fall of 2002 to delineate the extent of the remaining source material and confirm the groundwater results from the BGOURI. The results of the DGI as documented in the BGOURI Update/FS Report (TtNUS, 2004) showed that there is no contamination remaining in soil that is acting as a source of contamination to the groundwater and that there is no significant groundwater contamination at the site. The human health risk assessment and data screening results showed that there are no soil or groundwater COCs for Site 15. Comparison of the Phase II RI and DGI analytical results to the BGOURI results indicate that the BGOURI results were anomalies and were not representative of site conditions. The cause(s) of the anomalies may have been the field sampling methodology and/or laboratory issues. Based on the results of the DGI, it was recommended that the existing NFA ROD for Site 15 soil not be amended and that an NFA decision document be prepared for

Site 15 groundwater. The Interim ROD for groundwater at Sites 3, 7, 14, 15, 18, and 20 (OU9), signed in December 2004, documented the NFA decision for Site 15 groundwater (Navy, 2004d). The status of Site 15 soil and groundwater is considered RC.

Potential risks resulting from exposures to chemicals that have volatilized from groundwater and migrated through building foundations into indoor air were evaluated in a 2008 memorandum by comparing concentrations of volatile chemicals detected in groundwater to EPA and CTDEP screening criteria for vapor intrusion. Concentration of chloroform exceeded the EPA screening criterion and it was further evaluated using EPA's Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks were within EPA and CTDEP acceptable levels and vapor intrusion is not an issue at Site 15. As a result, NFA was selected for Site 15 in the Final OU9 ROD (Navy, 2008b).

A well inventory was conducted at NSB-NLON in 2007. This inventory included four Site 15 wells (TtNUS, 2007a). None of these wells were part of an active monitoring program; therefore, all four of these wells were abandoned in December 2007 (ECC, 2007).

#### **2.1.14 Site 16 - Hospital Incinerator**

Site 16 consists of two former locations where the skid-mounted hospital incinerator was reportedly operated. In the 1980s, the Naval Hospital Groton operated a skid-mounted waste incinerator at two sites adjacent to the base hospital. The two sites (16-A and 16-B) are located west of Tautog Road, adjacent to Building 449 and Building 452. The site map is included as Figure 2-14. The location of the site relevant to other IR sites is shown on Figure 1-2.

According to the FFA, the incinerator was used to destroy medical records and medical waste contaminated with pathological agents. Ash generated by the waste incinerator was transferred to dumpsters and disposed at the municipal landfill.

Site 16 was evaluated during the IAS (Envirodyne, 1983) for NSB-NLON, although no sampling activities were conducted as part of the study. The study's recommendation for this site was that no further investigation was necessary because, at the time of the IAS study, the site was still operational. As a result, no investigation of Site 16 was conducted during either the Phase I or the Phase II RIs. The Navy has subsequently ceased operations of the incinerator at the hospital.

The site was investigated during the BGOURI (TtNUS, 2002a) to determine the impact of the operation of the incinerator. The BGOURI focused on soil at Site 16, and surface and subsurface soil samples were collected for analysis during test boring activities. Temporary groundwater monitoring wells were to be installed and sampled during the investigation, but they were not installed because no overburden

groundwater was found before shallow bedrock was encountered. The depth to bedrock at Site 16 was found to be less than 3 feet below the ground surface. Additional efforts were not made to investigate the groundwater in the bedrock because of the following factors:

- The source of contamination at Site 16 was a skid-mounted incinerator, and the contaminants at the site (i.e., dioxins/furans, PCBs, and metals) are not typically mobile in the dissolved phase.
- The bedrock (granite) at NSB-NLON is relatively competent and would likely impede vertical contaminant migration. In addition, regional hydrogeologic information suggests that the depth to groundwater in the bedrock is more than 70 feet below the ground surface.

The nature and extent of contamination and human health risk assessment results from the RI indicated that past operation of the skid-mounted incinerator at Site 16 did not significantly impact the surrounding soil and that site soil does not pose significant risks to any potential human receptors (i.e., all risks were within acceptable levels). Risks to ecological receptors were not evaluated during this RI because the site does not provide suitable ecological habitat.

In addition to the sampling and analytical program, interviews were conducted during the RI to obtain historical information about the incinerator. Personnel at the Naval Groton Hospital (the Director of Records and the Regional Coordinator) and the NSB-NLON Public Works Department were contacted regarding this issue. None of the personnel could provide any historical information about the incinerator or any insight into its operation.

The results of the BGOURI did not indicate that subsequent rounds of investigation were necessary to further characterize Site 16. In addition, the results did not suggest that an FS was necessary for the site. Therefore, the BGOURI recommended that an NFA decision document be prepared for the site (TtNUS, 2002a). NFA was selected for Site 16 soil and was documented in the September 2004 ROD (Navy, 2004c). The status of Site 16 is considered RC.

No wells were determined to exist at Site 16 during the planning of the NSB-NLON well inventory; therefore, Site 16 was not included in the well inventory (TtNUS, 2007a).

#### **2.1.15 Site 17 - Lower Subbase-Hazardous Materials/Solvent Storage Area (Building 31)**

Building 31 was constructed in 1917 and was originally used as a battery shop until the mid-1950s. The site map is included as Figure 2-15. The location of Site 17 relative to other IR sites is shown on Figure 1-2. Battery overhaul was one of the largest operations conducted at NSB-NLON prior to use of nuclear power for the submarines. Lead-acid batteries from old diesel submarines were routinely serviced in the

Battery Overhaul Shop at Building 31. Services ranged from charging batteries to complete battery overhaul. Spent acid from the overhauled batteries was disposed in a spent acid tank located at Site 15 (Envirodyne, 1983).

After World War II, the building was converted to a storage facility for hazardous materials. Building 31 has been used as the main hazardous/flammable materials warehouse for the base since the 1970s. Items such as sulfuric acid, methyl isobutyl ketone, potassium hydroxide, potassium tetraborate, hydrofluoric acid, and nitric acid were stored in containers of up to 55-gallon capacity. In 1992, while the concrete floor of the building was being replaced to comply with RCRA regulations, a yellow discoloration was discovered in the soil beneath the floor slab. Analysis of soil samples revealed elevated levels of lead. As a result, an Action Memorandum was prepared (HNUS, 1993) to document the need to remediate lead-contaminated soil to a depth of 1 foot below the water table. The TCRA was completed in 1995 (HNUS, 1995a). Figure 2-16 shows the cells within Building 31 that were remediated. Some contaminated soil was left in place in the areas between Building 31 and the Thames River front because its removal would have caused significant interference with NSB-NLON traffic.

During subsequent investigations, Site 17 has been included in Zone 3 of the Lower Subbase, which extends from Capelin Road along the southern end of Zone 2 to the southern side of Bullhead Road. Zone 3 includes Site 17, fuel oil distribution lines, and steam, condensate, and electrical ducts. The Providence and Worcester Railroad borders the eastern edge of Zone 3, and the Thames River lies to the west of it. Because of this approach, the remainder of this section only discusses information in terms of Zone 3.

Fuel oil distribution lines and utility ducts and trenches run through Zone 3. In 1996, pressure leak testing was performed on the lines and valves in the fuel distribution system within Zone 3. All sections of the line and various valves tested in the portion of the distribution system within Zone 3 passed the pressure testing procedures.

The results of the Lower Subbase RI (TtNUS, 1999b) indicated that lead is still a concern in soil and groundwater at this site and that petroleum compounds are also of concern in soil. The Lower Subbase RI recommended that Zone 3 proceed to an FS. Because of the extensive amount of underground utilities in Zone 3 and the sensitive nature of the activities conducted at this location (i.e., national security), it was recommended that the FS for this zone focus on the evaluation of alternatives that rely on institutional controls to limit exposure to contaminated soil and a tiered groundwater monitoring program to verify that significant contaminant migration is not occurring. It was also recommended that "hot spot" removal actions for the lead contamination and cleaning and repair of the Zone 3 storm sewer system be evaluated during the FS. The ecological risk assessment for the Thames River adjacent to Zone 3

showed that the risks to ecological receptors in sediment adjacent to Zone 3 are relatively low and that lead is not a significant threat to ecological receptors. In addition, the Thames River provides significant dilution and mixing, which minimizes the impact of any contaminant migration from Zone 3.

The Navy subsequently cleaned the Lower Subbase storm sewer catch basins in August 2000. Two catch basins in Zone 3 were cleaned by Fleet Environmental using a vacuum truck. The material removed from the catch basins was containerized, tested, and properly disposed off site. The storm sewer lines were not surveyed or repaired during the effort.

Building 31 was demolished in 2001. The building's foundation and floor slab were not disturbed during the demolition. Building 78, which was located adjacent to Building 31, was demolished in 2005, and a parking lot was constructed in the area formerly occupied by Buildings 31 and 78. Three inches of asphalt were placed over the Building 31 floor slab, which covered the solidified waste material and contaminated soil remaining at Site 17, to make the parking lot. A draft FS was prepared for Zone 3 soil, which was finalized in March 2008. The draft FS (TtNUS, 2008b) evaluated several remedial alternatives; however, comment resolution was ongoing at the time this document was prepared and changes to the alternatives are likely. It is expected that the FS will be finalized and final remedies for Zone 3 will be selected by the Navy, EPA, and CTDEP in 2009.

A well inventory was conducted at NSB-NLON in 2007. This inventory included seven Site 17 wells (TtNUS, 2007a). Four of these wells had been documented as previously abandoned. Of the three remaining Site 17 wells, one was not functional and was abandoned (ECC, 2007). Although not part of an active monitoring program, it was recommended that the two functional Site 17 wells be maintained until a decision is reached on the selection of a remedial action at this site (TtNUS, 2007a).

#### **2.1.16 Site 18 - Solvent Storage Area (Building 33)**

Site 18 consists of Building 33, which is located east of Grayback Avenue. The site map is included as Figure 2-17. Several 55-gallon drums containing solvents such as TCE and dichloroethene and some gas cylinders were stored in Building 33 (EPA, 1995). The solvent storage area was identified during the IAS (Envirodyne, 1983) for NSB-NLON. The site was identified as Study Area F in the FFA and is now identified as ER Program Site 18. The location of Site 18 relative to other IR sites is shown on Figure 1-2.

No sampling activities were conducted at Site 18 prior to the BGOURI (TtNUS, 2002a). During the BGOURI, both soil and groundwater samples were collected at Site 18 to perform an initial characterization of the nature and extent of contamination at the site. Another objective of the RI was to quantify the risks to human receptors associated with the site. Ecological risks associated with the site

were not evaluated because a majority of the site consists of a building and paved parking lot, which do not represent viable habitat.

During the RI, both surface and subsurface soil samples were collected and analyzed. Three temporary groundwater monitoring wells were installed; however, only two were sampled during the RI because one well was dry. The nature and extent of contamination and human health risk assessment results from the RI indicated that past storage of solvents at Building 33 did not significantly impact the surrounding media and that the site does not pose significant risks to any potential human receptors. No significant concentrations of contaminants were detected in groundwater at Site 18. All carcinogenic risks from exposure to soil at Site 18 were less than or within acceptable risk levels, and all noncarcinogenic risks were less than the acceptable level of 1.0.

The results of the BGOURI did not indicate that subsequent rounds of investigation were necessary to further characterize the site. In addition, the results did not suggest that an FS was necessary for the site. Therefore, the RI recommended that an NFA decision document be prepared for this site. Separate RODs for Site 18 soil and groundwater (Navy, 2004c and 2004d) were prepared to document the NFA decisions. The ROD for Site 18 soil was signed in September 2004. The selected NFA remedy for groundwater at Site 18 was documented in the Interim ROD for groundwater at Sites 3, 7, 14, 15, 18, and 20 (OU9) signed in December 2004. No VOCs were detected in groundwater samples collected at Site 18 during the BGOURI, indicating that vapor intrusion is not a concern at Site 18. As a result, NFA was selected for Site 18 in the Final OU9 ROD (Navy, 2008b). The status of Site 18 soil and groundwater is considered RC.

No wells were determined to exist at Site 18 during the planning of the NSB-NLON well inventory; therefore, Site 18 was not included in the well inventory (TtNUS, 2007a).

#### **2.1.17 Site 19 - Lower Subbase-Solvent Storage Area (Building 316)**

Site 19 – Solvent Storage Area Building 316, is located in the Lower Subbase, west of Pier 2. The site map is included as Figure 2-11. The location of Site 19 relative to other IR sites is shown on Figure 1-2. Several 5-gallon cans containing methyl ethyl ketone were stored in Building 316 (EPA, 1995). Solvents are no longer stored in this facility.

Soil and groundwater sampling and analysis were conducted at this site during the Lower Subbase RI (TtNUS, 1999b). This site was included in Zone 4, which includes Site 13 - Building 79 Waste Oil Pit, Site 19 - Solvent Storage Area (Building 316), the Quay Wall Study Area, and the fuel distribution pipeline, during the Lower Subbase RI. Because of this approach, the remainder of this section only discusses information in terms of Zone 4.

Lead contamination was identified in shallow and deep soil and groundwater in Zone 4. Widespread TPH contamination was identified in deep soil at Zone 4. Some petroleum contamination was also evident in shallow soil and groundwater. The human health risk assessment indicated potential risks to receptors from exposure to contaminated site media under current and future scenarios. The ecological risk assessment for the Thames River (sediment and surface water) adjacent to Zone 4 indicated that risks to ecological receptors were low to moderate.

The Lower Subbase RI recommended that Zone 4 proceed to an FS to evaluate appropriate remedial alternatives. Because of the extensive amount of underground utilities in Zone 4 and the sensitive nature of the activities conducted at this location (i.e., national security), it was recommended that the FS for this zone focus, to the extent possible, on evaluation of alternatives that rely on institutional controls to limit exposure to contaminated soil and passive and/or in-situ remedial alternatives. In addition, it was suggested that the Zone 4 FS consider "hot spot" removal actions in lieu of full-scale excavation. A tiered groundwater monitoring program and cleaning and repair of the Zone 4 storm sewer system were recommended for evaluation during the FS. The RI also recommended additional characterization of sediment in the Thames River to provide the data necessary to refine the ecological risk assessment prior to proceeding to an FS.

The Navy subsequently cleaned the Lower Subbase storm sewer catch basins in August 2000. Seven Zone 4 catch basins were cleaned by Fleet Environmental using a vacuum truck. The material removed from the catch basins was containerized, tested, and properly disposed off site. The storm sewer lines were not surveyed or repaired during the effort.

Per the recommendations of the Lower Subbase RI, Battelle is conducting an investigation of Thames River sediment that includes sampling and ecological risk evaluations for Zones 4 and 7 and the newly identified site at Pier 1. The Pier 1 site was identified based on the results of sampling conducted in the area by SAIC in 1999 and by the Navy in association with the siting of the Controlled Industrial Facility Building. Battelle completed a Rapid Sediment Characterization Pilot Study in 2003 to supplement existing data in the area, and a Validation Study is in progress to evaluate potential ecological impacts due to contaminant migration from onshore source areas or activities associated with the berthing of submarines and ships in the pier areas.

A draft FS was prepared for Zone 4 soil, groundwater, and sediment (Thames River). The Pier 1 site was incorporated into Zone 4 of the Lower Subbase, the zone in closest proximity, for future evaluations. The draft FS (TtNUS, 2008b) evaluated several remedial alternatives; however, comment resolution was ongoing at the time this document was prepared and changes to the alternatives are likely. It is expected

that the FS will be finalized and final remedies for Zone 1 will be selected by the Navy, EPA, and CTDEP in 2009.

A well inventory was conducted at NSB-NLON in 2007. This inventory included one Site 19 well. Although not part of an active monitoring program, it was recommended that the Site 19 well be maintained until a decision is reached on the selection of a remedial action at this site (TtNUS, 2007a).

#### **2.1.18 Site 20 - Area A Weapons Center**

Site 20 is the Area A Weapons Center, which is located north of the terminus of Triton Road, adjacent to the Area A Wetland. The site map is included as Figure 2-18. The site's location relative to other IR sites is shown on Figure 1-2. The site includes Building 524 and the northern and southern weapons storage areas. Building 524 is used for administration, minor torpedo assembly, and storage of simulator torpedoes (B&RE, 1997b). No weapons production takes place in this building. Chemicals and chemical wastes, including cleaning and lubricating compounds, paints, adhesives, and liquid fuels, were stored in 1-gallon to 5-gallon containers in seven metal storage cabinets located on a paved area south of the building. Many of these materials are classified as corrosive or flammable. Building 524 was constructed in 1990 and 1991. Prior to construction, the area was primarily woodlands. Portions of the site were blasted to remove bedrock during construction.

The northern and southern weapons storage bunkers are located southeast of Building 524. The southern bunkers are first evident in photographs from 1969, and the northern area bunker is evident in photographs from 1974. Weapons containing liquid fuels such as Otto fuel, JP-10, and TH-Dimer (jet rocket fuel), are stored in these bunkers. Routine maintenance and security improvements planned for the Area A Weapons Center include grouting and waterproofing of bunkers, repaving of roads, regrading, and culvert installation.

This site was investigated during the Phase II RI (B&RE, 1997b), and it was found that minimal contamination of surface water and groundwater exists and that the potential for substantial contaminant transport is low. Therefore, limited action was recommended for this site in the Phase II RI. Although Building 524 is part of Site 20, an RA in this area is not expected because no impacted soil or sediment has been identified.

A ROD was signed for the soil and sediment OU associated with Site 20 in June 2000 (Navy, 2000). A small (less than 200 cubic yards) RA was conducted at the site in 2001 to address PAH and arsenic contamination in soil and sediment. The action was intended to mitigate direct exposures to soil and sediment and involved the excavation of soil and sediment with contaminant concentrations exceeding cleanup levels. Confirmatory soil and sediment samples were collected from the bottom and sidewalls of

the excavation. Following verification of contaminated soil removal, the excavations were backfilled with clean soil, drainage swales were regraded, and disturbed asphalt was replaced. Based on the results of the RA at Site 20, the status of site soil is RC.

The groundwater at Site 20 was further characterized during the BGOURI (TtNUS, 2002a). The objective of the investigation was to further characterize the nature and extent of groundwater contamination and to quantify the risks to human receptors from groundwater contamination. In general, organic and inorganic contaminants were detected infrequently and at low concentrations in groundwater at Site 20. TCE and benzo(a)pyrene were the only organic contaminants identified as significant contaminants in groundwater. Metals detected at significant concentrations in groundwater included antimony, arsenic, nickel, silver, thallium, and zinc. High levels of total suspended solids and total dissolved solids in one sample may be the reason for the elevated concentrations of two of the metals. All the organic and inorganic contaminants were identified in samples from overburden monitoring wells.

The human health risk assessment determined that risks posed by exposure of construction workers to maximum observed concentrations of site contaminants in groundwater at Site 20 are less than acceptable levels. The human health risk assessment also evaluated future residential groundwater usage, and calculated risks were greater than acceptable levels based on exposure to maximum contaminant concentrations. Even though contaminant concentrations were generally low and risks were acceptable under the current land use scenario, the RI recommended that an FS be prepared for the groundwater associated with Site 20.

Prior to proceeding to an FS for the groundwater, a DGI was conducted at Site 20 to confirm the groundwater results of the BGOURI. The results of the DGI were presented in the BGOURI Update/FS (TtNUS, 2004). During the DGI, groundwater samples were collected from the two monitoring wells in which high silver concentrations were detected during the BGOURI. The groundwater samples were analyzed for total and dissolved TAL inorganics. Silver was not detected at concentrations greater than the detection limit (4.8 µg/L) in either well during the DGI. These results indicate that the silver concentrations detected during the BGOURI were anomalies because they were not detected during the Phase II RI or the DGI. Further data and risk evaluations were also conducted during the BGOURI Update. The results of the evaluations showed that there is no significant contamination in Site 20 groundwater and that there are no significant risks to human health associated with exposure to Site 20 groundwater. The BGOURI Update recommended that an FS not be prepared for Site 20 groundwater and that an NFA decision document be prepared for the groundwater. The Interim ROD for OU9, signed in December 2004, documented the NFA decision for Site 20 groundwater (Navy, 2004d).

Potential risks resulting from exposures to chemicals that have volatilized from groundwater and migrated through building foundations into indoor air were evaluated in a 2008 memorandum by comparing concentrations of volatile chemicals detected in groundwater to EPA and CTDEP screening criteria for vapor intrusion. Concentration of TCE exceeded the EPA screening criterion and it was further evaluated using EPA's Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks were within EPA and CTDEP acceptable levels and vapor intrusion is not an issue at Site 20. As a result, NFA was selected for Site 20 in the Final OU9 ROD (Navy, 2008b).

A well inventory was conducted at NSB-NLON in 2007. This inventory included four Site 20 wells (TtNUS, 2007a). None of these wells were part of an active monitoring program; therefore all four of these wells were abandoned in December 2007 (ECC, 2007).

The status of Site 20 groundwater is considered RC.

**2.1.19 Site 21 - Lower Subase-Berth 16**

Site 21, Berth 16, is located at the Lower Subase along the Thames River at the intersection of Amberjack Road and Albacore Road. The site map is included as Figure 2-19. The location of the site relative to other IR sites is shown on Figure 1-2. The following structures are currently included in Berth 16 (Atlantic, 1995a):

<b>Building</b>	<b>Original Use</b>	<b>Current Use</b>
103	Instruction	Instruction
173	Substation	Electrical distribution
106	Photolab and electronics	Storage
157	Periscope Shop	Optical Shop
456,478	Maintenance Shop	Maintenance Shop

Berth 16 formerly included a refuse/classified materials incinerator, an underground, 250-gallon, diesel fuel storage tank, and an underground, diesel-fuel transfer line (Atlantic, 1995a). The incinerator, which was located at the current site of Building 478, has been separated from Site 21 and is now designated as Site 25. The UST was located adjacent to the northern wall of Building 157, and the underground fuel line extended along Pier 51, east of Building 173. All these items have been decommissioned (Atlantic, 1995a).

The area was investigated during the Pier 33 and Berth 16/Former Incinerator Site Investigation (Atlantic, 1995a) and the Lower Subase RI (TtNUS, 1999b). A geotechnical investigation for the replacement of the quay wall was also conducted at the site in 1989. The results of the geotechnical investigation were presented in the Site Investigation Report.

During the geotechnical investigation, a soil sample was collected and analyzed for metals, VOCs, TPH, oil type by fluorescence, pesticides, and PCBs, and a groundwater sample was collected and analyzed for VOCs. No. 2 fuel oil was detected in subsurface soil in front of Building 175 during the investigation. Petroleum contamination was also evident based on odor and visual inspection.

Following discovery of the petroleum contamination, the site was added to the ER Program. Atlantic conducted a Site Investigation at the site to determine the presence and magnitude of specific contaminants and to determine if the results warranted an RI/FS. The field investigation consisted of a soil gas survey, a utility-manhole inspection, soil boring installation, monitoring well installation, and soil, groundwater, and sediment sampling and analysis. Petroleum and metals contamination was identified during the Site Inspection.

Prior to proceeding to the Lower Subbase RI, available data were collected and reviewed to identify data gaps that needed to be filled during the RI. As a result of the review, further investigation of soil and groundwater containing petroleum constituents, contamination in storm sewer catch basins, extent of ash disposal in the vicinity of 20MW6, and any soils containing TCLP lead levels greater than 150 µg/L were recommended. Also, testing of any UST and piping not recently tested was recommended to eliminate the possibility of an ongoing petroleum source. Additional investigation of site operations and sediment analysis of the storm sewer system were also recommended to determine the extent and source of sediment contamination. Removal and disposal of contaminated sediments and modification of any site operations identified as a contributor to the contaminated sediment were also recommended.

Soil, groundwater, and sediment sampling (in the adjacent Thames River) and analysis were conducted at this site in conjunction with the Lower Subbase RI (TtNUS, 1999b). Sites 21 and 25 were evaluated collectively as Zone 7 during the Lower Subbase RI. Because of this approach, the remainder of this section only discusses information in terms of Zone 7.

A large area of lead contamination was identified in shallow and deep soil in Zone 7. TPH contamination was also identified in two general areas. Little organic contamination was identified in groundwater; however, two areas of lead contamination were identified in Zone 7 groundwater. The human health risk assessment indicated potential risks to receptors from exposure to contaminated site media. The ecological risk assessment for the Thames River (sediment and surface water) adjacent to Zone 7 indicated that risks to ecological receptors were low to moderate. The evaluation indicated that there were potential risks to sediment-dwelling organisms from contaminants near Pier 17 but not near Pier 15. However, most of the sediment near Piers 15 and 17 was subsequently dredged, making interpretation of the results from historical studies difficult.

The Lower Subbase RI Report (TtNUS, 1999b) recommended additional characterization of the sediment in the Thames River to provide the data necessary to refine the ecological risk assessment prior to proceeding to an FS. The RI also recommended that Zone 7 soil and groundwater proceed to an FS for evaluation of appropriate remedial alternatives. Because of the extensive amount of underground utilities in Zone 7 and the sensitive nature of the activities conducted at this location (i.e., national security), it was recommended that the FS for this zone focus, to the extent possible, on alternatives that rely on institutional controls to limit exposure to contaminated soil and passive and/or in-situ remedial alternatives. "Hot spot" removal actions for the lead contamination were also recommended for evaluation during the FS. In addition, it was recommended that the FS evaluate limited action scenarios for the groundwater and storm sewer system of Zone 7 in conjunction with the soil remedial alternatives. A tiered groundwater monitoring program was recommended for evaluation during the FS.

The Navy subsequently cleaned the Lower Subbase storm sewer catch basins in August 2000. Five catch basins in Zone 7 were cleaned by Fleet Environmental using a vacuum truck. The material removed from the catch basins was containerized, tested, and properly disposed off site. The storm sewer lines were not surveyed or repaired during the effort.

Per the recommendations of the Lower Subbase RI, Battelle is conducting an investigation of Thames River sediment that includes sampling and ecological risk evaluations for Zones 4 and 7 and the newly identified site at Pier 1. The Pier 1 site was identified based on the results of sampling conducted in the area by SAIC in 1999 and by the Navy in association with the siting of the Controlled Industrial Facility Building. Battelle completed a Rapid Sediment Characterization Pilot Study in 2003 to supplement existing data in the area, and a Validation Study is in progress to evaluate potential ecological impacts due to contaminant migration from onshore source areas or activities associated with the berthing of submarines and ships in the pier areas.

A draft FS was prepared and submitted in March 2008 for Zone 7 soil (TtNUS, 2008b). The draft FS evaluated several remedial alternatives; however, comment resolution was ongoing at the time this document was prepared and changes to the alternatives are likely. It is expected that the FS will be finalized and final remedies for Zone 7 will be selected by the Navy, EPA, and CTDEP in 2009.

A well inventory was conducted at NSB-NLON in 2007. This inventory included 10 Site 21 wells (TtNUS, 2007a). As a result of the inventory, the two Site 21 wells that were not functional were properly abandoned (ECC, 2007). Two wells could be located, but because those wells were shallow and not part of an active monitoring program, no further action was recommended. Although not part of an active

monitoring program, it was recommended that the six functional Site 21 wells be maintained until a decision is reached on the selection of a remedial action at this site.

#### **2.1.20 Site 22 - Lower Subbase - Pier 33**

Site 22 is located at the Lower Subbase along the Thames River and includes Pier 33, Building 175, and approximately 800 feet of property in the area of Pier 33, Building 175, and Amberjack Road. The site map is included as Figure 2-20. The site's location relative to other IR sites is shown on Figure 1-2.

Building 175 was originally used to house several above-ground battery acid storage tanks (Atlantic, 1995a). The building was completely filled with large above-ground storage tanks. Transfer lines from the battery acid storage tanks extended along Amberjack Road in trenches to the piers. These storage tanks and the associated transfer piping have been removed. There are no known or reported spills from the storage tanks or transfer system. Building 175 is currently used for miscellaneous storage and administrative purposes. No underground steam or fuel-oil utilities service Building 175.

A 1,000-gallon, underground fuel storage tank was located adjacent to the southern side of Building 175. The age and type of the tank are unknown. Based on a tank test performed on May 22, 1990, no leakage was identified. Stained soil was observed around the fill pipe of the UST, and concentrations of TPH detected in shallow and deep soil samples collected in the vicinity of the UST exceeded State and federal criteria (Atlantic, 1995a). This information indicated that the UST was the source of the TPH contamination; this tank has since been excavated, removed, and replaced by a new 1,000-gallon UST. A 250-gallon, underground diesel fuel storage tank is located adjacent to the northern side of Building 175. This tank services an emergency generator for the sewage lift station. The age and type of this tank are unknown.

Zone 5 consists of Site 22. The area was investigated during the Pier 33 and Berth 16/Former Incinerator Site Investigation (Atlantic, 1995a) and the Lower Subbase RI (TtNUS, 1999b). A geotechnical investigation for the replacement of the quay wall was also conducted at the site in 1989. The results of the geotechnical investigation were presented in the Site Investigation Report.

During the geotechnical investigation, soil samples were collected and analyzed for metals, VOCs, TPH, oil type by fluorescence, pesticides, and PCBs. No. 2 fuel oil was detected in subsurface soils in front of Building 175 during the investigation. Petroleum contamination was also evident based on odor and visual inspection.

Following discovery of the petroleum contamination, the site was added to the ER Program. Atlantic conducted a Site Investigation at the site to determine the presence and magnitude of specific

contaminants and to determine if the results warranted an RI/FS. The field investigation consisted of a soil gas survey, a utility-manhole inspection, soil boring installation, monitoring well installation, and soil, groundwater, and sediment sampling and analysis.

Prior to proceeding to the Lower Subbase RI, available data were collected and reviewed to identify data gaps that needed to be filled during the RI. It was recommended that additional investigation of the stained soil at the southwestern corner of Building 175, metal contaminants in storm sewer drains, and any TCLP lead levels greater than 150 µg/L be completed during the RI. Additional investigation of site operations and sediment analysis of the storm sewer system were also recommended to determine the extent and source of sediment contamination. Removal and disposal of contaminated sediment and modification of any site operations identified as a contributor to the contaminated sediment were also recommended.

Additional soil, groundwater, and sediment sampling (in the adjacent Thames River) were conducted at this zone in conjunction with the Lower Subbase RI. Petroleum compounds and lead were identified as the primary COCs for this site. The petroleum contamination appears to be from an UST formerly located at the site. The lead contamination, detected in sediment collected from a catch basin between Zones 5 and 6, appears to be related to the storage of lead ballast in this area and to surface water runoff. The human health risk assessment indicated potential risks from exposure to site media under a hypothetical future residential scenario. The ecological risk assessment for the Thames River adjacent to Zone 5 indicated that risks to ecological receptors in this area are relatively low.

The Lower Subbase RI Report (TtNUS, 1999b) recommended that Zone 5 proceed to an FS to evaluate appropriate remedial alternatives. Because of the extensive amount of underground utilities in Zone 5 and the sensitive nature of the activities conducted at this location (i.e., national security), it was recommended that the FS for this zone focus, to the extent possible, on alternatives that rely on institutional controls to limit exposure to contaminated soil and passive and/or in-situ remedial alternatives. It was also recommended that a "hot spot" removal action for the petroleum contamination in the soil of Zone 5 should be included in one of the alternatives evaluated during the FS. It was also recommended that the FS evaluate limited action scenarios for the groundwater and storm sewer system of Zone 5, in conjunction with the soil remedial alternatives. The scenario for the groundwater should include a combination of monitored natural attenuation and a tiered groundwater monitoring program.

The Navy subsequently cleaned the Lower Subbase storm sewer catch basins in August 2000. Two catch basins in Zone 5 were cleaned by Fleet Environmental using a vacuum truck. The material removed from the catch basins was containerized, tested, and properly disposed off site. The storm sewer lines were not surveyed or repaired during the effort.

A draft FS was prepared and submitted in March 2008 for Zone 5 soil (TtNUS, 2008b). The draft FS evaluated several remedial alternatives; however, comment resolution was ongoing at the time this document was prepared and changes to the alternatives are likely. It is expected that the FS will be finalized and final remedies for Zone 5 will be selected by the Navy, EPA, and CTDEP in 2009.

A well inventory was conducted at NSB-NLON in 2007. This inventory included three Site 22 wells (TtNUS, 2007a). One well could be located, but because the well was shallow and not part of an active monitoring program, no further action was recommended. Although not part of an active monitoring program, it was recommended that the two remaining functional Site 22 wells be maintained until a decision is reached on the selection of a remedial action at this site.

#### **2.1.21 Site 23 - Fuel Farm**

In the early 1940s, Crystal Lake was drained and dredged to allow for construction of the nine concrete USTs (see Figure 2-9). When construction was complete, the former lake bed was reportedly filled with soil excavated from a small hill west of the Site 23 and graded to create a level surface for development at NSB-NLON. The location of Site 23 relative to the other IR sites is shown on Figure 1-2. The Fuel Farm features include the following:

- Nine former 110-foot-diameter, 11-foot-high USTs (OT-1 to OT-9)
- A 30,000-gallon, double-walled UST (OT-10)
- An oil/water separator (at OT-10)
- A 10,000-gallon waste oil tank (at OT-10)
- A fuel oil loading area adjacent to Building 482
- A tanker truck dumping pad and trough (at OT-10)
- Associated UST piping systems
- The Morale, Welfare, and Recreation (MWR) Center (Building 461)
- Buildings 310, 322, and O-831
- Six baseball/softball fields
- A restroom facility (Building 445)
- An partially abandoned air sparging (AS)/soil vapor extraction (SVE) facility for the Naval Exchange (NEX) service station
- Two 150,000-gallon diesel above-ground storage tanks
- Six baseball/recreational fields and a number of parking areas are located on top of the Fuel Farm

Each of the nine former USTs had a holding capacity of 750,000 gallons and was approximately 110 feet in diameter and 11 feet in depth. Tank stability was obtained using a combination of a site-wide drainage system, a series of columns inside the tanks, and an underdrain system. A site-wide stormwater drainage/dewatering system and french drains were installed around OT-1, OT-2, OT-3, OT-4, and OT-5. A series of 37 columns transmitted the weight of the tank roof and overlying fill to the floor of the tank.

The Fuel Farm originally contained an extensive drainage system consisting of numerous catch basins, corrugated metal pipe, perforated corrugated metal pipe, vitrified clay pipe, and reinforced concrete pipe. According to NSB-NLON personnel, the drainage system served approximately one-third of the entire facility. Portions of the drainage system were installed with perforated corrugated metal pipe to depress the water table in the Fuel Farm. The surface water and groundwater collected by the storm sewer system ultimately discharge to a boomed area of the Thames River, adjacent to the Goss Cove Landfill. Based on known elevations of storm sewer catch basins, the elevation of the drainage system was below the process piping.

No. 6 fuel oil was stored in tanks OT-1 through OT-3 from the date of construction until they were removed from service in the summer of 1991. Tanks OT-7 through OT-9 were decommissioned in the summer of 1990 and were used exclusively for storage of diesel during all 48 years of service. Product (No. 6 fuel oil or diesel fuel) was historically delivered via barge to a pier, where it was pumped via pipelines to the Fuel Farm USTs through the Building 332 valve house. Product was transferred via pipeline from the USTs to the power plant or the submarines at the Lower Subbase on an as-needed basis. The No. 6 fuel oil transfer lines were situated within concrete-lined trenches but were removed because No. 6 fuel oil was no longer used at NSB-NLON. The trenches for the diesel lines were not lined.

A reduced demand for diesel fuel at NSB-NLON in the mid-1970s led to the decommissioning and demolition of tank OT-6. This reduced demand also led to the modification of tank OT-5 for waste oil storage purposes. Tank OT-4 was used to store tank bottom wastes from OT-1. Tank OT-5 was used as part of an oil/water separator system. Tanks OT-4 and OT-5 were reportedly decommissioned after the installation of a new 30,000-gallon waste oil underground tank (OT-10) in 1990. Tanks OT-1 through OT-9 have been demolished and closed in place. Tank closure was accomplished following RCRA closure requirements by cleaning the tanks, demolishing the tank roof supports, and allowing the roof to collapse into the tank. The void was then filled with gravel, and the site was restored using soil and topsoil.

A number of petroleum releases were documented by the Navy in the vicinity of the Fuel Farm at NSB-NLON. Investigations of the Fuel Farm conducted from 1989 through 1999 detected evidence of releases

of petroleum products from these tanks and their associated piping and, possibly, from other nearby sources. Both soil contamination and free-product were identified at Site 23 during the investigations. Petroleum hydrocarbons have been detected periodically at the outfall of the Fuel Farm storm sewer system.

RAs were conducted to address free product and soil contamination at Site 23 in 1997. The actions were conducted in accordance with the Corrective Action Plan contained in the Site Investigation Report (B&RE, 1997i). Approximately 783 tons of petroleum-impacted soil were removed from Site 23 near OT-8 and Tang Avenue during the removal actions.

The Fuel Farm drainage system was rehabilitated in 2000. The original combined groundwater and stormwater system was separated into a deep groundwater system and a new shallow stormwater system. The old deteriorated pipes in the groundwater collection system were slip-lined to improve their integrity and conductance. The old tank ring-drains (french drains) were not rehabilitated, but their connection with the groundwater collection system was maintained. As part of the drainage system rehabilitation project, contaminated soil and free product, which were previously identified during the Tank Farm Site Investigation Addendum (TtNUS, 1999d) in the vicinity of the former UST OT-3, were removed and disposed off site. The Navy initiated a sampling program for the deep groundwater collection system after construction activities were completed. It was anticipated that the results would be used to determine if further action is required for groundwater.

Site 23 was further characterized during the BGOURI in 2000 (TtNUS, 2002a). Groundwater samples were collected from monitoring wells completed in the overburden and bedrock aquifers. Soil samples were collected to characterize the hydrogeologic properties of the overburden aquifer. VOCs and SVOCs were detected infrequently in groundwater samples collected during the BGOURI. Metals were detected frequently in groundwater samples, but the detections are likely related to the fill material used to construct the Fuel Farm. The human health risk assessment did not identify any significant risks to receptors from exposure to groundwater. The RI recommended postponing any decisions on the groundwater at Site 23 until a sufficient amount of data was available from the groundwater collection system monitoring program to properly characterize the groundwater. A work plan for quarterly sampling of groundwater from the metering pit at Site 23 was implemented in 2007. The Site 23 underdrain metering pit was sampled after construction and quarterly for a period of 1 year starting in June 2007. Samples were collected from the metering pit that collects groundwater from the Site 23 area underdrains from four former tanks. All relevant concentrations were less than established Connecticut criteria (with the exception of some anomalous results). Based on results less than criteria, Site 23 groundwater (including Site 9 groundwater) being collected and conveyed in the storm sewer system does not pose a

significant threat to human health or the environment under the current land use scenario; however, risks would be unacceptable if groundwater at the site was used as a drinking water supply (Navy, 2008b).

Concentrations of chloroform and TCE exceeded the EPA screening criterion at Sites 23. Chloroform and TCE were further evaluated using the Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks for chloroform under a residential scenario were within EPA acceptable levels but exceeded CTDEP acceptable levels. Cancer risks for TCE based upon Cal EPA toxicity criteria were within EPA and CTDEP acceptable levels for residential and industrial scenarios but cancer risks for a residential scenario based upon draft EPA toxicity criteria exceeded CTDEP acceptable levels. Further valuation against ARARs showed that vapor intrusion is not an issue at Site 23. NFA is required for vapor intrusion issues (Navy, 2008b).

A well inventory was conducted at NSB-NLON in 2007. This inventory included 52 Site 23 IR program wells and 16 Site 23 UST wells (TtNUS, 2007a). As a result of the inventory, two Site 23 IR program wells were properly abandoned because they were not functional (ECC, 2007). The conditions of 25 wells were identified as not deficient and conditions of 4 wells could not be determined. Although not part of an active monitoring program, it was recommended that the remaining functional Site 23 wells be maintained until a decision is reached on the selection of a remedial action at this site (TtNUS, 2007a).

Based on the Final ROD for OU9, a Basewide Groundwater RD for Land Use Controls was prepared. LUCs at Site 23 are to prevent the withdrawal and/or use of groundwater for potable water purposes and ensure that groundwater extracted during construction dewatering activities is properly handled, stored, and disposed (TtNUS, 2008e).

#### **2.1.22 Site 24 - Lower Subbase-Central Paint Accumulation Area (Building 174)**

Site 24 - Central Paint Accumulation Area (Building 174) is located in the northern section of the Lower Subbase along the Thames River, immediately east of Pier 32. The site map is included as Figure 2-21. The location of Site 24 relative to other IR sites is shown on Figure 1-2.

In 1982, Building 174 was refitted to allow boat anchor sandblasting and painting activities (EPA, 1995). Also in the late 1980s, the building was used as the primary paint storage facility for all paints used for boat maintenance activities.

No investigations of the soil or groundwater at this site were conducted prior to the Lower Subbase RI. Soil, groundwater, and sediment sampling (in the adjacent Thames River) were conducted at this site in conjunction with the Lower Subbase RI (TtNUS, 1999b). For investigation purposes, Site 24 and the

surrounding area were identified as Zone 6. Because of this approach, the remainder of this section only discusses information in terms of Zone 6.

Petroleum compounds (TPH and PAHs) and several inorganics were identified as COCs for this zone. The source(s) of the TPH and PAHs is not known. Lead contamination detected in sediment collected from a catch basin between Zones 5 and 6 appears to be related to the storage of lead ballast in this area and to surface water runoff. The human health risk assessment indicated potential risks from exposure to site media under a hypothetical future residential scenario. The ecological risk assessment for the Thames River adjacent to Zone 6 indicated that risks to ecological receptors in this area are relatively low.

The Lower Subbase RI Report (TtNUS, 1999b) recommended that Zone 6 proceed to an FS to evaluate appropriate remedial alternatives. Because of the extensive amount of underground utilities in Zone 6 and the sensitive nature of the activities conducted at this location (i.e., national security), it was recommended that the FS for this zone focus, to the extent possible, on alternatives that rely on institutional controls to limit exposure to contaminated soil and passive and/or in-situ remedial alternatives. It was also recommended that the FS evaluate limited action scenarios for the groundwater and storm sewer system of Zone 6, in conjunction with the soil remedial alternatives. A tiered groundwater monitoring program was also recommended for evaluation during the FS.

The Navy subsequently cleaned the Lower Subbase storm sewer catch basins in August 2000. Two catch basins in Zone 6 were cleaned by Fleet Environmental using a vacuum truck. The material removed from the catch basins was containerized, tested, and properly disposed off site. The storm sewer lines were not surveyed or repaired during the effort.

A draft FS was prepared and submitted in March 2008 for Zone 6 soil (TtNUS, 2008b). The draft FS evaluated several remedial alternatives; however, comment resolution was ongoing at the time this document was prepared and changes to the alternatives are likely. It is expected that the FS will be finalized and final remedies for Zone 6 will be selected by the Navy, EPA, and CTDEP in 2009.

A well inventory was conducted at NSB-NLON in 2007. This inventory included five Site 24 wells. Although not part of an active monitoring program, it was recommended that the five Site 24 wells be maintained until a decision is reached on the selection of a remedial action at this site (TtNUS, 2007a).

#### **2.1.23 Site 25 - Lower Subbase-Classified Materials Incinerator**

Site 25 consists of the former classified materials incinerator located on the Lower Subbase, approximately 300 feet east of Pier 17. The site map is included as Figure 2-19. The site's location relative to other IR sites is shown on Figure 1-2.

It was reported that, between 1944 and 1963, facilities within former Building 97 (current Building 478) were used to burn classified materials and other solid wastes generated at NSB-NLON (EPA, 1995). All materials generated by base operations that were not salvageable were incinerated at Site 25. Residual ash produced by materials burning was disposed in the Goss Cove Landfill (EPA, 1995). Adjacent to the incinerator was a dumpster-cleaning operation. The incinerator became inoperable in 1963 and operations ceased. The incinerator was demolished in 1979, and Buildings 456 and 478 were constructed.

The area was investigated during the Pier 33 and Berth 16/Former Incinerator Site Investigation (Atlantic, 1995a) and the Lower Subbase RI (TtNUS, 1999b). A geotechnical investigation for the replacement of the quay wall was also conducted at the site in 1989. The results of the geotechnical investigation were presented in the Site Investigation Report.

During the geotechnical investigation, a soil sample was collected and analyzed for metals, VOCs, TPH, oil type by fluorescence, pesticides, and PCBs, and a groundwater sample was collected and analyzed for VOCs. No. 2 fuel oil was detected in subsurface soils in front of Building 175 during the investigation. Petroleum contamination was also evident based on odor and visual inspection.

Following discovery of the petroleum contamination, the site was added to the ER Program. Atlantic conducted a Site Investigation at the site to determine the presence and magnitude of specific contaminants and to determine if the results warranted an RI/FS. The field investigation consisted of a soil gas survey, a utility-manhole inspection, soil boring installation, monitoring well installation, and soil, groundwater, and sediment sampling and analysis. Petroleum and metal contamination was identified during the Site Inspection.

Prior to proceeding to the Lower Subbase RI, available data were collected and reviewed to identify data gaps that needed to be filled during the RI. As a result of the review, further investigation of soil and groundwater containing petroleum constituents, contamination in storm sewer catch basins, extent of ash disposal in the vicinity of 20MW6, and any soils containing TCLP lead levels greater than 150 µg/L were recommended. Also, testing of any UST and piping not recently tested was recommended to eliminate the possibility of an ongoing petroleum source. Additional investigation of site operations and sediment analysis of the storm sewer system were also recommended to determine the extent and source of sediment contamination. Removal and disposal of contaminated sediments and modification of any site operations identified as a contributor to the contaminated sediment were also recommended.

Soil, groundwater, and sediment sampling (in the adjacent Thames River) and analysis were completed at this site during the Lower Subbase RI (TtNUS, 1999b). Site 25 was evaluated collectively with Site 21

and Transformers at Building 157, Vault 31 during the RI as Zone 7. Because of this approach, the remainder of this section only discusses information in terms of Zone 7.

A large area of lead contamination was identified in shallow and deep soil in Zone 7. TPH contamination was also identified in two general areas. Little organic contamination was identified in groundwater; however, two areas of lead contamination were identified in Zone 7 groundwater. The human health risk assessment indicated potential risks to receptors from exposure to contaminated site media. The ecological risk assessment for the Thames River (sediment and surface water) adjacent to Zone 7 indicated that risks to ecological receptors were low to moderate. The evaluation indicated that there were potential risks to sediment-dwelling organisms from contaminants near Pier 17 but not near Pier 15. However, most of the sediment near Piers 15 and 17 were subsequently dredged, making interpretation of the results from historical studies difficult.

The Lower Subbase RI Report (TtNUS, 1999b) recommended additional characterization of the sediment in the Thames River to provide the data necessary to refine the ecological risk assessment prior to proceeding to an FS. The RI also recommended that Zone 7 soil and groundwater proceed to an FS for evaluation of appropriate remedial alternatives. Because of the extensive amount of underground utilities in Zone 7 and the sensitive nature of the activities conducted at this location (i.e., national security), it was recommended that the FS for this zone focus, to the extent possible, on alternatives that rely on institutional controls to limit exposure to contaminated soil and passive and/or in-situ remedial alternatives. "Hot spot" removal actions for the lead contamination were also recommended for evaluation during the FS. In addition, it was recommended that the FS evaluate limited action scenarios for the groundwater and storm sewer system of Zone 7, in conjunction with the soil remedial alternatives. A tiered groundwater monitoring program was recommended for evaluation during the FS.

The Navy subsequently cleaned the Lower Subbase storm sewer catch basins in August 2000. Five catch basins in Zone 7 were cleaned by Fleet Environmental using a vacuum truck. The material removed from the catch basins was containerized, tested, and properly disposed off site. The storm sewer lines were not surveyed or repaired during the effort.

Per the recommendations of the Lower Subbase RI, Battelle is conducting an investigation of Thames River sediment that includes sampling and ecological risk evaluations for Zones 4 and 7 and the newly identified site at Pier 1. The Pier 1 site was identified based on the results of sampling conducted in the area by SAIC in 1999 and by the Navy in association with the siting of the Controlled Industrial Facility Building. Battelle completed a Rapid Sediment Characterization Pilot Study in 2003 to supplement existing data in the area, and a Validation Study is in progress to evaluate potential ecological impacts

due to contaminant migration from onshore source areas or activities associated with the berthing of submarines and ships in the pier areas.

A draft FS was prepared and submitted in March 2008 for Zone 7 soil (TtNUS, 2008b). The draft FS evaluated several remedial alternatives; however, comment resolution was ongoing at the time this document was prepared and changes to the alternatives are likely. It is expected that the FS will be finalized and final remedies for Zone 7 will be selected by the Navy, EPA, and CTDEP in 2009.

A well inventory was conducted at NSB-NLON in 2007. This inventory included one Site 25 well. This well could be located, but because the well was shallow and not part of an active monitoring program, no further action was recommended (TtNUS, 2007a).

## **2.2 SITE GROUPINGS**

Several sites are located in the area of NSB-NLON referred to as the Lower Subase. The Lower Subase site is bounded on the west by the Thames River and to the east by the Providence and Worcester Railroad. The Lower Subase extends from Pier 1 in the south to Pier 33 in the north. The Lower Subase is the original Subase and therefore the history of its use dates back to 1867. Most of the construction at the Lower Subase took place in the early 1900s, with a major expansion from 1935 to 1945. Sites in the Lower Subase, which were described in previous sections, have been grouped together to facilitate additional investigation. The following sites are included in the Lower Subase:

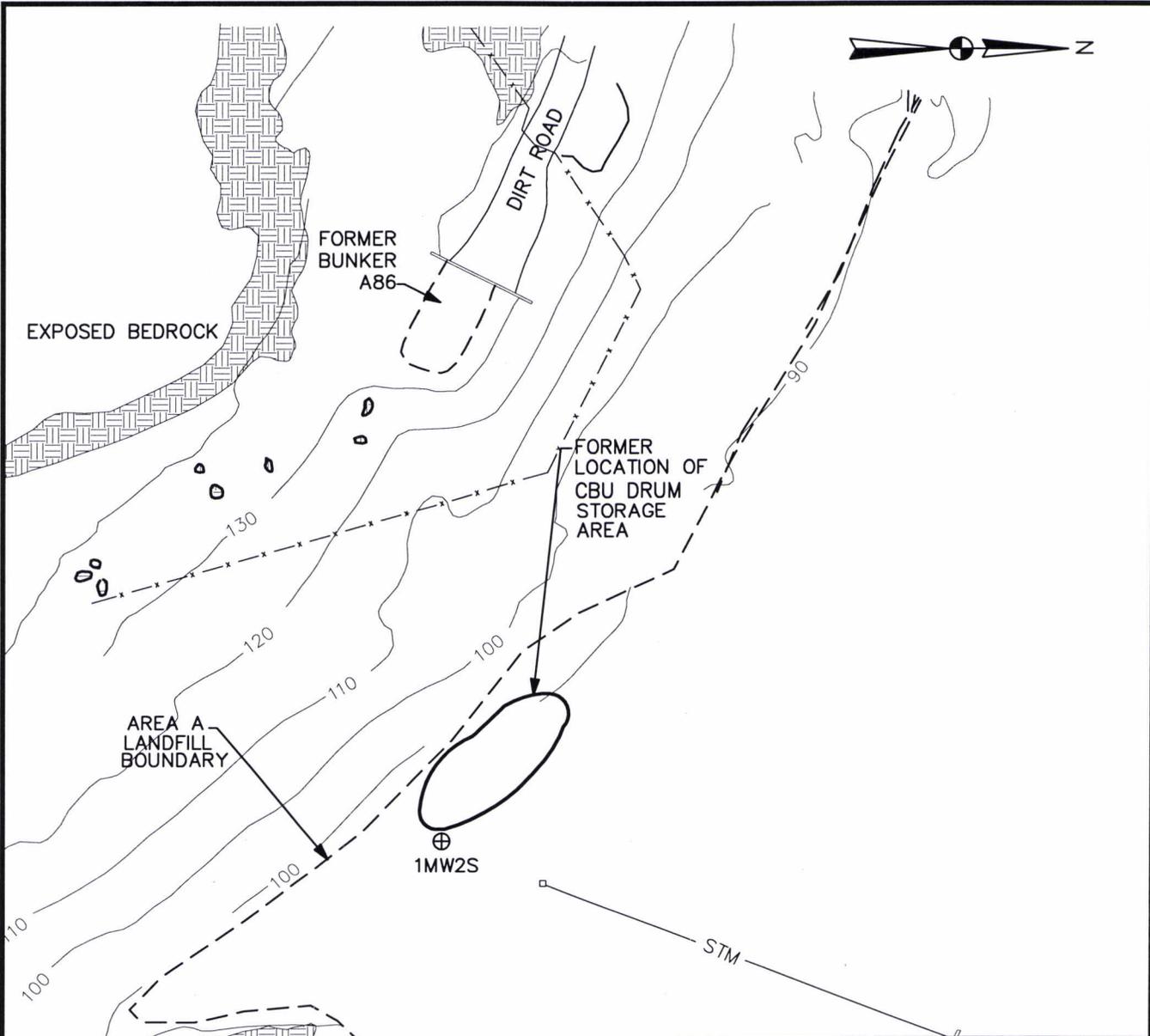
- Site 10 - Lower Subase - Fuel Storage Tanks and Tank 54-H
- Site 11 - Lower Subase - Power Plant Oil Tanks
- Site 13 - Lower Subase - Building 79 Waste Oil Pit
- Site 17 - Lower Subase - Hazardous Materials/Solvent Storage Area (Building 31)
- Site 19 - Lower Subase - Solvent Storage Area (Building 316)
- Site 21 - Lower Subase - Berth 16
- Site 22 - Lower Subase - Pier 33
- Site 24 - Lower Subase - Central Paint Accumulation Area (Building 174)
- Site 25 - Lower Subase - Classified Materials Incinerator

In the Lower Subase RI and FS documents, the Lower Subase is divided into seven Zones. Sites are included in the Lower Subase zones as follows:

- Zone 1 - Sites 10 and 11
- Zone 2 - Former fuel distribution lines
- Zone 3 - Site 17

- Zone 4 - Sites 13 and 19 and Thames River sediment adjacent to Zone 4 and Pier 1
- Zone 5 - Site 22
- Zone 6 - Site 24
- Zone 7 - Sites 22 and 25

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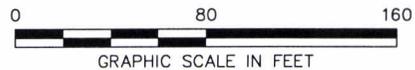


**NOTES**

1. UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE.
2. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON AND PHASE II RI WORK PLAN.

**LEGEND:**

- ⊕ ABANDONED MONITORING WELL
- 80— EXISTING CONTOUR
- STM— STORM SEWER
- · · · — WATER COURSE
- x — x — FENCE



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REVISED BY	DATE
SCALE AS NOTED	

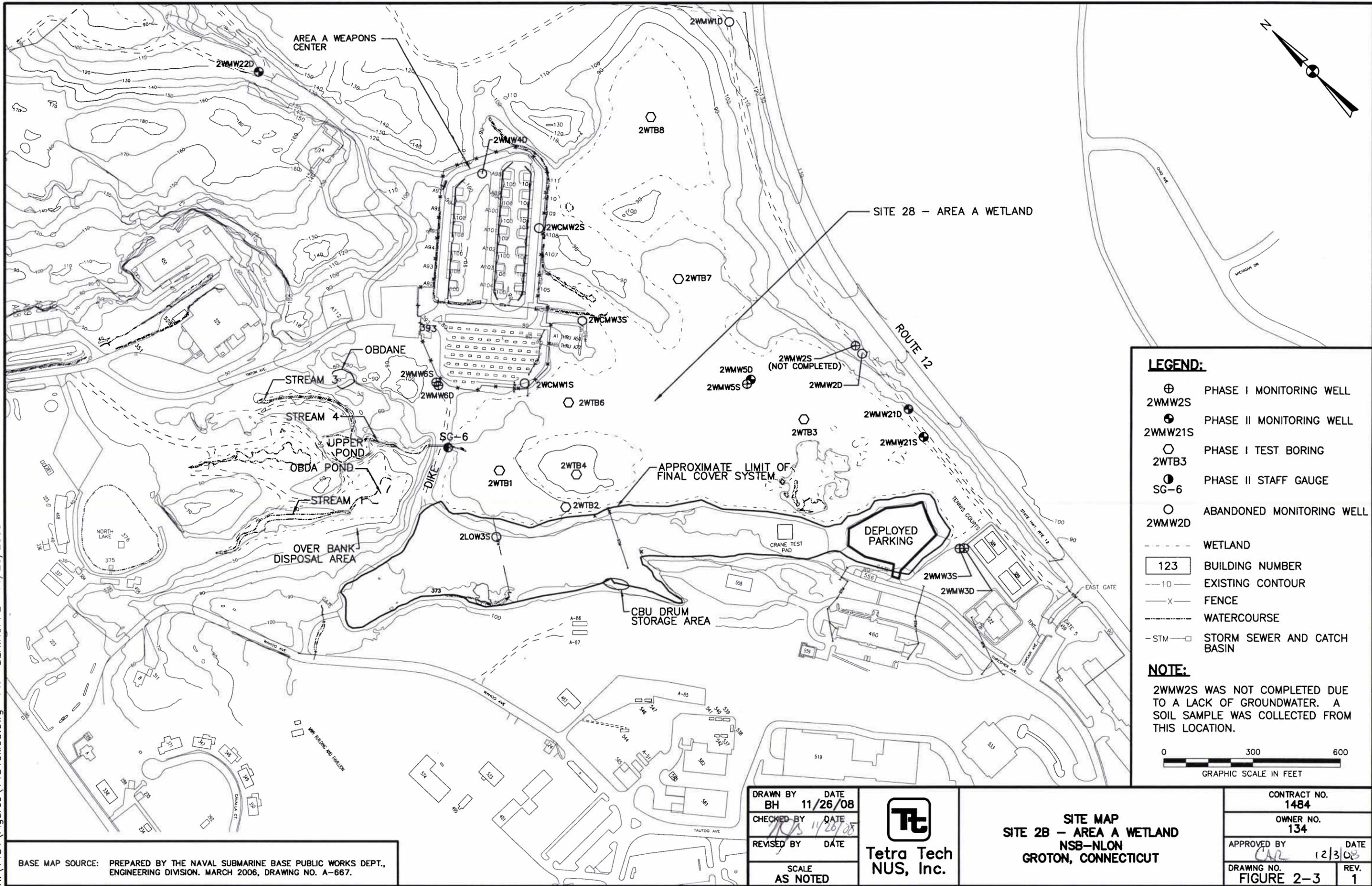


**SITE MAP  
SITE 1 - CBU DRUM STORAGE AREA  
NSB-NLON  
GROTON, CONNECTICUT**

CONTRACT NO. <b>1484</b>	
OWNER NO. <b>134</b>	
APPROVED BY <i>CAR</i>	DATE <b>12/31/08</b>
DRAWING NO. <b>FIGURE 2-1</b>	REV. <b>1</b>



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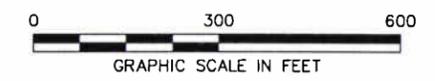


**LEGEND:**

- ⊕ PHASE I MONITORING WELL
- PHASE II MONITORING WELL
- PHASE I TEST BORING
- PHASE II STAFF GAUGE
- ABANDONED MONITORING WELL
- WETLAND
- 123 BUILDING NUMBER
- 10— EXISTING CONTOUR
- x- FENCE
- WATERCOURSE
- STM- STORM SEWER AND CATCH BASIN

**NOTE:**

2WMW2S WAS NOT COMPLETED DUE TO A LACK OF GROUNDWATER. A SOIL SAMPLE WAS COLLECTED FROM THIS LOCATION.



BASE MAP SOURCE: PREPARED BY THE NAVAL SUBMARINE BASE PUBLIC WORKS DEPT., ENGINEERING DIVISION. MARCH 2006, DRAWING NO. A-667.

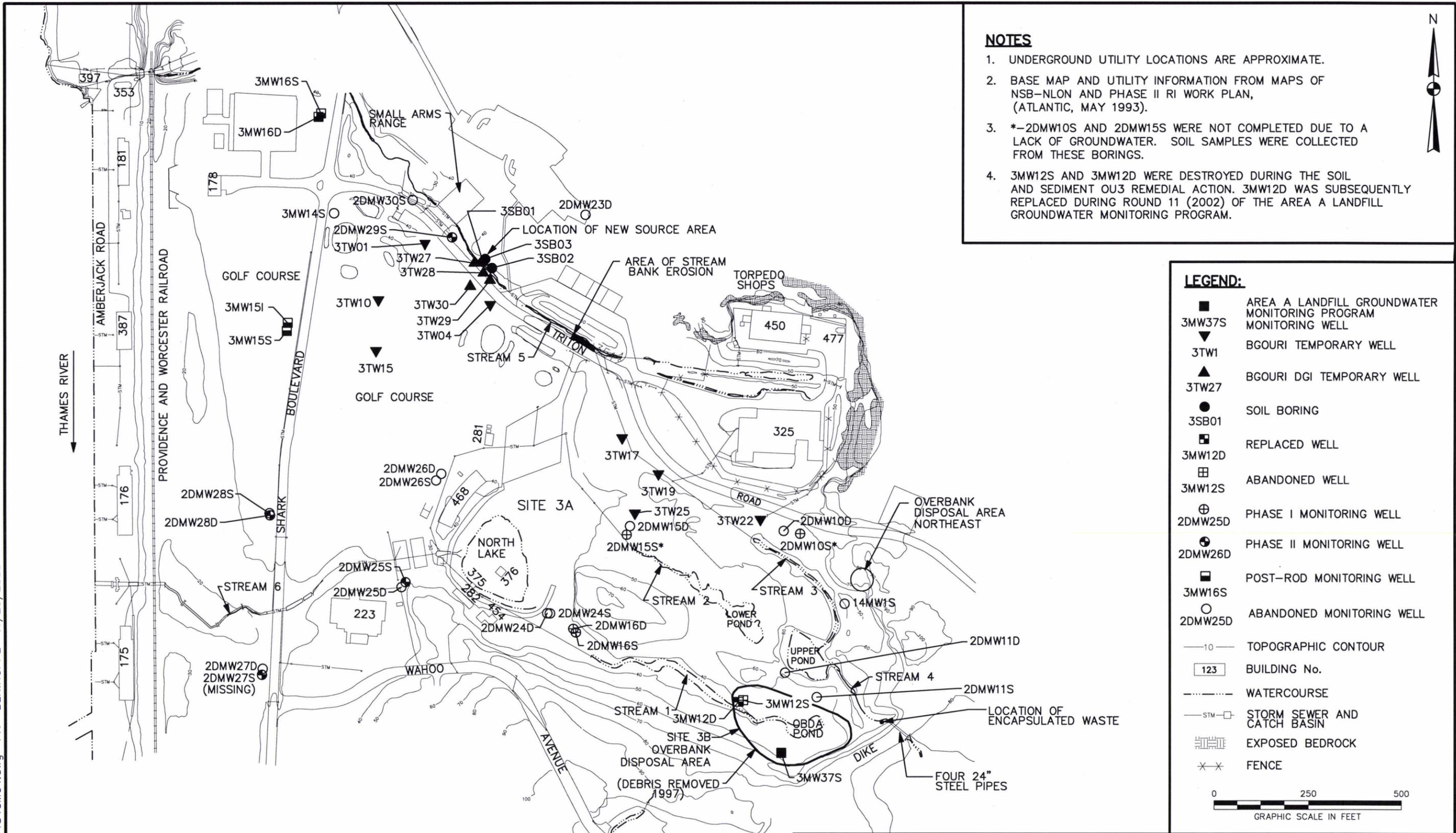
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BH	11/26/08
CHECKED BY	DATE
REVIS	11/26/08
REVISED BY	DATE

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NUS, Inc.

**SITE MAP**  
**SITE 2B - AREA A WETLAND**  
NSB-NLON  
GROTON, CONNECTICUT

CONTRACT NO. 1484	
OWNER NO. 134	
APPROVED BY CAR	DATE 12/3/08
DRAWING NO. FIGURE 2-3	REV. 1

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**NOTES**

1. UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE.
2. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON AND PHASE II RI WORK PLAN, (ATLANTIC, MAY 1993).
3. \*-2DMW10S AND 2DMW15S WERE NOT COMPLETED DUE TO A LACK OF GROUNDWATER. SOIL SAMPLES WERE COLLECTED FROM THESE BORINGS.
4. 3MW12S AND 3MW12D WERE DESTROYED DURING THE SOIL AND SEDIMENT OU3 REMEDIAL ACTION. 3MW12D WAS SUBSEQUENTLY REPLACED DURING ROUND 11 (2002) OF THE AREA A LANDFILL GROUNDWATER MONITORING PROGRAM.



**LEGEND:**

- AREA A LANDFILL GROUNDWATER MONITORING PROGRAM MONITORING WELL
  - 3MW37S
  - ▼ BGOURI TEMPORARY WELL
  - 3TW1
  - ▲ BGOURI DGI TEMPORARY WELL
  - 3TW27
  - SOIL BORING
  - 3SB01
  - REPLACED WELL
  - 3MW12D
  - ⊞ ABANDONED WELL
  - 3MW12S
  - ⊕ PHASE I MONITORING WELL
  - 2DMW25D
  - ⊕ PHASE II MONITORING WELL
  - 2DMW26D
  - POST-ROD MONITORING WELL
  - 3MW16S
  - ABANDONED MONITORING WELL
  - 2DMW25D
  - 10— TOPOGRAPHIC CONTOUR
  - 123 BUILDING No.
  - WATERCOURSE
  - STM— STORM SEWER AND CATCH BASIN
  - EXPOSED BEDROCK
  - ×× FENCE
- 0 250 500  
GRAPHIC SCALE IN FEET

BASE MAP SOURCE: PREPARED BY THE NAVAL SUBMARINE BASE PUBLIC WORKS DEPT., ENGINEERING DIVISION. MARCH 2006, DRAWING NO. A-667.

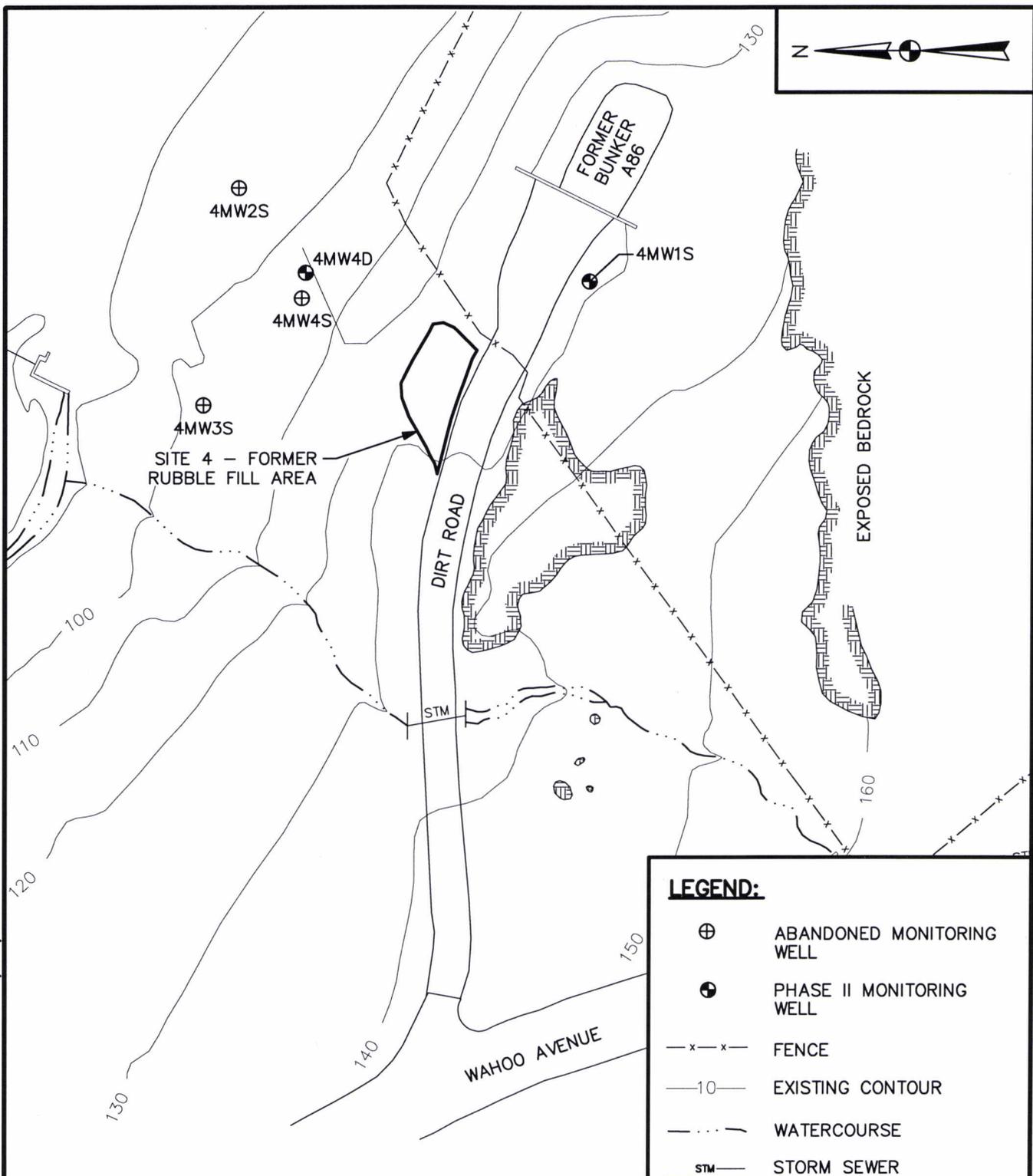
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CHECKED BY	DATE
REVIS	11/26/08
REVISED BY	DATE
SCALE	AS NOTED



**SITE MAP**  
**SITE 3 - AREA A DOWNSTREAM**  
**WATERCOURSES/OBDA**  
**NSB-NLON**  
**GROTON, CONNECTICUT**

CONTRACT NO. 1484	
OWNER NO. 134	
APPROVED BY CAR	DATE 12/3/08
DRAWING NO. FIGURE 2-4	REV. 1

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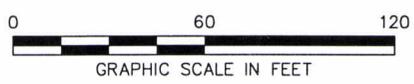


**NOTES**

1. UNDERGROUND UTILITY LOCATIONS AREA APPROXIMATE.
2. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON AND PHASE II RI WORK PLAN.

**LEGEND:**

- ⊕ ABANDONED MONITORING WELL
- ⊙ PHASE II MONITORING WELL
- x - x - FENCE
- 10 - EXISTING CONTOUR
- . . . - WATERCOURSE
- STM - STORM SEWER
- CATCH BASIN



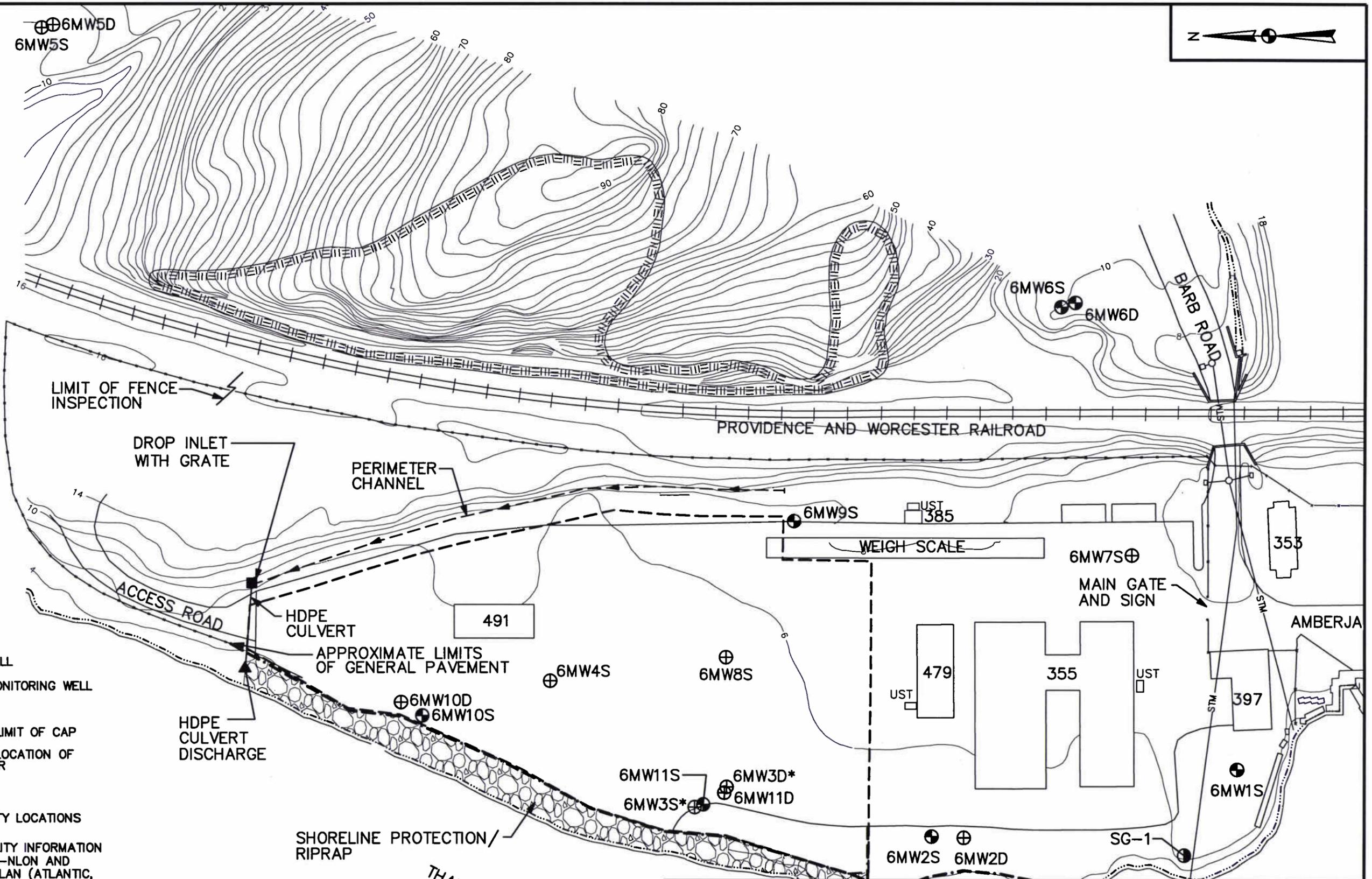
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CHECKED BY <i>[Signature]</i>	DATE 11/26/08
REMOVED BY	DATE
SCALE AS NOTED	



**SITE MAP**  
**SITE 4 - RUBBLE FILL AREA AT BUNKER A86**  
 NSB-NLON  
 GROTON, CONNECTICUT

CONTRACT NO. 1484	
OWNER NO. 134	
APPROVED BY <i>[Signature]</i>	DATE 12/3/08
DRAWING NO. FIGURE 2-5	REV. 1

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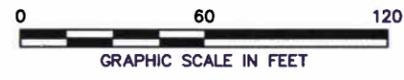


**LEGEND:**

- MONITORING WELL
- ⊕ ABANDONED MONITORING WELL
- STAFF GAUGE
- APPROXIMATE LIMIT OF CAP
- .-.- APPROXIMATE LOCATION OF JERSEY BARRIER

**NOTES:**

- 1) UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE.
  - 2) BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON AND PHASE II RI WORK PLAN (ATLANTIC, 1993.)
  - 3) APPROXIMATE CAP LIMITS AND OTHER FEATURES COMPILED FROM OHM COMPLETION REPORT AND ATLANTIC DESIGN SHEET C-2.
- \* LOCATION EXISTS WITH WELL GROUTED TO SURFACE



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REVISED BY	DATE
SCALE AS NOTED	



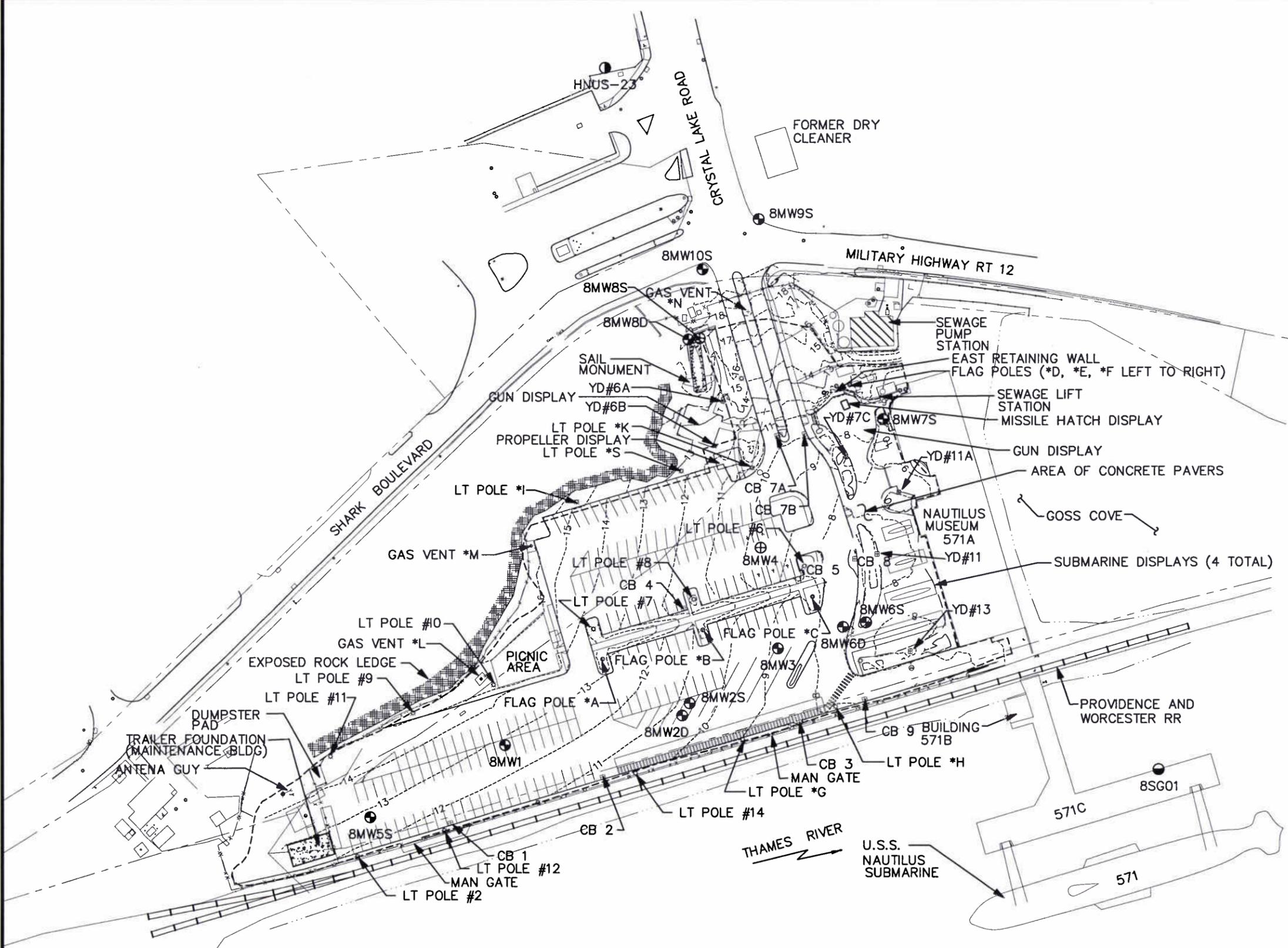
**SITE PLAN FOR  
SITE 6 - FORMER DRMO  
NSB-NLON  
GROTON, CONNECTICUT**

CONTRACT NO. 1484	
OWNER NO. 134	
APPROVED BY CAR	DATE 12/30/08
DRAWING NO. FIGURE 2-6	REV. 1





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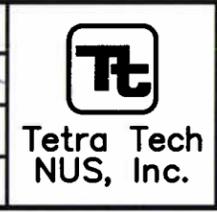
- MONITORING WELL
- ⊕ ABANDONED MONITORING WELL
- STAFF GAUGE
- ⊙ TANK FARM MONITORING WELL
- ASPHALT PAVEMENT AREA CAP SYSTEM
- - 12 - - TOPOGRAPHIC ELEVATION CONTOUR (NAVD88)
- x - x - CHAIN-LINK FENCE

**NOTE:**

\* IDENTIFICATION NUMBER/LETTER WITH AN ASTERISK INDICATES AN ARBITRARY DESIGNATION FOR THE O&M MANUAL AND WAS NOT PROVIDED IN THE DESIGN OR AS-BUILT DOCUMENTATION.

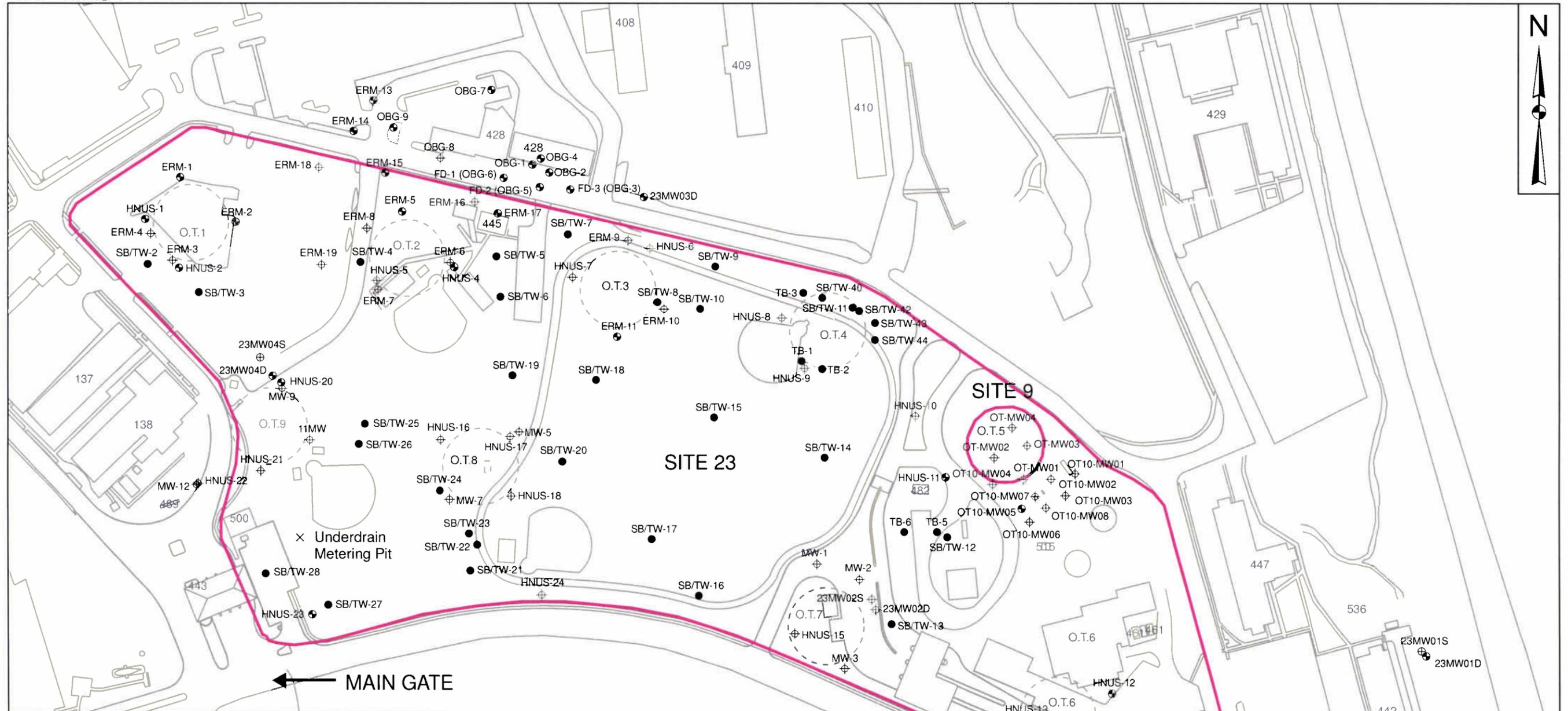
0 100 200  
GRAPHIC SCALE IN FEET

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CHECKED BY NOS	DATE 11/26/08
REVISED BY	DATE
SCALE AS NOTED	



**SITE MAP  
SITE 8 - GOSS COVE LANDFILL  
NSB-NLON  
GROTON, CONNECTICUT**

CONTRACT NO. 1484	
OWNER NO. 134	
APPROVED BY CAR	DATE 12/3/08
DRAWING NO. FIGURE 2-8	REV. 1



**Legend**

- ⊕ BGOURI Well
- Historical Temporary Well/Soil Boring
- ⊕ Destroyed, Missing, or Abandoned Monitoring Well
- Existing Monitoring Well
- ▭ Site Boundary
- Former Tank

NOTE: Air sparging and soil vapor extraction wells and testing points not shown.

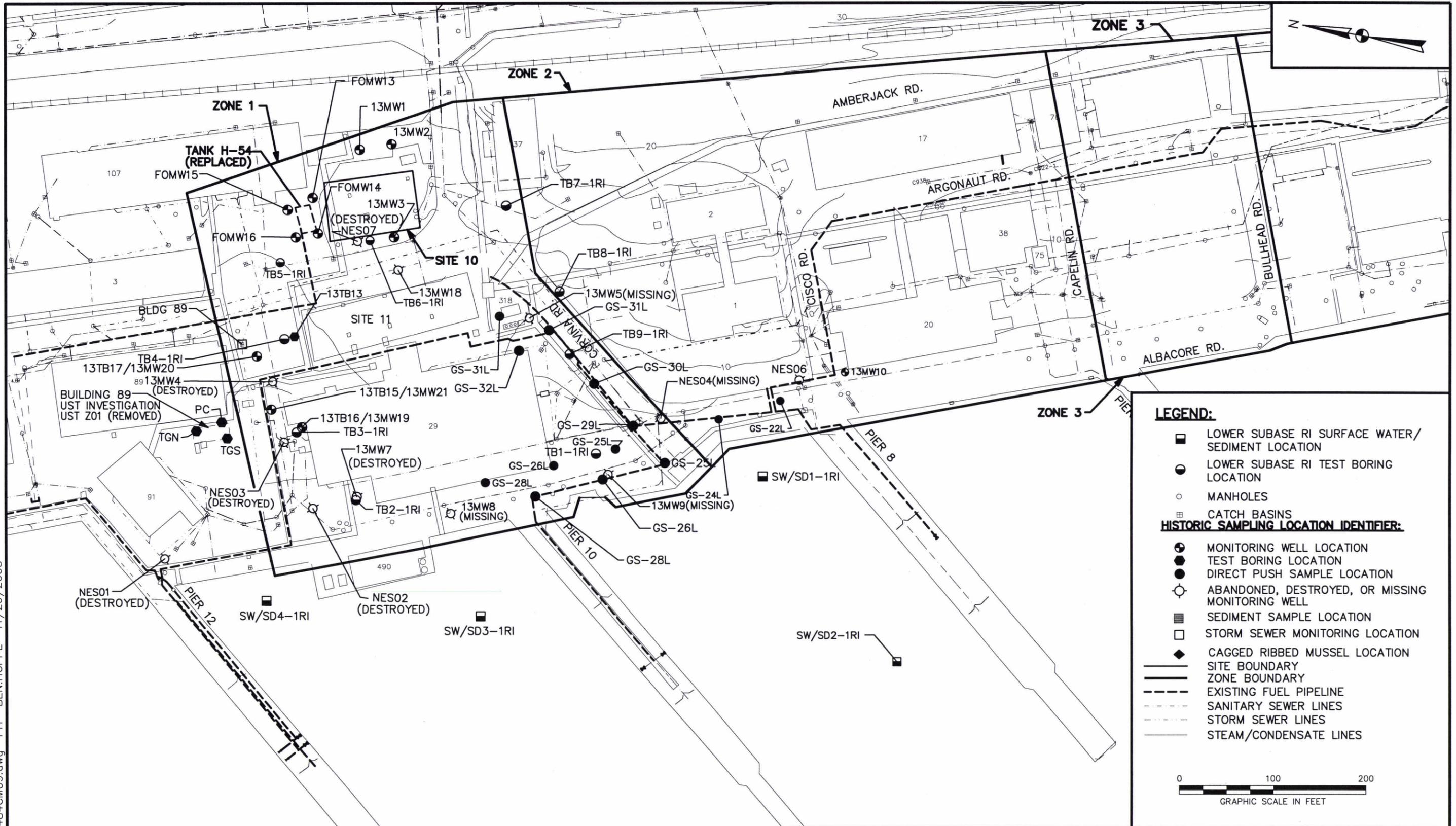
DRAWN BY K. MOORE	DATE 5/11/07
CHECKED BY N. BALSAMO	DATE 11/21/08
REVISED BY K. MOORE	DATE 11/20/07
SCALE AS NOTED	



SITE MAP  
SITE 9 OT-5 AND SITE 23 FUEL FARM  
NSB-NLON  
GROTON, CONNECTICUT

CONTRACT NO. CTO 1484	OWNER NO. 134
APPROVED BY <i>Car</i>	DATE 11/26/08
APPROVED BY	DATE
FIGURE NO. 2-9	REV. 1

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BASE MAP SOURCE: PREPARED BY THE NAVAL SUBMARINE BASE PUBLIC WORKS DEPT., ENGINEERING DIVISION. MARCH 2006, DRAWING NO. A-667.

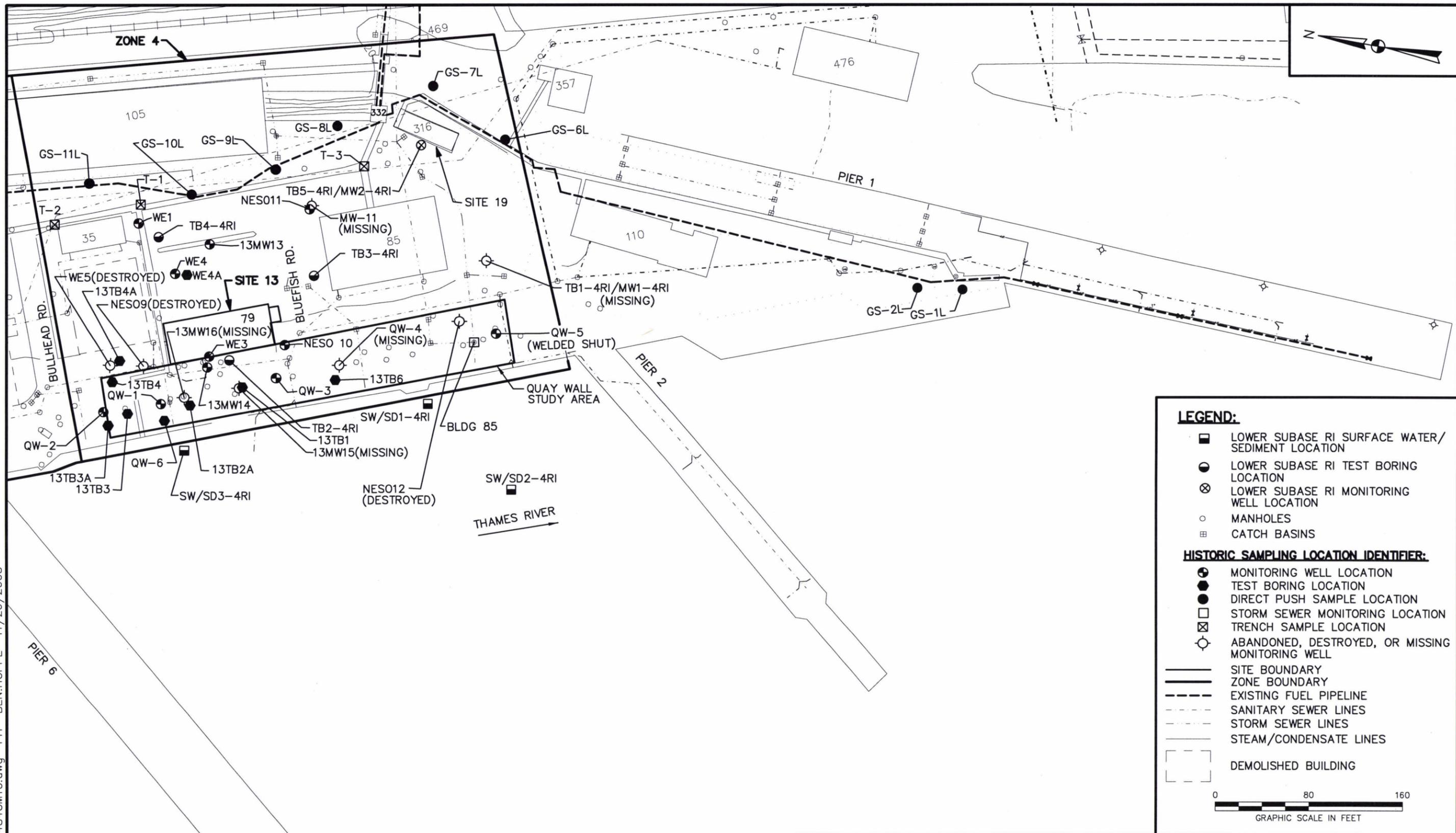
DRAWN BY BH	DATE 11/26/08
CHECKED BY <i>[Signature]</i>	DATE 11/26/08
REVISED BY	DATE
SCALE AS NOTED	



**SITE MAP**  
**SITE 10 - FUEL STORAGE TANKS**  
**AND TANK 54-H**  
**AND SITE 11 - POWER PLANT OIL TANKS**  
**NSB-NLON**  
**GROTON, CONNECTICUT**

CONTRACT NO. 1484	
OWNER NO. 134	
APPROVED BY <i>[Signature]</i>	DATE 12/3/08
DRAWING NO. FIGURE 2-10	REV. 1

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**LEGEND:**

- LOWER SUBBASE RI SURFACE WATER/ SEDIMENT LOCATION
- LOWER SUBBASE RI TEST BORING LOCATION
- ⊗ LOWER SUBBASE RI MONITORING WELL LOCATION
- MANHOLES
- ⊞ CATCH BASINS

**HISTORIC SAMPLING LOCATION IDENTIFIER:**

- ⊕ MONITORING WELL LOCATION
- TEST BORING LOCATION
- DIRECT PUSH SAMPLE LOCATION
- STORM SEWER MONITORING LOCATION
- ⊗ TRENCH SAMPLE LOCATION
- ⊕ ABANDONED, DESTROYED, OR MISSING MONITORING WELL

— SITE BOUNDARY  
 — ZONE BOUNDARY  
 - - - EXISTING FUEL PIPELINE  
 - - - SANITARY SEWER LINES  
 - - - STORM SEWER LINES  
 - - - STEAM/CONDENSATE LINES

□ DEMOLISHED BUILDING

0 80 160  
 GRAPHIC SCALE IN FEET

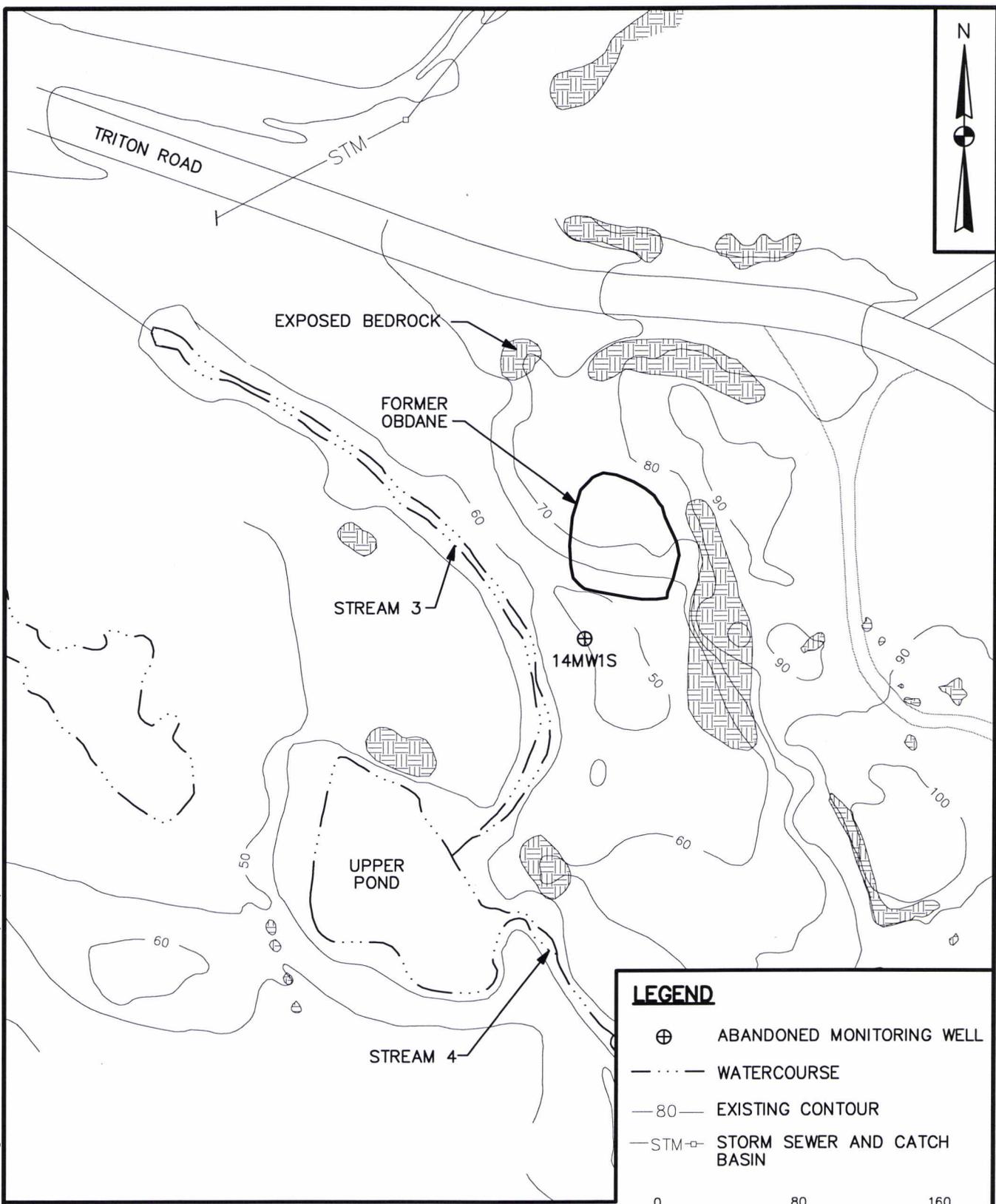
BASE MAP SOURCE: PREPARED BY THE NAVAL SUBMARINE BASE PUBLIC WORKS DEPT., ENGINEERING DIVISION. MARCH 2006, DRAWING NO. A-667.

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CHECKED BY [Signature]	DATE 11/26/08
REVISED BY	DATE
SCALE AS NOTED	



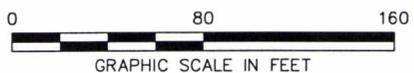
**SITE MAP**  
 SITE 13 - BUILDING 79 WASTE OIL PIT  
 AND SITE 19 - SOLVENT STORAGE AREA  
 (BUILDING 316) AND PIER 1  
 NSB-NLON  
 GROTON, CONNECTICUT

CONTRACT NO. 1484	
OWNER NO. 134	
APPROVED BY [Signature]	DATE 12/3/08
DRAWING NO. FIGURE 2-11	REV. 1



**LEGEND**

- ⊕ ABANDONED MONITORING WELL
- · - · - WATERCOURSE
- 80 - EXISTING CONTOUR
- STM - □ - STORM SEWER AND CATCH BASIN



BASE MAP SOURCE: PREPARED BY THE NAVAL SUBMARINE BASE PUBLIC WORKS DEPT., ENGINEERING DIVISION. MARCH 2006, DRAWING NO. A-667.

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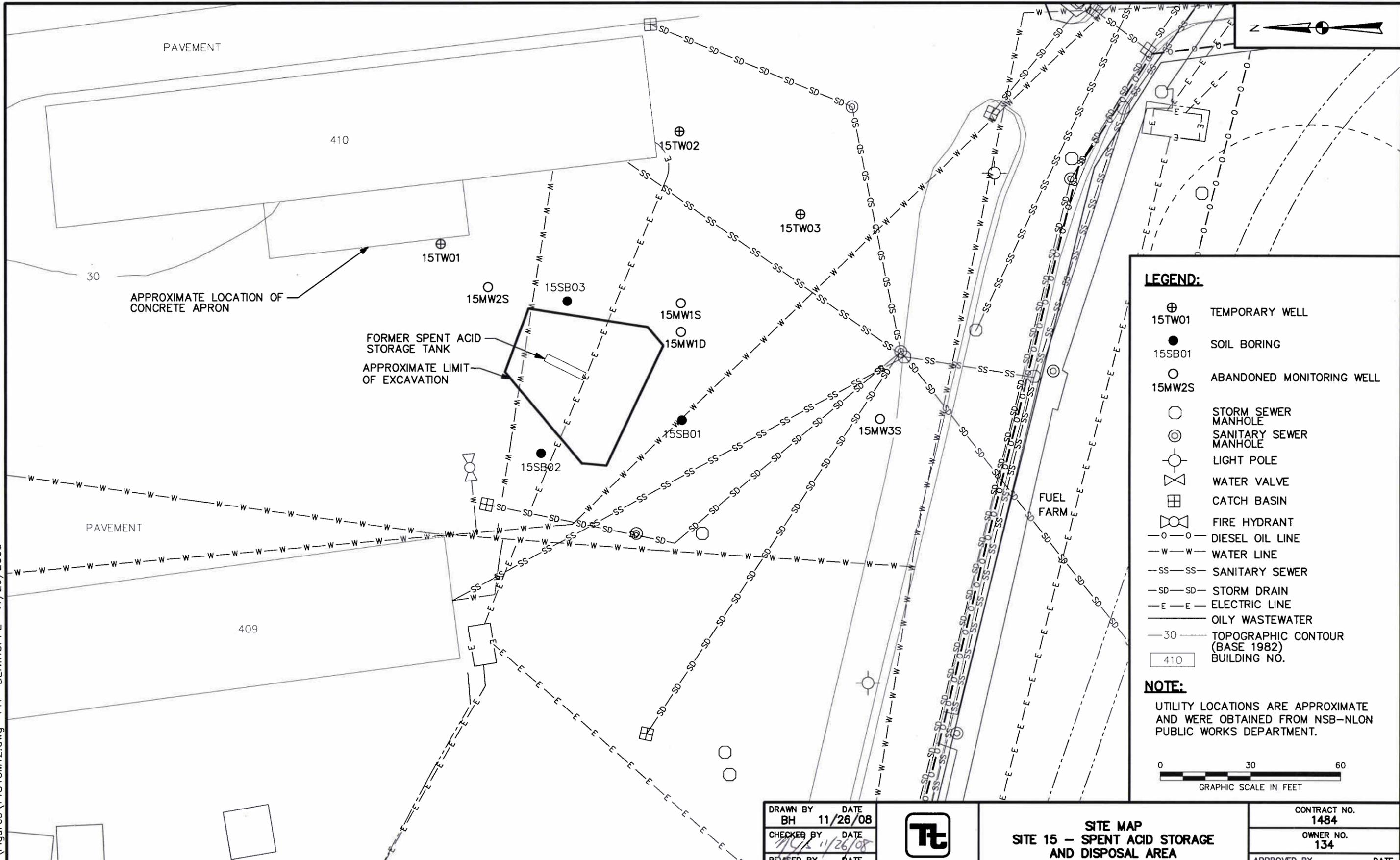
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CHECKED BY <i>MCS</i>	DATE <b>11/26/08</b>
REVISED BY	DATE
SCALE AS NOTED	



**SITE MAP  
SITE 14 - OBDANE  
NSB-NLON  
GROTON, CONNECTICUT**

CONTRACT NO. <b>1484</b>	
OWNER NO. <b>134</b>	
APPROVED BY <i>CAE</i>	DATE <b>12/3/08</b>
DRAWING NO. <b>FIGURE 2-12</b>	REV. <b>1</b>

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**LEGEND:**

- ⊕ 15TW01 TEMPORARY WELL
- 15SB01 SOIL BORING
- 15MW2S ABANDONED MONITORING WELL
- STORM SEWER MANHOLE
- ⊙ SANITARY SEWER MANHOLE
- LIGHT POLE
- ⊗ WATER VALVE
- ⊠ CATCH BASIN
- ⊕ FIRE HYDRANT
- DIESEL OIL LINE
- W-W- WATER LINE
- SS-SS- SANITARY SEWER
- SD-SD- STORM DRAIN
- E-E- ELECTRIC LINE
- OILY WASTEWATER
- 30- TOPOGRAPHIC CONTOUR (BASE 1982)
- 410 BUILDING NO.

**NOTE:**  
 UTILITY LOCATIONS ARE APPROXIMATE AND WERE OBTAINED FROM NSB-NLON PUBLIC WORKS DEPARTMENT.

0 30 60  
 GRAPHIC SCALE IN FEET

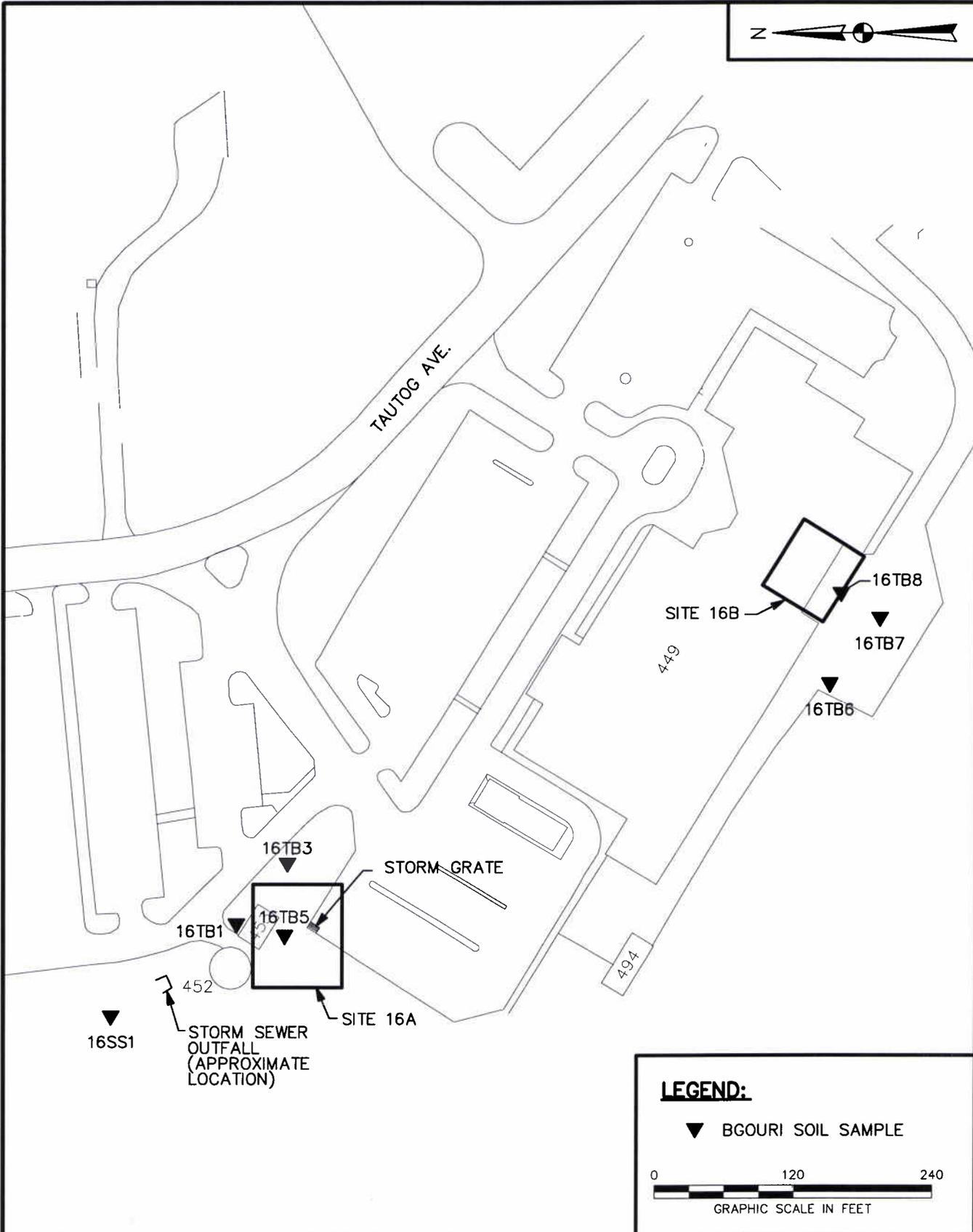
BASE MAP SOURCE: PREPARED BY THE NAVAL SUBMARINE BASE PUBLIC WORKS DEPT., ENGINEERING DIVISION. MARCH 2006, DRAWING NO. A-667.

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BH	11/26/08
CHECKER BY	DATE
REVISOR BY	DATE
SCALE AS NOTED	

**Tt**  
 Tetra Tech  
 NUS, Inc.

**SITE MAP**  
**SITE 15 - SPENT ACID STORAGE AND DISPOSAL AREA**  
**NSB-NLON**  
**GROTON, CONNECTICUT**

CONTRACT NO. 1484	
OWNER NO. 134	
APPROVED BY	DATE
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DRAWING NO. FIGURE 2-13	REV. 1



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**LEGEND:**

▼ BGOURI SOIL SAMPLE

0 120 240  
GRAPHIC SCALE IN FEET

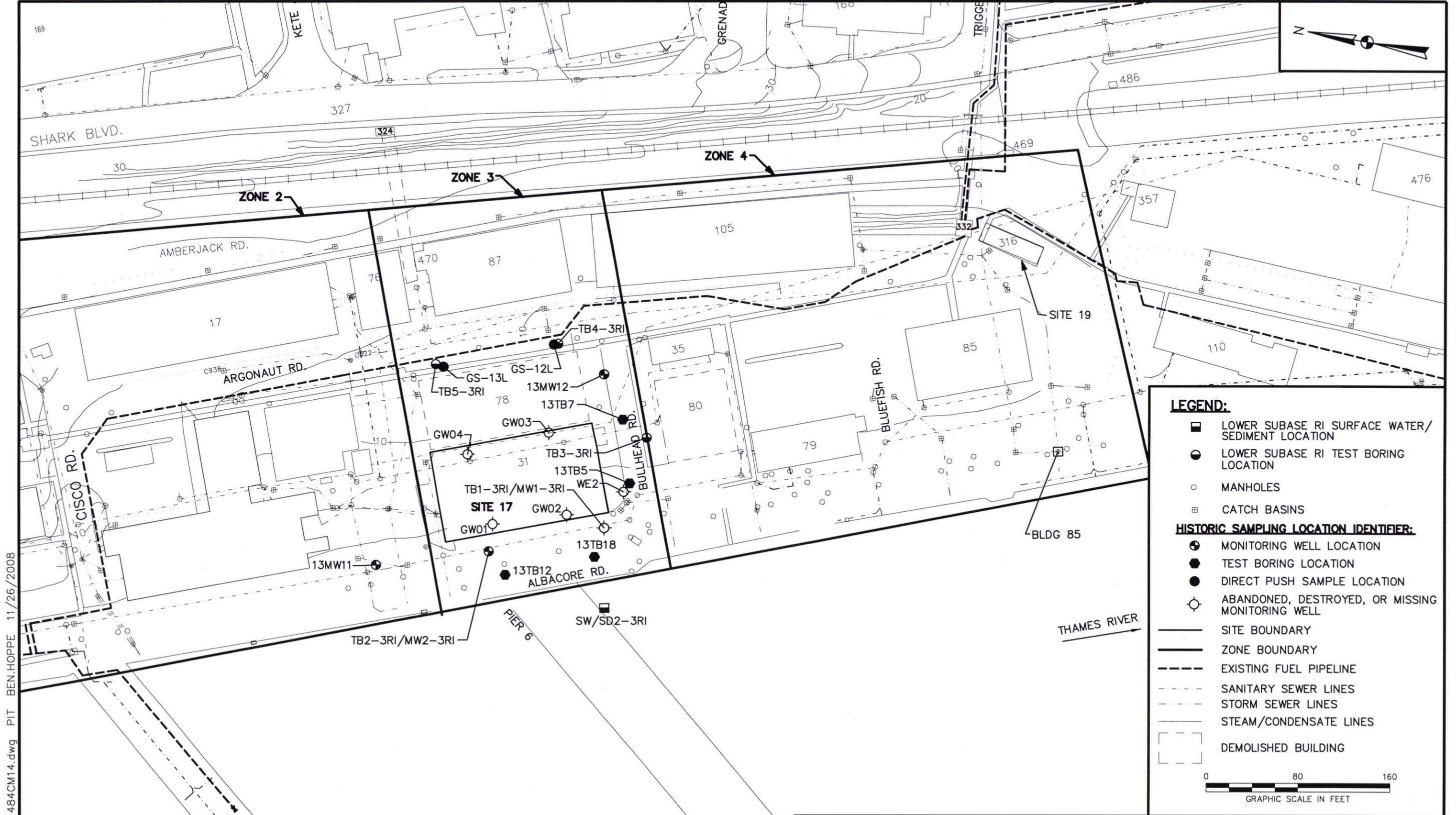
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CHECKED BY <i>M/S</i>	DATE <b>11/26/08</b>
REVISED BY	DATE
SCALE AS NOTED	



**Tetra Tech  
NUS, Inc.**

**SITE MAP  
SITE 16 - HOSPITAL INCINERATORS  
NSB-NLON  
GROTON, CONNECTICUT**

CONTRACT NO. <b>1484</b>	
OWNER NO. <b>134</b>	
APPROVED BY <i>CAZ</i>	DATE <b>12/3/08</b>
DRAWING NO. <b>FIGURE 2-14</b>	REV. <b>0</b>



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BASE MAP SOURCE: PREPARED BY THE NAVAL SUBMARINE BASE PUBLIC WORKS DEPT., ENGINEERING DIVISION. MARCH 2006, DRAWING NO. A-667.

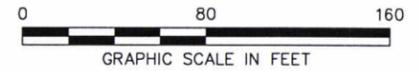
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REVISED BY	DATE

SCALE  
AS NOTED

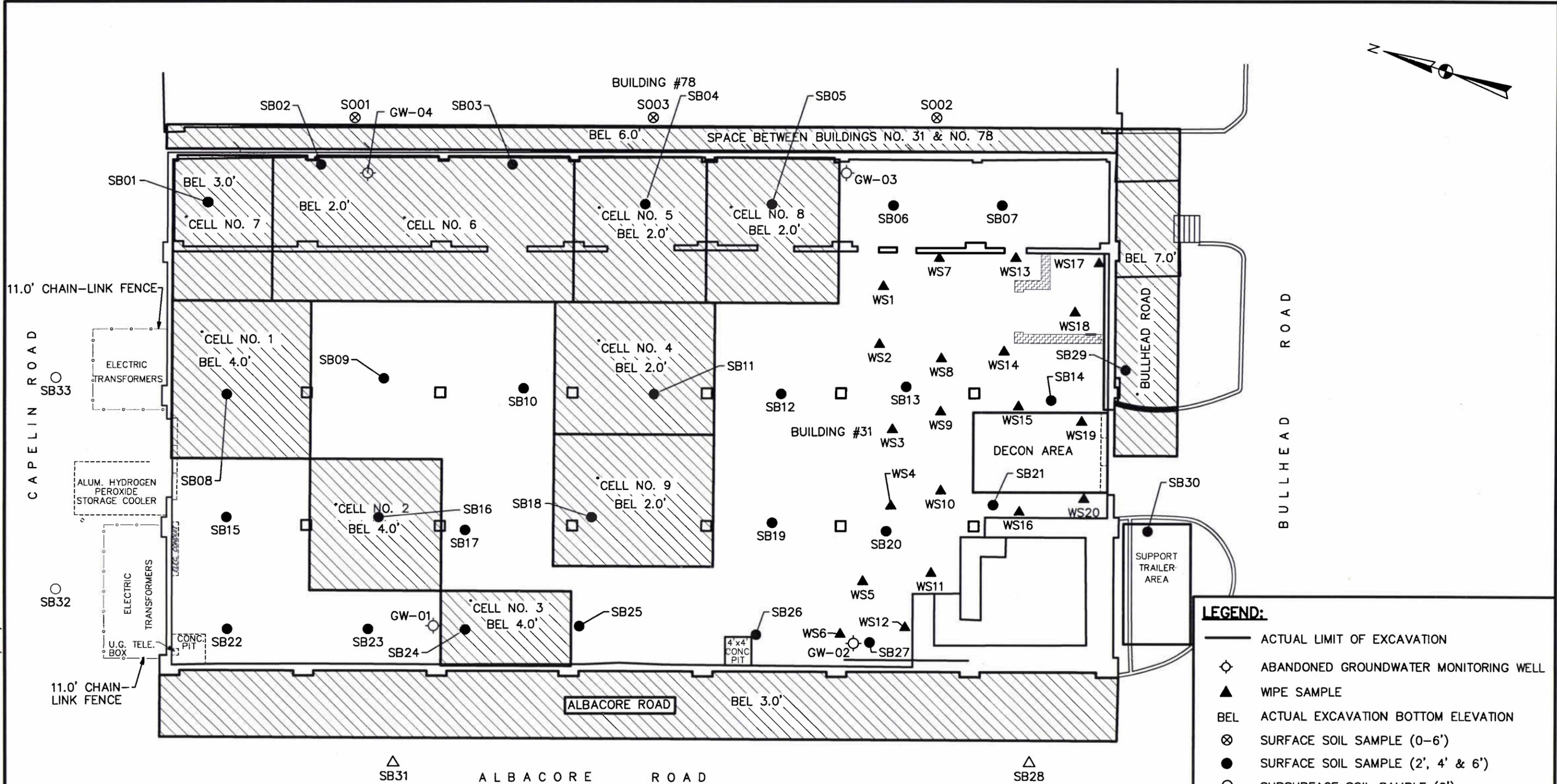


**SITE MAP**  
**SITE 17 - HAZARDOUS MATERIALS/SOLVENT**  
**STORAGE AREA (FORMER BUILDING 31)**  
 NSB-NLON  
 GROTON, CONNECTICUT

CONTRACT NO. 1484	
OWNER NO. 134	
APPROVED BY CAR	DATE 12/3/08
DRAWING NO. FIGURE 2-15	REV. 1



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**LEGEND:**

- ACTUAL LIMIT OF EXCAVATION
- ⊗ ABANDONED GROUNDWATER MONITORING WELL
- ▲ WIPE SAMPLE
- BEL ACTUAL EXCAVATION BOTTOM ELEVATION
- ⊗ SURFACE SOIL SAMPLE (0-6')
- SURFACE SOIL SAMPLE (2', 4' & 6')
- SUBSURFACE SOIL SAMPLE (2')
- △ SUBSURFACE SOIL SAMPLE (2' & 4')

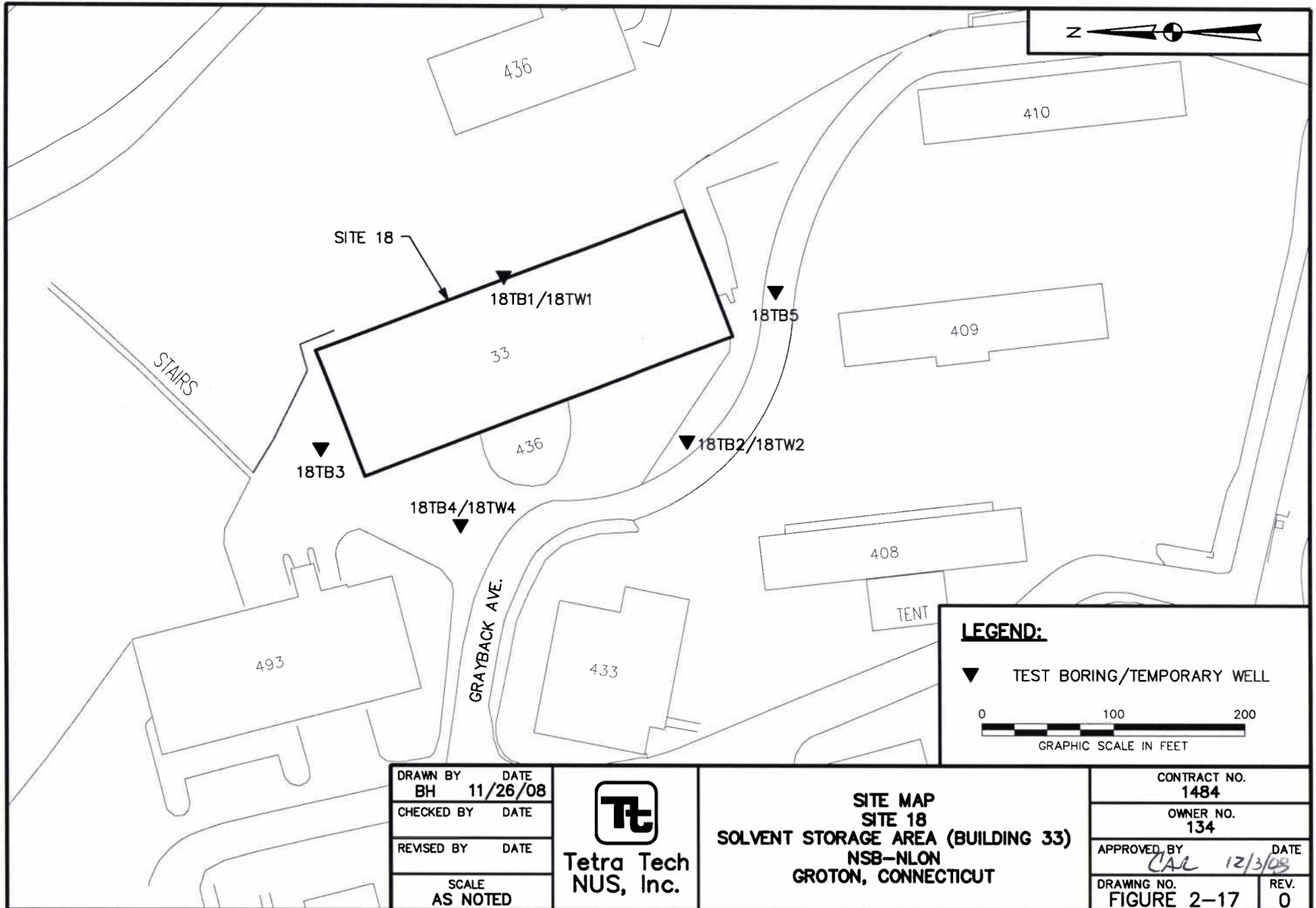
0 15 30  
GRAPHIC SCALE IN FEET

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REVISED BY	DATE
SCALE AS NOTED	



**SITE MAP**  
**AREAS OF REMEDIATION AT SITE 17**  
 NSB-NLON  
 GROTON, CONNECTICUT

CONTRACT NO. 1484	
OWNER NO. 134	
APPROVED BY CAR	DATE 12/3/08
DRAWING NO. FIGURE 2-16	REV. 0



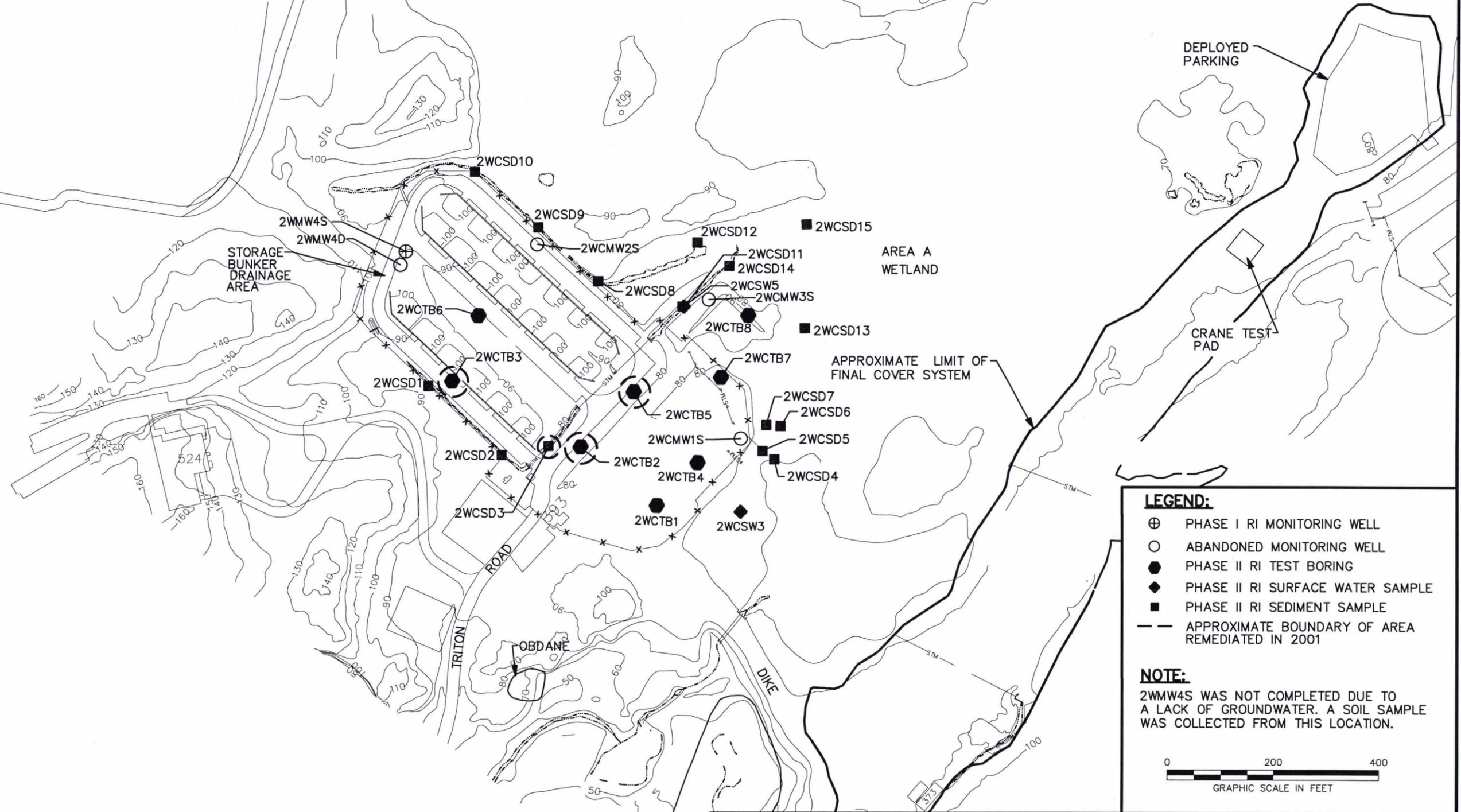
DRAWN BY BH	DATE 11/26/08
CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	

**Tt**  
Tetra Tech  
NUS, Inc.

**SITE MAP**  
**SITE 18**  
**SOLVENT STORAGE AREA (BUILDING 33)**  
**NSB-NLON**  
**GROTON, CONNECTICUT**

CONTRACT NO. 1484	
OWNER NO. 134	
APPROVED BY <i>CAL</i>	DATE 12/3/08
DRAWING NO. FIGURE 2-17	REV. 0

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- LEGEND:**
- ⊕ PHASE I RI MONITORING WELL
  - ABANDONED MONITORING WELL
  - PHASE II RI TEST BORING
  - ◆ PHASE II RI SURFACE WATER SAMPLE
  - PHASE II RI SEDIMENT SAMPLE
  - - - APPROXIMATE BOUNDARY OF AREA REMEDIATED IN 2001

**NOTE:**  
 2WMMW4S WAS NOT COMPLETED DUE TO A LACK OF GROUNDWATER. A SOIL SAMPLE WAS COLLECTED FROM THIS LOCATION.

0 200 400  
 GRAPHIC SCALE IN FEET

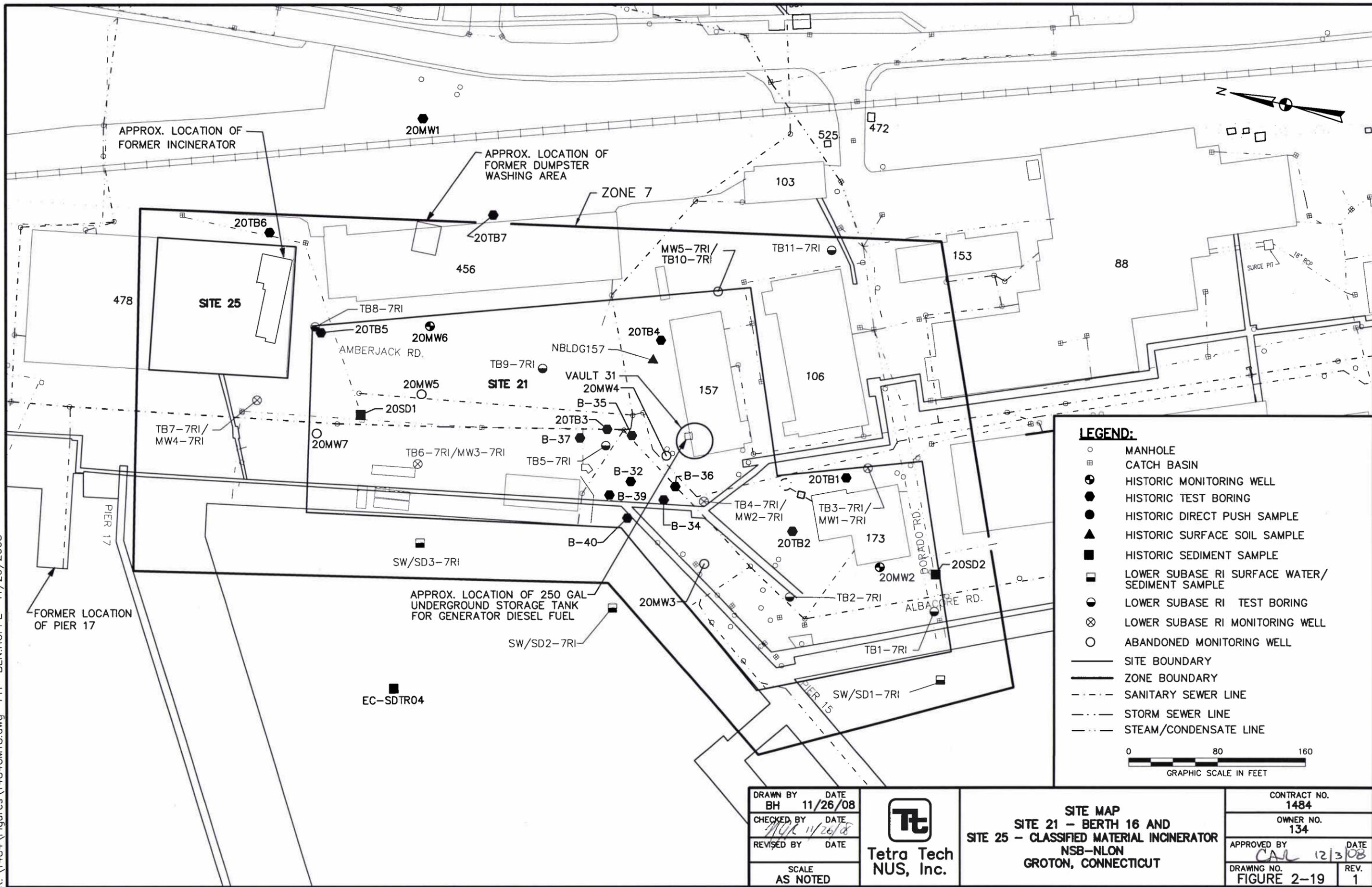
DRAWN BY BH	DATE 11/26/08
CHECKED BY MJS	DATE 11/26/08
REVISED BY	DATE
SCALE AS NOTED	



**SITE MAP**  
**SITE 20 – AREA A WEAPONS CENTER**  
**NSB-NLON**  
**GROTON, CONNECTICUT**

CONTRACT NO. 1484	
OWNER NO. 134	
APPROVED BY CAR	DATE 12/3/08
DRAWING NO. FIGURE 2-18	REV. 1

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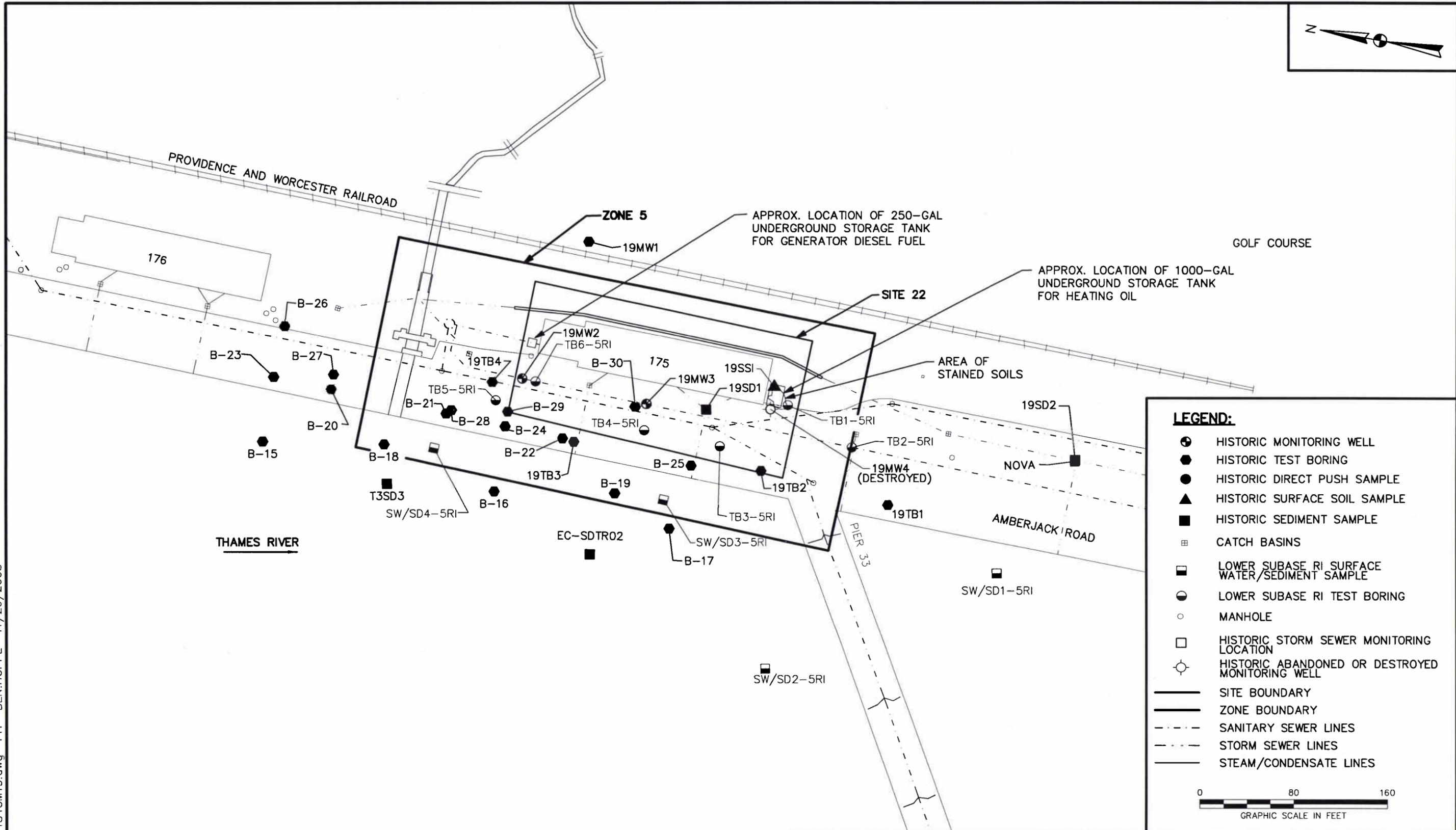


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CHECKED BY <i>[Signature]</i>	DATE 11/26/08
REVISED BY	DATE
SCALE AS NOTED	

**Tetra Tech**  
NUS, Inc.

**SITE MAP**  
SITE 21 - BERTH 16 AND  
SITE 25 - CLASSIFIED MATERIAL INCINERATOR  
NSB-NLON  
GROTON, CONNECTICUT

CONTRACT NO. 1484	
OWNER NO. 134	
APPROVED BY <i>[Signature]</i>	DATE 12/3/08
DRAWING NO. FIGURE 2-19	REV. 1



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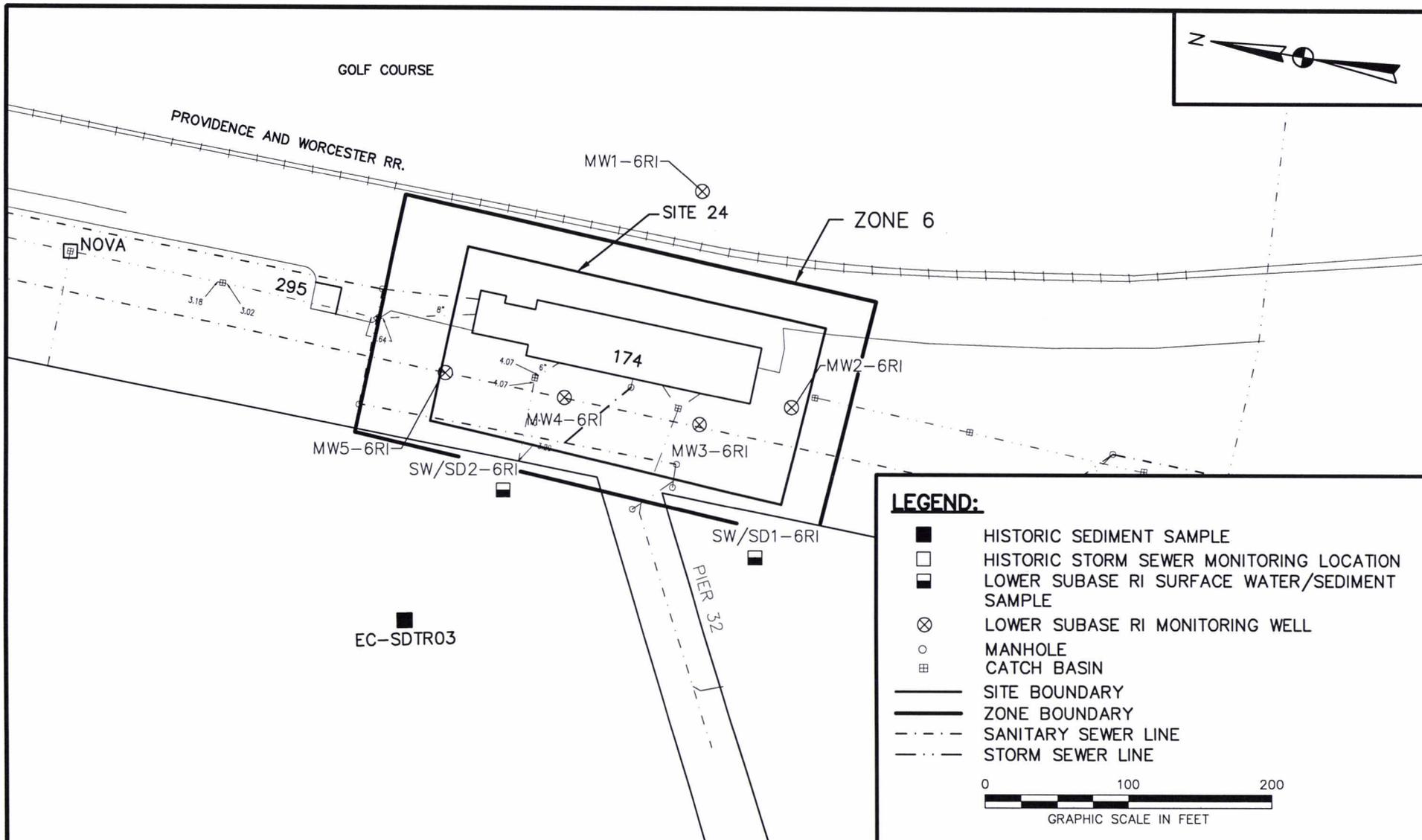
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REVISED BY	DATE
SCALE AS NOTED	



**Tetra Tech  
NUS, Inc.**

**SITE MAP  
SITE 22 - PIER 33  
NSB-NLON  
GROTON, CONNECTICUT**

CONTRACT NO. <b>1484</b>	
OWNER NO. <b>134</b>	
APPROVED BY <i>[Signature]</i>	DATE 12/31/08
DRAWING NO. <b>FIGURE 2-20</b>	REV. <b>0</b>



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REVISED BY	DATE
SCALE AS NOTED	



**SITE MAP**  
**SITE 24 CENTRAL PAINT ACCUMULATION**  
**AREA A (BUILDING 174)**  
**NSB-NLON**  
**GROTON, CONNECTICUT**

CONTRACT NO. <b>1484</b>	
OWNER NO. <b>134</b>	
APPROVED BY <i>CAR</i>	DATE 12/3/08
DRAWING NO. <b>FIGURE 2-21</b>	REV. <b>1</b>

## 3.0 SCHEDULE

A schedule of milestones and a detailed schedule that covers all active ER Program sites in the SMP is attached as Appendix A. The schedules for historical CERCLA activities at the sites have generally been removed from the schedule and only recent and future events are presented.

### 3.1 SCHEDULE DEVELOPMENT

The schedules were developed using the current status of activity for each site at NSB-NLON, anticipated activities, and projected funding availability. Line item durations were typically developed using the FFA, which provides durations for specific process activities.

In some cases, due to requests from regulators, accelerated durations were used for scheduling. The "deliverables" required during the remedial process are separated into two categories: primary and secondary. A description of each of these deliverables is provided below.

#### 3.1.1 Primary Documents

According to the FFA, Primary Documents are developed by the Navy and initially submitted as drafts. The draft Primary Documents are subject to review by the EPA, CTDEP, and the Restoration Advisory Board (RAB).

Following the Navy response to and resolution of EPA, CTDEP, and RAB comments on a draft Primary Documents, a draft final version Primary Document is prepared. Following a regulator concurrence period, the final Primary Document is prepared and issued. Primary Documents include the following:

- Final Plan of Action for IR - August 1989
- Phase I RI Report - August 1992
- Scope of Work for RI/FS
- SIAS
- PA
- Study Area Screening Evaluation Report

- RI/FS Work Plan (and any RI/FS Work Plan Addenda for subsequent phases)
- Phase I RI Report (Including sampling and data results, risk assessment, and preliminary analysis of alternatives)
- Phase II RI Work Plan
- Phase II RI Report (Including sampling and data results, risk assessment, and preliminary analysis of alternatives)
- RI/FS Report (including treatability and pilot studies, initial screening of alternatives, detailed analysis of alternatives, and risk assessment addendum, if warranted by the scope of the RI)
- Proposed Plans and RODs
- Scope of Work for RD/RA
- RD Work Plan
- Sixty percent (60 percent) RD [including Quality Assurance/Quality Control (QA/QC) and Contingency Plans]
- Final RD (including RA Work Plan and Final Construction QA/QC Project Plan)
- Project Closeout Report
- Five-Year Reviews

### **3.1.2     Secondary Documents**

Secondary Documents include those documents that are discrete portions of Primary Documents and are typically input or feeder documents. Secondary Documents are issued by the Navy in draft and are subject to review and comment by EPA and CTDEP. Although the Navy will respond to comments received, the draft Secondary Documents may be finalized in the context of the corresponding draft final Primary Documents. Secondary Documents include the following:

- Study Area Screening Evaluation Work Plan
- Initial Screening of Alternatives
- Detailed Analysis of Alternatives
- Treatability and Pilot Study Work Plans (if warranted by the scope of the RI/FS)
- Treatability and/or Pilot Studies (if warranted by the scope of the RI/FS)
- Sampling and Data Results
- RA Work Plan
- Pre-Final RD (85 percent)

### **3.1.3 Durations**

The FFA (EPA, 1995) defines review, response, and revision time frames for Primary and Secondary documents as follows:

- EPA/State review of draft Secondary and Primary Documents - 60 days
- Navy review and response to EPA/State comments on draft Primary and Secondary Documents - 45 days
- Meeting(s) held to informally dispute any unresolved issues regarding draft Primary Documents or to discuss any unresolved issues regarding draft Secondary Documents; Navy submittal of draft final Primary and Secondary Documents - 45 days
- EPA/State submittal of Letter of Concurrence with draft final Primary Document or invoking of Formal Dispute Resolution in accordance with Section XIII (Dispute Resolution) - 30 days
- Navy issuance of final Primary Document after Navy submittal of draft final Primary Document pursuant to Section 7.6 (e) (3) - 60 days
- Navy issuance of final Primary Document that conforms to the results of Dispute Resolution - 45 days

The FFA provides a provision to extend a timetable, deadline, or schedule for good cause.

The SMP is reviewed and revised as necessary. The review cycle is as follows:

- Discussion (90 days) of budget with EPA/CTDEP, Natural Resources Trustee, and community members; amended SMP submitted by the third quarter of the fiscal year.
- 30-day period for review and comment by regulators.
- 30-day period for the Navy to respond to comments.

## 4.0 NSB-NLON CLEANUP TEAM

The names, addresses, and responsibilities of the cleanup team are as follows:

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NAVFAC Mid-Atlantic  
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**APPENDIX A**

**MILESTONE AND DETAILED SCHEDULES**

## **MILESTONE SCHEDULE**















## **DETAILED SCHEDULE**



























