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SOIL AND GROUNDWATER PRE-DESIGN INVESTIGATION COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM FOR LOWER SUBASE OPERABLE UNIT 4 (OU4)
VOLUME 1 OF 3 NSB NEW LONDON CT
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TETRA TECH

Lower Subase (Operable Unit 4) Soil and Groundwater Pre-Design Investigation Completion Report and Feasibility Study Addendum

Volume I of III - Text

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Groton, Connecticut

Naval Facilities Engineering Command Mid-Atlantic

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LOWER SUBASE (OPERABLE UNIT 4)
SOIL AND GROUNDWATER PRE-DESIGN INVESTIGATION COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM

VOLUME I - TEXT

NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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ACRONYMS LIST

ANSI	American National Standards Institute
ARAR	Applicable or Relevant and Appropriate Requirement
Atlantic	Atlantic Environmental Services, Inc.
AWQC	Ambient Water Quality Criterion
B&RE	Brown & Root Environmental
BaP	Benzo(a)pyrene
bgs	Below ground surface
bss	Below sediment surface
CAA	Clean Air Act
CAD	Confined Aquatic Disposal
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGS	Connecticut General Statutes
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	Chemical of concern
COPC	Chemical of potential concern
CSF	Cancer Slope Factor
CTDEEP	Connecticut Department of Energy & Environmental Protection
CTDEP	Connecticut Department of Environmental Protection
CTE	Central tendency exposure
CTO	Contract Task Order
CWA	Clean Water Act
cy	Cubic yards
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
DEC	Direct Exposure Criterion
DO	Dissolved oxygen
DoD	Department of Defense
DO-IT™	Dissolved Oxygen – In situ Treatment
DOT	Department of Transportation
DPT	Direct push technology
DQI	Data Quality Indicator
DQR	Data Quality Review
DTI	Depth to invert

E.O.	Executive Order
EE/CA	Engineering Evaluation/Cost Analysis
EQ	Equivalent
ELUR	Environmental Land Use Restriction
EPC	Exposure point concentration
ERPM	Environmental Restoration Program Manager
ETPH	Extractable Total Petroleum Hydrocarbons
FEAD	Facilities Engineering and Acquisitions Department
FFA	Federal Facility Agreement
FOL	Field Operations Leader
FS	Feasibility Study
FTMR	Field Task Modification Request
GA/GAA/GB	CTDEP Groundwater Quality Classifications
GAC	Granular activated carbon
gpd	Gallon per day
gpm	Gallon per minute
GPR	Ground-penetrating radar
GPS	Global Positioning System
GRA	General response action
GWPC	Groundwater Protection Criterion
HHRA	Human health risk assessment
HI	Hazard Index
HNUS	Halliburton NUS Corporation
HQ	Hazard Quotient
I/C	Industrial/Commercial
ICP-MS	Inductively coupled plasma-mass spectrometry
ID	Inside diameter
IDW	Investigation-derived waste
IEUBK	Integrated Exposure Uptake Biokinetic
ILCR	Incremental Lifetime Cancer Risk
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
lbs	Pounds
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LDA	Large diameter auger
LNAPL	Light non-aqueous phase liquid

LTTD	Low-temperature thermal desorption
LUC	Land Use Control
mg/kg	Milligram per kilogram
mg/L	Milligram per liter
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NAD	North American Datum
NAVD	North American Vertical Datum
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEDT	New England Disposal Technologies, Inc.
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
ng/kg	nanogram per kilogram
NPW	Net present worth
NSB-NLON	Naval Submarine Base - New London
NTCRA	Non-Time Critical Removal Action
NTU	Nephelometric turbidity unit
ORC	Oxygen-release compound
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PAH	Polycyclic aromatic hydrocarbon
PAL	Project action limit
PCB	Polychlorinated biphenyl
PDI	Pre-Design Investigation
PID	Photoionization detector
PM	Project Manager
PMC	Pollutant Mobility Criteria
PPE	Personal protective equipment
ppm	Part per million
ppt	Part per thousand
PRG	Preliminary Remediation Goal
PVC	Polyvinyl chloride
PWD	Public Works Department
QC	Quality Control

QSM	Quality Systems Manual
%R	Percent recovery
RADCON	Radiation Control
RAO	Remedial action objective
RCRA	Resource Conservation and Recovery Act
RCSA	Regulations of Connecticut State Agencies
RD	Remedial Design
RfD	Reference Dose
RI	Remedial Investigation
RME	Reasonable maximum exposure
ROD	Record of Decision
RPD	Relative Percent Difference
RSR	Remediation Standard Regulations (Connecticut)
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SDG	Sample Delivery Group
SOP	Standard Operating Procedure
SOPA	Standard Operating Procedure – Administrative
SPCS	State Plane Coordinate System
SPLP	Synthetic Precipitation Leaching Procedure
SSL	Soil Screening Level
SSO	Site Safety Officer
S.U.	Standard Unit
SVOC	Semivolatile organic compound
SWPC	Surface Water Protection Criteria
TBC	To Be Considered
TCDD	2,3,7,8-tetrachlordibenzo-p-dioxin
TCLP	Toxicity Characteristic Leaching Procedure
TEF	Toxicity Equivalency Factor
Tetra Tech	Tetra Tech, Inc.
TOC	Total organic carbon
TPH	Total petroleum hydrocarbons
TRW	Technical Review Workgroup
TSCA	Toxic Substances Control Act
TSDF	Treatment, storage, and disposal facility
U.S.C.	United States Code
µg/L	Microgram per liter

µg/kg	Microgram per kilogram
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UST	Underground storage tank
VOC	Volatile organic compound
WQS	Water Quality Standard

1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) prepared this Lower Subase Soil and Groundwater Pre-Design Investigation (PDI) Completion Report and Feasibility Study (FS) Addendum for the United States Department of the Navy, Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic, under Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62470-08-D-1001, Contract Task Orders (CTOs) WE57 and WE67. This work in the Lower Subase portion of Naval Submarine Base – New London (NSB-NLON) in Groton, Connecticut, was conducted in accordance with the Navy's Installation Restoration Program (IRP), which supports the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986.

1.1 PURPOSE AND SCOPE

The final Lower Subase FS was issued in December 2010 with the understanding that additional data would be collected as part of Soil and Groundwater PDIs that might impact the findings of the FS. The New London IRP Team [Navy, United States Environmental Protection Agency (USEPA), and Connecticut Department of Energy & Environmental Protection (CTDEEP) (formerly Connecticut Department of Environmental Protection (CTDEP))] agreed that an FS Addendum would be prepared that incorporated the results of the Soil and Groundwater PDIs. The goals for the Lower Subase Soil and Groundwater PDIs and FS Addendum are detailed below.

1.1.1 Soil PDI

During completion of the Lower Subase FS, areas needing additional information were identified from the soil databases of all seven Lower Subase zones of investigation (Zones 1 through 7). Six of these zones include one or more sites being investigated under the Navy's IRP (i.e., Zone 1 - Sites 10 and 11, Zone 3 – Site 17, Zone 4 - Sites 13 and 19, Zone 5 - Site 22, Zone 6 - Site 24, and Zone 7 – Sites 21 and 25). The goals for the Soil PDI, as described in the final Soil PDI Sampling and Analysis Plan (SAP) (Tetra Tech, 2010b), were as follows:

1. To sample and analyze soil for primary chemicals of concern (COCs) at the horizontal and vertical locations with the greatest uncertainties of complying with Industrial/Commercial (I/C) Direct Exposure Criteria (DEC) and Pollutant Mobility Criteria (PMC) to determine a more accurate estimate of the volume of soil requiring remediation in each zone.

2. To sample and analyze soil for total petroleum hydrocarbons (TPH) at the locations with the greatest uncertainties of complying with calculated potential light non-aqueous phase liquid (LNAPL) concentrations to determine a more accurate estimate of LNAPL requiring remediation in Zone 1.

3. To sample and analyze soil for primary COCs at the horizontal and vertical locations with the greatest uncertainties of complying with Residential DEC and PMC to determine a more accurate estimate of the area of soil requiring land use controls (LUCs) while unacceptable risks exist.

4. To determine the speciation of chromium (trivalent and hexavalent) in soil to more accurately determine associated human health risks.

5. To evaluate the effectiveness of engineered controls as a remedy by determining the extent of storm sewer lines located above the mean high water table that pass through contaminated soil with identified pollutant mobility concerns.

6. To survey the condition of existing monitoring wells in the Lower Subase to determine the extent of maintenance required.

It was anticipated that data collected during the Soil PDI to address the first four goals would be used in conjunction with soil data collected during previous Lower Subase investigations to confirm the extent of contamination, COCs, and volumes of soil exceeding regulatory criteria. The updated soil volumes would in turn be used to update the evaluation of remedial alternatives for the Lower Subase zones. The data collected during the Soil PDI to address the fifth goal were to be used to evaluate the effectiveness of engineered controls as a remedial action. The data collected to address the sixth goal were to be used to identify maintenance issues with existing monitoring wells at the Lower Subase and to develop a schedule to complete appropriate operation and maintenance activities. The data were not collected for direct use in updating the Lower Subase FS or any remedial action decisions.

1.1.2 Groundwater PDI

The Groundwater PDI, as described in the final Groundwater PDI SAP (Tetra Tech, 2010a), was designed to collect additional groundwater samples from select monitoring wells in the Lower Subase at NSB-NLON. The additional groundwater data were used to confirm the presence and extent of select metals (i.e., arsenic, copper, and lead) in groundwater at the four zones of investigation (Zones 1, 4, 5, and 7) in the Lower Subase. Each of these zones includes one or more sites being investigated under the Navy's IRP.

Multiple rounds of groundwater sampling were conducted at monitoring wells in the four zones during previous investigations; however, elevated detection limits and potential false positive detections for select metals in historical data indicated that matrix interferences may have impacted the laboratory's ability to detect and quantify target analytes at all concentrations of concern. Low-flow sampling techniques and appropriate analytical methods were proposed to be used during PDI sampling efforts to minimize matrix interferences, attain appropriate detection limits, and provide defensible data acceptable to the New London IRP Team. In addition, two rounds of samples were to be collected under two different hydrologic regimes to assess the impact of seasonality on the analytical data. The samples were also to be collected during low tide to reduce salinity interference with detection of metals.

The goals for the Groundwater PDI were to identify select metals with concentrations exceeding regulatory criteria, to delineate the extent of groundwater contamination in the four zones, to validate the zone-specific remedies selected for groundwater in the Lower Subase FS (Tetra Tech, 2010a), and if necessary, to use it to develop the Lower Subase groundwater remedial design.

1.1.3 Feasibility Study Addendum

As discussed above, the final Lower Subase FS (Tetra Tech, 2010d) was issued with the understanding that additional data were to be collected under the Soil and Groundwater PDIs and that an FS Addendum would be prepared to incorporate the results of the PDIs. The goal of the FS Addendum was to provide sufficient supplemental documentation and evaluation that could be used in conjunction with the final Lower Subase FS to refine selection of appropriate remedial alternatives for the Lower Subase sites. Based on the results of the FS Addendum the remedy selection process will be completed through an informed risk management decision-making process through preparation of a Proposed Plan and Record of Decision.

The sections of the FS impacted by PDI data include the human health risk assessment (HHRA), COC and medium of concern selection, volumes of contaminated media, and remedial alternative evaluation. It was anticipated that the new data would not substantially affect other portions of the FS, including remedial action objectives (RAOs), Applicable or Relevant and Appropriate Requirements (ARARs), remediation technologies, or comparative analysis. However, all sections of the FS were updated as necessary to complete the FS Addendum so that appropriate remedial alternatives were developed and evaluated that permanently and significantly reduce risks to human health and the environment. The alternatives provide cost-effective methods to mitigate the identified risks, and the range of alternatives is adequate so that consensus can be reached between the Navy and regulators regarding the selected response action.

1.2 BACKGROUND INFORMATION

1.2.1 NSB-NLON

1.2.1.1 Location

NSB-NLON is located in southeastern Connecticut in the Towns of Ledyard and Groton (Figure 1-1) and is situated on the eastern bank of the Thames River, approximately 6 miles north of Long Island Sound. It is bordered to the east by Connecticut Route 12, to the south by Crystal Lake Road, and to the west by the Thames River. The northern border of the site is a low ridge that trends approximately east-southeast from the Thames River to Baldwin Hill.

For the purpose of this Lower Subase Soil and Groundwater PDI Completion Report and FS Addendum, the Lower Subase study area includes approximately 33 acres of land along the Thames River that extends from just south of Pier 2 to just north of Pier 33 (Figure 1-2). Building 175, located just north of Pier 33, is included within the Lower Subase study area. Figure 1-2 also depicts the locations of other IRP sites at NSB-NLON. The Lower Subase of NSB-NLON is bordered on the west by the Thames River and on the east by the Providence and Worcester Railroad. A quay (retaining) wall runs along the Thames River for the entire length of the Lower Subase. The Lower Subase contains piers and berths for submarine docking; facilities for submarine maintenance, repair, and overhaul; and administrative buildings.

After the FS was completed, but during completion of this FS Addendum, the boundary between Zone 2 and Zone 3 was altered so that all Zone 2 soil estimated to have lead concentrations greater than residential criteria was moved into Zone 3. Based on this change, the soil remaining in Zone 2 is not expected to represent a concern under CERCLA.

1.2.1.2 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. In 1868, the Navy officially designated the property a Navy Yard that was used to moor small craft and obsolete warships and that served as a coaling station for the Atlantic fleet. The Navy designated the site a submarine base in 1916. During World War I, facilities at the base were extensively expanded; six piers and 81 buildings were added. In 1917, a submarine school was established, and in 1918, the Submarine Medical Center was founded. The facility underwent another period of growth during World War II. Between 1935 and 1945, the Navy added more than 180 buildings and acquired land adjacent to NSB-NLON, expanding the facility from 112 acres to 497 acres. The growth of NSB-NLON continued after World War II, and in 1946, the Medical Research Laboratory was established. In 1968, the status of the submarine school was changed from an Activity to a Command,

and the submarine school became the largest tenant activity on the base. The Naval Submarine Support Facility was established in 1974, and the Naval Undersea Medical Institute was established the following year.

Currently, NSB-NLON consists of more than 207 buildings on 687 acres of land and provides base command for Naval submarine activities in the Atlantic Ocean. NSB-NLON also provides housing for Navy personnel and their families and supports submarine training facilities, military offices, medical facilities, and facilities for submarine maintenance, repair, and overhaul.

1.2.1.3 Operations

The Lower Subase is part of the 112-acre parcel making up the original Navy base and, as such, its use dates back to 1868. Most of the construction in the Lower Subase from approximately Pier 15 south took place in the early 1900s, with a major expansion from 1935 to 1940. In 1946, the waterfront north of Pier 15 was developed extensively to accommodate berthing of the reserve fleet. The area was dredged and filled, and bulkheads, piers, support buildings, and utilities were constructed.

Battery overhaul was one of the largest operations at the Lower Subase prior to the advent of nuclear-powered submarines. Lead-acid battery maintenance and overhaul activities were conducted in this area until the mid-1950s. A classified materials incinerator was also operated in the Lower Subase until 1967. Although incinerator residues were disposed of in landfills at other sites within the facility, it is possible that some of the ash was disposed of in portions of the Lower Subase. Petroleum products were used by the Navy throughout the Lower Subase. Releases of petroleum products to the environment may have occurred because of leaks from underground storage tanks (USTs) and fuel distribution lines, vehicle and locomotive maintenance operations and associated waste disposal practices, and marine fueling activities. Other ship and submarine maintenance activities (e.g., sandblasting and painting) were also conducted in the Lower Subase and adjacent Thames River.

Over the past decade, maintenance dredging was undertaken by the Navy in the Thames River adjacent to the Lower Subase to maintain water depths required for the submarine fleet. Dredging was conducted during 1995 and 1996 as part of the Pier 17 Replacement and Seawolf Class Submarine Homeporting projects. Dredged material from this project was disposed of at a designated open-water disposal site in Long Island Sound. Dredging was also conducted in 2006 as part of the Pier 6 replacement project. Dredged material from this project was disposed of in a Confined Aquatic Disposal (CAD) cell constructed in the Thames River just downstream of NSB-NLON. Additional maintenance dredging in numerous other areas along the Lower Subase waterfront pier complex began in December 2009 and was completed in February 2010.

1.2.2 IRP Sites

This Lower Subase PDI Completion Report and FS Addendum address IRP sites located in the Lower Subase, which has been designated Operable Unit (OU) 4. Under the IRP, the Navy designated seven separate zones for investigation at the Lower Subase. The zones include a total of nine IRP sites and the Quay Wall Study Area and were delineated to encompass specific sites and potential sources to focus the preparation of reports. The following zones/sites are shown on Figure 1-2 and were included in the PDIs and FS Addendum:

- Zone 1 – Site 10 (Fuel Storage Tanks and Former Tank 54-H), Site 11 (Power Plant Oil Tanks), and Building 89 UST.
- Zone 2 – Fuel oil distribution lines.
- Zone 3 – Site 17 (Former Hazardous Materials/Solvent Storage Area and Battery Overhaul Area, Building 31).
- Zone 4 – Site 13 (Building 79 Former Waste Oil Pit), Site 19 (Former Solvent Storage Area, Former Building 316), and the Quay Wall Study Area.
- Zone 5 – Site 22 (Pier 33).
- Zone 6 – Site 24 (Central Paint Accumulation Area, Building 174).
- Zone 7 – Site 21 (Berth 16 and Transformers at Building 157 Vault 31) and Site 25 (Former Classified Materials Incinerator).

1.3 ORGANIZATION

This report is organized into six sections. Section 1.0 provides an introduction and summary of site information. Sections 2.0 and 3.0 present summaries of the field activities completed during the Soil and Groundwater PDIs, respectively. Sections 4.0 and 5.0 detail the results of the Soil and Groundwater PDIs, respectively. The FS Addendum is documented in Section 6.0. Supporting information is provided in Appendices A through K of this report.

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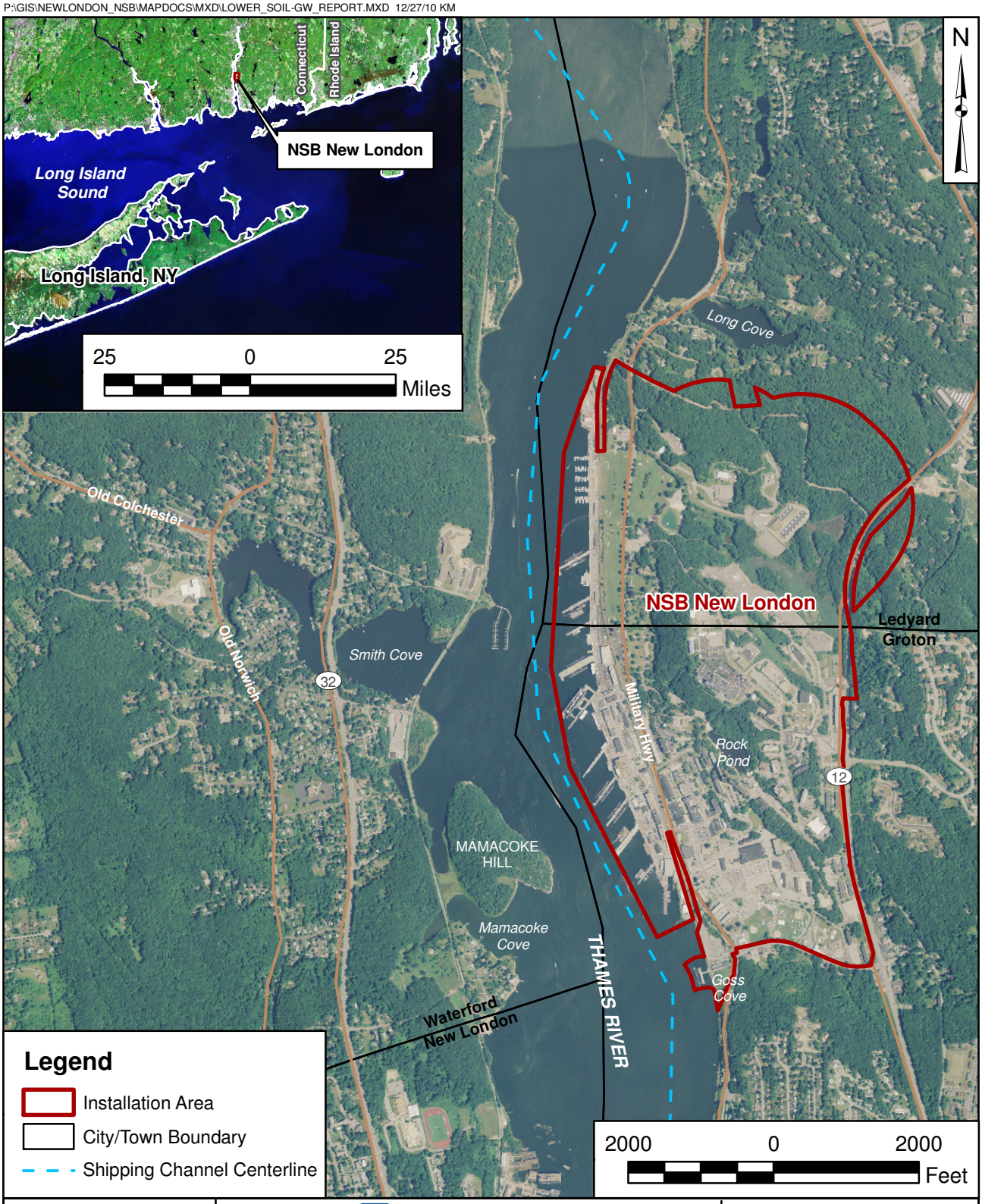


DRAWN BY K. MOORE	DATE 12/23/10	TETRA TECH	CONTRACT NUMBER CTO 064
CHECKED BY C. RICH	DATE 12/23/10	FACILITY LOCATION MAP LOWER SUBASE SOIL AND GROUNDWATER COMPLETION REPORT AND FS ADDENDUM NSB-NLON GROTON, CONNECTICUT	APPROVED BY ___ DATE ___
COST/SCHEDULE AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 1-1 / REV 0

LEGEND:

——— SITE BOUNDARY

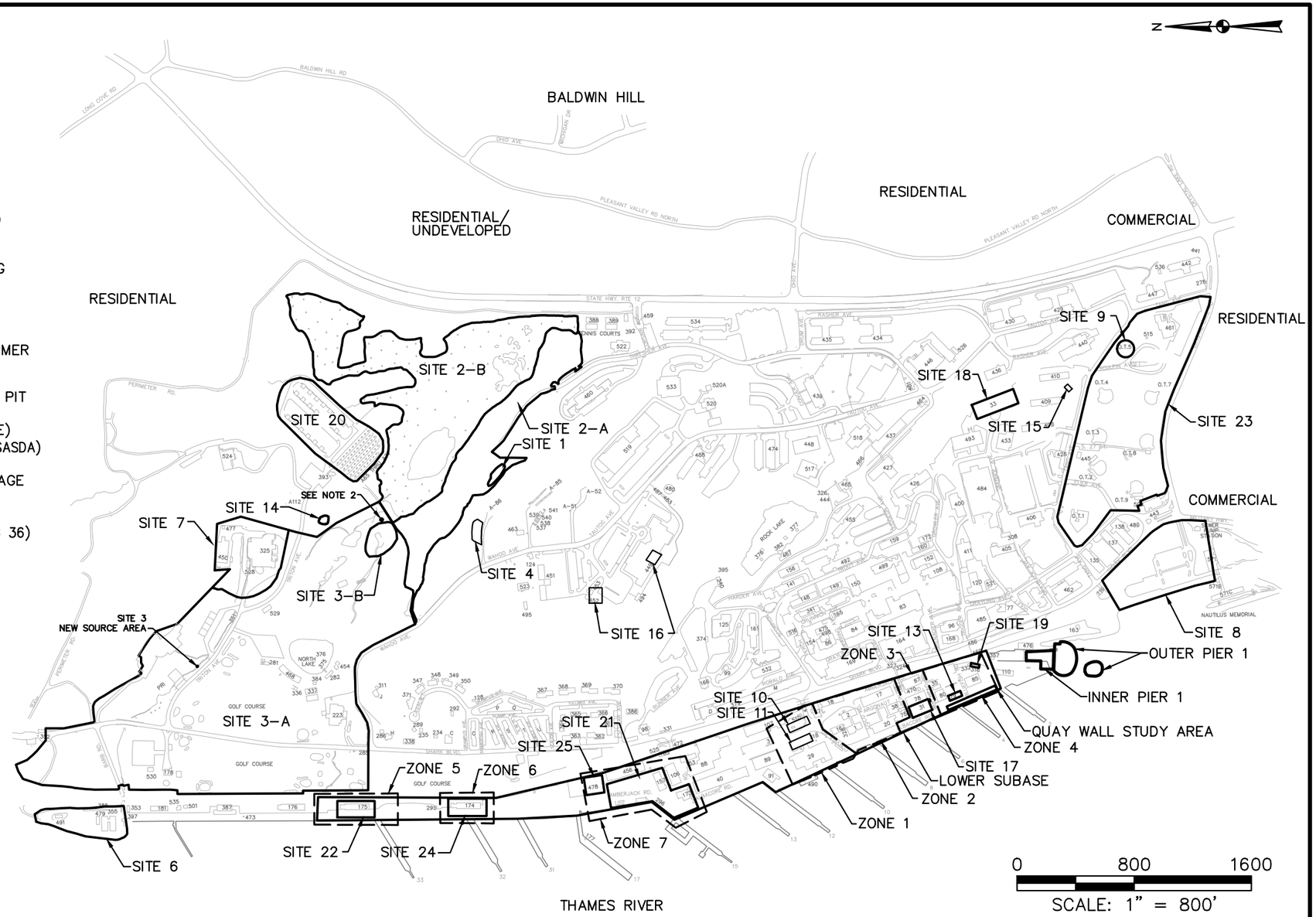
— — — LOWER SUBASE REMEDIAL INVESTIGATION ZONE BOUNDARY

SITE IDENTIFICATION:

SITE 1 – FORMER 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) FORMER OVERBANK DISPOSAL AREA (OBDA)
SITE 4 – FORMER 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 – FORMER OILY WASTEWATER TANK (OT–5)
SITE 10 – LOWER SUBASE–FUEL STORAGE TANKS AND FORMER TANK 54–H
SITE 11 – LOWER SUBASE–POWER PLANT OIL TANKS
SITE 13 – LOWER SUBASE–BUILDING 79 FORMER WASTE OIL PIT AND INNER AND OUTER PIER 1
SITE 14 – OVERBANK DISPOSAL AREA NORTHEAST (OBDANE)
SITE 15 – FORMER SPENT ACID STORAGE AND DISPOSAL AREA (SASDA)
SITE 16 – FORMER HOSPITAL INCINERATORS
SITE 17 – FORMER HAZARDOUS MATERIALS/SOLVENT STORAGE AREA (FORMER BUILDING 31)
SITE 18 – SOLVENT STORAGE AREA (BUILDING 33)
SITE 19 – FORMER SOLVENT STORAGE AREA (FORMER BUILDING 36)
SITE 20 – AREA A WEAPONS CENTER
SITE 21 – BERTH 16
SITE 22 – PIER 33
SITE 23 – FORMER FUEL FARM
SITE 24 – CENTRAL PAINT ACCUMULATION
SITE 25 – LOWER SUBASE–FORMER CLASSIFIED MATERIALS INCINERATOR

NOTES:

1. SITE BOUNDARIES ARE APPROXIMATE.
2. LOCATION OF CONCRETE–CAPPED SOIL.



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2.0 SOIL PDI FIELD ACTIVITIES

Field activities performed during the Lower Subase Soil PDI included the following:

- Mobilization/Demobilization
- Utility clearance
- Soil boring and sampling
- Sample shipping
- Equipment decontamination and investigation-derived waste (IDW) management
- Catch basin and manhole survey
- Site survey
- Monitoring well condition survey

The field activities were performed between August 23, 2010, and September 14, 2010, in accordance with the Soil PDI SAP (Tetra Tech, 2010b) and the Health and Safety Plan (Tetra Tech, 2010c). Of the 59 planned borings, 58 borings were drilled. Some borings were relocated because of utility interference issues, and fewer samples than planned were collected from several of the borings because of refusal at shallow depths. Modifications to the Soil PDI SAP that occurred during field activities are discussed in more detail below. Figures 2-1 through 2-7 show the locations of the 58 borings installed in Zones 1 through 7, respectively, during the Soil PDI. In addition to soil sampling, a survey of pipe invert elevations in select catch basins and manholes was included in the Soil PDI. A monitoring well inventory was also performed in accordance with the Soil PDI SAP, but the well inventory field activities are described in Section 3.0, Groundwater PDI Field Activities.

Appendices A.1 through A.4 include Soil PDI Field Task Modification Request (FTMR) form, boring and sample logs, soil sample chain-of-custodies, and field equipment calibration logs, respectively. IDW chain-of-custody forms, manifests, and analytical results are presented in Appendix A.5. Daily activities were summarized in the field logbook, and copies of the logbook pages are provided in Appendix A.6. Catch basin and manhole survey log sheets are included in Appendix A.7. Appendix A.8 includes the survey information.

2.1 MOBILIZATION/DEMOBILIZATION

A brief field team orientation meeting was conducted in Tetra Tech's Pittsburgh, Pennsylvania, office prior to the start of fieldwork to familiarize personnel with the site's health and safety requirements, objectives

and scope of the field activities, and chain of command. The meeting was attended by the FOL/SSO, PM, and project chemist.

Tetra Tech mobilized to NSB-NLON on August 23, 2010, to conduct the soil PDI sampling. The Tetra Tech FOL and field technician picked up NSB-NLON personnel identification passes and vehicle passes and met with the New London FEAD field inspector prior to conducting site-specific health and safety training. The sample team also met with the New London Hazardous Waste Program Manager to set up a staging area for equipment, supplies, and IDW. Field supplies and sample bottleware was inventoried and stored at the staging area. Prior to commencing field activities, the sample team received RADCON training at Building 135, conducted a site tour, discussed access requirements, PPE requirements, work hours, and vehicle parking with NSB-NLON personnel. The field team was also issued "off hours" work permits to allow access to Lower Subase at times required to fulfill low-tide sampling requirements.

At the completion of the soil PDI sampling event, all field equipment was packed and returned to the appropriate rental companies, and the field staff demobilized from the site. All rented sampling equipment was shipped on August 30, 2010.

2.2 UTILITY CLEARANCE

Prior to drilling, 59 boring locations were marked in the field by Tetra Tech and then utility clearance was performed by Tetra Tech's subcontractor, Hager-Richter Geosciences, Inc. The locations were marked by Tetra Tech personnel with an approximately 8-inch-wide plus sign (+) at each proposed location using white marking paint. Two technicians from Hager-Richter marked the underground utilities in a 20-foot by 20-foot grid around each proposed soil boring location. Hager-Richter personnel used ground-penetrating radar (GPR) and a precision pipe and cable locator to locate utilities. Hager-Richter personnel also opened utility manholes near planned boring locations and marked the directions of connecting underground utilities into and out of the manholes. Hager-Richter used the American National Standards Institute (ANSI) standard color code (i.e., red for electric power, blue for water, etc) to mark the underground utilities.

As Hager-Richter completed marking utilities at the various Lower Subase zones, the NSB-NLON Public Works Department (PWD) Engineer, with Tetra Tech personnel assistance, assessed each proposed boring location to determine whether it was approved for drilling. If the location was approved, the PWD Engineer signed off on the NSB-NLON "Request to Excavate Permit" (dig permit) form, and marked "OK" on the ground at the drilling location. If the location was not clear of underground utilities, the location mark was obliterated using flat black paint, and the mark was moved to a new suitable location. The dig permits were then sent to the NSB-NLON PWD Lower Subase Coordinator for final review and signature

approval. After approval, Tetra Tech personnel maintained the permits on site during soil boring advancement. Following completion of the investigation, the permits were returned to the NSB-NLON PWD.

As a result of the first mobilization for utility clearing, three locations (Z1-PDI-008, Z3-PDI-003, and Z3-PDI-004) could not be cleared due to underground utilities. An FTMR Form (Appendix A.1) was submitted to the Navy, with copies to USEPA and CTDEP, explaining that the locations needed to be either eliminated or moved to other suitable locations clear of underground utilities. A team decision was made to relocate, not eliminate the three borings, as documented in Appendix A.1. The three locations were relocated and cleared during the second mobilization of the utility clearance contractor. After completion of the second utility clearance event, the three locations discussed in the FTMR and two additional locations in two zones were moved from their originally proposed locations avoid utilities. In Zone 1, Z1PDI-008 was moved approximately 60 feet north-northeast and Z1PDI-014 was moved 8 feet west of their planned locations. In Zone 3, Z3PDI-002 was moved 16 feet southwest, Z3PDI-003 was moved approximately 35 feet south-southeast, and Z3PDI-005 was moved 7 feet west of their planned locations to avoid utilities. In addition, one location, Z3PDI-004, could not be drilled or sampled due to utility interference. This location was moved three times in an attempt to find a drilling location clear of utilities; however, no clear location was found. To avoid all utilities would have required either relocating the boring out of the area of interest or adjacent to an existing boring; therefore, this boring was not installed. No borings were offset a significant distance (greater than approximately 5 feet) due to utility clearance issues in Zones 2, 4, 5, or 6.

2.3 SOIL BORING AND SAMPLING

On September 7, 2010, Tetra Tech's drilling subcontractor, Drilex Environmental, mobilized to the site. Drilling began on September 8, 2010, using a Geoprobe® 6610DT track-mounted direct-push technology (DPT) rig and a 2.25-inch inside diameter Macro-Core® sampler (5-foot length). Disposable plastic liners were used in the Macro-Core® sampler to minimize decontamination requirements and assist with recovery of the core sample for sampling. Fifty-five of the 58 locations were sampled using the DPT rig. The remaining three locations (Z1PDI-002, Z6PDI-004, and Z7PDI-005) were in areas that were not accessible by the DPT rig; therefore, at those locations, a hand-held Bosch hammer drill was used to advance the sampling tool to the desired depths.

Soil boring and sampling were conducted on September 8 through September 12, and September 14, 2010. Borings Z1PDI-003, -004, -009, -010, -011, -012 and Z7PDI-014, -015, -016, -018, and -019 were completed first because they were in areas scheduled to be paved by the Navy, and the new pavement would have covered the utility clearance markings. Sample identification numbers, dates, numbers of

samples, duplicate samples, and matrix spike/matrix spike duplicate (MS/MSD) samples collected at each boring location are presented in Table 2-1. Sampling intervals varied between boring locations to meet the requirements specified in the Soil PDI SAP. Sample locations, depths, and analyses are listed in Table 2-2. Boring and sample log sheets are provided in Appendix A.2. A photoionization detector (PID) was used to field screen soil samples for organic vapors and the results were documented on the soil boring logs.

The following deviations to the Soil PDI SAP occurred during installation of Zone 1 borings and collection of required soil samples:

- Z1PDI-001 was to extend 14 feet below ground surface (bgs) and five samples were to be collected, but only three samples could be collected before refusal at a depth of 9 feet. Although Z1PDI-001 was offset four times, the boring could not be advanced past the 9-foot depth, and no additional samples could be collected.

- Z1PDI-002 was to extend 14 feet bgs and six samples were to be collected, but refusal was encountered at 6 feet and only two samples were collected. Three attempts were made to complete boring Z1PDI-002 to its required depth, but none were successful. Additional attempts were not made due to nearby buildings and utilities.

- Z1PDI-005 was to be drilled to 10 feet bgs, but refusal was encountered at 6.5 feet bgs. Although three samples were collected at Z1PDI-005 as planned, two of those samples were collected at shallower depths than planned.

- No sample was collected from the top 2 feet at Z1PDI-007 because the entire top 2 feet consisted of concrete, asphalt, and wood.

- As previously mentioned, Z1PDI-008 and ZPDI-014 were relocated during utility clearance.

- Boring Z1PDI-011 met refusal at 2 feet bgs; therefore it was offset 15 inches east, where utilities were cleared, the boring was drilled, and all planned samples were collected.

The remaining borings were located and drilled as planned. A total of 40 samples were collected from 14 borings at Zone 1, compared to 47 planned samples from 14 planned borings.

At Zone 2, one boring was drilled and three samples were collected as planned. Samples from Z2PDI-001 were to be analyzed for extractable total petroleum hydrocarbons (ETPH) only; however,

sample Z2PDI-001-0002 was mislabeled as Z7PDI-001-0002 in the field, and was therefore marked for analysis for antimony, synthetic precipitation leaching procedure (SPLP) antimony, lead, SPLP lead, and polycyclic aromatic hydrocarbons (PAHs). After the error was determined, the laboratory was notified of the mistake and the remaining soil from sample Z2PDI-001-0002 was analyzed for ETPH, although the holding time for the analysis had been exceeded.

One Zone 3 soil boring location, Z2PDI-002, was given Zone 2 nomenclature because at the time of the PDI that location was in Zone 2. The Zones 2 and 3 boundaries were later changed; however, and location Z2PDI-002 is now in Zone 3. The following deviations to the Soil PDI SAP occurred during installation of Zone 3 borings and collection of required soil samples:

- Boring Z3PDI-001 met refusal at 4 inches bgs and therefore was offset 6 feet to the east where utilities were previously cleared. The boring was drilled at the new location, and all planned samples were collected.

- As previously mentioned, Z3PDI-002 and Z1PID-003 were relocated during utility clearance, and Z3-PDI-004 could not be drilled due to utility interference.

- Location Z3PDI-005 was to extend to 5 feet bgs and two samples were to be collected, but refusal was encountered at 2 feet bgs and only one sample was collected. Consideration was made to moveZ3PDI-005, but there was no room to offset the boring.

- Seven samples were collected from four borings at Zone 3, compared to 10 planned samples from five planned borings.

Boring and sampling activities proceeded without any deviations to the Soil PDI SAP at Zones 4 and 5. At Zone 4, 15 samples were collected from nine borings, and at Zone 5, 10 samples were collected from five borings.

At Zone 6, eight samples were collected from four planned borings. Boring Z6PDI-003 was relocated 30 feet east because no soil existed at the planned location. The original proposed location was in an area where concrete decking was suspended directly over the Thames River.

In Zone 7, 39 of 40 planned soil samples were collected from 20 planned borings. Boring Z7PDI-005 was to extend to 6 feet bgs and three samples were to be collected, but refusal was encountered at a depth of 3.5 feet and only two samples were collected. Six attempts were made to advance Z7PDI-005 to the

desired depth, but all encountered refusal at shallow depths. No significant boring location offsets were necessary in Zone 7.

Samples in Paved and Unpaved Areas

The following borings were drilled in unpaved locations as required in the Soil PDI SAP to address CTDEP concerns regarding inaccessible soil (i.e., soil at depths greater than 4 feet bgs in unpaved areas):

Zone 1	Zone 2	Zone 5	Zone 6	Zone 7
Z1PDI-001	Z2PDI-001	Z5PDI-001	Z6PDI-004	Z7PDI-005
Z1PDI-002		Z5PDI-005		
Z1PDI-006				
Z1PDI-013				
Z1PDI-014				

Sample Z4PDI-002 was also to be completed in an unpaved area, but the proposed sample location was on a steep grassy slope that was inaccessible to the DPT rig, so it was moved to an adjacent paved area. The remaining samples were located in paved areas as planned.

Quality Control Samples

Field duplicate pairs and MS/MSD samples were collected as described in Soil PDI SAP Worksheet #20. Field duplicates were generally collected at a rate of one duplicate pair per every 10 samples. MS/MSDs were generally collected at a rate of one per every 20 samples per analyte. Locations of quality control (QC) samples are presented in Table 2-1 and on soil chain-of-custody forms in Appendix A.3. Two rinsate blanks were also collected, as indicated on the chain-of-custody forms.

Field Calibration

The PID used to field screen the soil samples for organic vapors was calibrated daily during drilling activities, and the results were summarized on a calibration sheet provided in Appendix A.4.

2.4 SAMPLE SHIPPING

Samples were packed and shipped via FedEx for overnight delivery on September 9, 13, and 14, 2010, to the appropriate laboratories for analysis. Soil samples collected for chromium speciation analysis were shipped to TestAmerica Laboratories, Inc. in Pittsburgh, Pennsylvania and samples for all other analyses

were shipped to Katahdin Analytical in Scarborough, Maine. Soil chain-of custody forms are provided in Appendix A.3.

2.5 EQUIPMENT DECONTAMINATION AND IDW MANAGEMENT

Drilling equipment was decontaminated upon arrival at the site, between each borehole location, and at the completion of the project per Tetra Tech Standard Operating Procedure (SOP) SA-7.1. Decontamination was performed on a decontamination pad constructed near the southern side of Building 29 in Zone 1. Decontamination fluids were collected and containerized in one 55-gallon drum. Drill cuttings were also collected and containerized in a separate 55-gallon drum. Each drum was properly labeled with appropriate information (e.g., facility, contents, well, date, and responsible party). All personal protective equipment (PPE) was double bagged and placed in an approved dumpster at the facility.

All drummed IDW was subsequently transported from the Lower Subase to the NSB-NLON short-term waste storage facility off Wahoo Avenue by the Navy. The liquid and solid wastes were sampled for characterization purposes by Tetra Tech's subcontractor New England Disposal Technologies, Inc. (NEDT) on September 15, 2010. Manifests, waste profiles, analytical results for the characterization samples, and chain of custodies are provided in Appendix A.5. The results showed that liquid IDW was non-hazardous and that solid IDW was hazardous due to lead. The drummed waste was collected by NEDT on October 29, 2010, and transported off site for treatment/disposal at appropriate facilities (Dynecol in Detroit, Michigan, for liquid and EQ in Detroit, Michigan for solids). Both facilities are approved to accept waste from CERCLA sites under the CERCLA Off-Site Rule (see email from William Damico from USEPA Region 5 in Appendix A.5).

2.6 CATCH BASIN AND MANHOLE SURVEY

The Soil PDI SAP (Worksheet #14) identified eight manholes and eight catch basins to be surveyed to assess the depth of storm sewers relative to the depth of contaminated soil in the vicinity of the catch basin/manholes. Measurements were taken at 12 of the 16 planned locations. The four locations that were not surveyed and the associated rationale are summarized as follows:

- Catch basin C520-A and manhole C924 were not surveyed because they could not be located.
- Manhole C520 was not surveyed because the manhole lid was welded shut.
- Catch basin C520-B-Z2 was not surveyed because a jersey barrier was located on top of the grate, and it could not be moved.

At each of the 12 surveyed locations, covers were removed, a reference point on the frame of each was marked with paint, and the vertical distance from the reference point to each pipe invert (bottom inside of pipe) within each catch basin or manhole was measured to the nearest 0.1 foot. The depths to invert (DTIs) and estimated diameters, materials, and directions of pipes connecting to the catch basins and manholes surveyed in each zone are presented in in Appendix I on Table I-1. The results of the catch basin and manhole survey were documented on log sheets provided in Appendix A.7.

2.7 SITE SURVEY

CME Associates, Inc. of Woodstock, Connecticut, a subcontractor to Tetra Tech, surveyed the horizontal and vertical locations of the borings and reference points marked on the catch basins and manholes. Richard H. Strouse, a Connecticut-licensed surveyor at CME, oversaw completion of the surveying. The existing NSB-NLON Base Traverse and Monument System was used for control during the survey. The survey was completed in the Connecticut State Plane Coordinate System (SPCS) North American Datum (NAD) 1983 horizontal control and North American Vertical Datum (NAVD) 1988 vertical control. The surveyor's report, including tables of coordinates and figures showing boring, catch basin, and manhole locations, is provided in Appendix A.8.

TABLE 2-1

SOIL PDI BORING COLLECTION SUMMARY
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Boring Location/ID	Date Sampled	Number of Samples	Duplicate Collected	MS/MSD Collected
Z1PDI-001	8-Sep-10	3	0	0
Z1PDI-002	11-Sep-10	2	0	0
Z1PDI-003	8-Sep-10	6	1	0
Z1PDI-004	8-Sep-10	4	1	0
Z1PDI-005	12-Sep-10	3	0	0
Z1PDI-006	8-Sep-10	3	0	0
Z1PDI-007	9-Sep-10	1	0	0
Z1PDI-008	14-Sep-10	3	0	0
Z1PDI-009	8-Sep-10	3	0	0
Z1PDI-010	8-Sep-10	2	0	0
Z1PDI-011	9-Sep-10	2	0	0
Z1PDI-012	8-Sep-10	2	0	0
Z1PDI-013	8-Sep-10	2	1	0
Z1PDI-014	10-Sep-10	4	0	0
Z2PDI-001	12-Sep-10	3	0	0
Z2PDI-002	12-Sep-10	1	0	0
Z3PDI-001	14-Sep-10	2	0	0
Z3PDI-002	12-Sep-10	2	0	0
Z3PDI-003	14-Sep-10	2	0	0
Z3PDI-004	---	NA	NA	NA
Z3PDI-005	12-Sep-10	1	0	0
Z4PDI-001	10-Sep-10	2	1	0
Z4PDI-002	10-Sep-10	3	0	0
Z4PDI-003	11-Sep-10	1	0	0
Z4PDI-004	11-Sep-10	1	0	0
Z4PDI-005	11-Sep-10	1	0	0
Z4PDI-006	10-Sep-10	2	1	0
Z4PDI-007	10-Sep-10	2	0	1
Z4PDI-008	11-Sep-10	2	0	0
Z4PDI-009	11-Sep-10	1	0	0
Z5PDI-001	9-Sep-10	2	1	0
Z5PDI-002	9-Sep-10	2	1	0
Z5PDI-003	9-Sep-10	2	0	0
Z5PDI-004	9-Sep-10	2	1	1
Z5PDI-005	9-Sep-10	2	0	0
Z6PDI-001	9-Sep-10	2	1	1
Z6PDI-002	9-Sep-10	2	0	1

TABLE 2-1

SOIL PDI BORING COLLECTION SUMMARY
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Boring Location/ID	Date Sampled	Number of Samples	Duplicate Collected	MS/MSD Collected
Z6PDI-003	14-Sep-10	2	0	0
Z6PDI-004	9-Sep-10	2	0	0
Z7PDI-001	11-Sep-10	3	0	0
Z7PDI-002	11-Sep-10	2	1	1
Z7PDI-003	10-Sep-10	3	2	2
Z7PDI-004	11-Sep-10	3	0	0
Z7PDI-005	11-Sep-10	2	0	0
Z7PDI-006	11-Sep-10	1	0	0
Z7PDI-007	10-Sep-10	2	1	1
Z7PDI-008	10-Sep-10	2	0	1
Z7PDI-009	11-Sep-10	2	2	1
Z7PDI-010	10-Sep-10	2	2	0
Z7PDI-011	10-Sep-10	2	0	0
Z7PDI-012	10-Sep-10	1	1	0
Z7PDI-013	10-Sep-10	2	1	0
Z7PDI-014	8-Sep-10	2	0	2
Z7PDI-015	8-Sep-10	2	1	0
Z7PDI-016	8-Sep-10	2	0	0
Z7PDI-017	11-Sep-10	2	1	0
Z7PDI-018	8-Sep-10	1	1	1
Z7PDI-019	8-Sep-10	1	0	0
Z7PDI-020	10-Sep-10	2	1	1

NA - Not applicable.

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z1PDI-001	Z1PDI-SO-001-0002	705389.5185	1180761.648	0 to 2 ft	ETPH	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (6) To address PMC
	Z1PDI-SO-001-0204	705389.5185	1180761.648	2 to 4 ft	ETPH	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (6)To address PMC
	Z1PDI-SO-001-0810	705389.5185	1180761.648	8 to 9 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC (7) To quantify LNAPL
Z1PDI-001 Total =						**3**		
Z1PDI-002	Z1PDI-SO-002-0002	705328.8831	1180627.399	0 to 2 ft	ETPH, PAHs(11)	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC In unpaved areas (6) To address PMC
Z1PDI-002	Z1PDI-SO-002-0204	705328.8831	1180627.399	2 to 4 ft	ETPH, PAHs(11)	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (6) To address PMC
Z1PDI-002 Total =						**2**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z1PDI-003	Z1PDI-SO-003-0002	705355.1404	1180707.313	0.5 to 2 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z1PDI-003	Z1PDI-SO-003-0406	705355.1404	1180707.313	4 to 6 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC
Z1PDI-003	Z1PDI-SO-003-0809	705355.1404	1180707.313	8 to 9.5 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC (7) To quantify LNAPL
Z1PDI-003	Z1PDI-SO-003-0910	705355.1404	1180707.313	9.5 to 10 ft	ETPH	1	(1)(2)(3)(4)	(7) To quantify LNAPL
Z1PDI-003	Z1PDI-SO-003-1012	705355.1404	1180707.313	10 to 12 ft	ETPH	1	(1)(2)(3)(4)	(7) To quantify LNAPL
Z1PDI-003	Z1PDI-SO-003-1214	705355.1404	1180707.313	12 to 14 ft	ETPH	1	(1)(2)(3)(4)	(7) To quantify LNAPL
Z1PDI-003 Total =						**6**		
Z1PDI-004	Z1PDI-SO-004-0002	705450.7345	1180668.077	0 to 2 ft	ETPH, PAHs(11)	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z1PDI-004	Z1PDI-SO-004-0406	705450.7345	1180668.077	4 to 6 ft	ETPH, PAHs(11)	1	(1)(2)(3)(4)	(6) To address PMC (7) To quantify LNAPL
Z1PDI-004	Z1PDI-SO-004-0809	705450.7345	1180668.077	8 to 9 ft	ETPH, PAHs(11)	1	(1)(2)(3)(4)	(6) To address PMC (7) To quantify LNAPL
Z1PDI-004	Z1PDI-SO-004-0910	705450.7345	1180668.077	9 to 10 ft	ETPH	1	(1)(2)(3)(4)	(7) To quantify LNAPL
Z1PDI-004 Total =						**4**		
Z1PDI-005	Z1PDI-SO-005-0002	705182.3956	1180607.206	1 to 2 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z1PDI-005	Z1PDI-SO-005-0305	705182.3956	1180607.206	3 to 5 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC (7) To quantify LNAPL
Z1PDI-005	Z1PDI-SO-005-0507	705182.3956	1180607.206	5 to 6.5 ft	ETPH	1	(1)(2)(3)(4)	(7) To quantify LNAPL
Z1PDI-005 Total =						**3**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z1PDI-006 (at Zone 1 boundary near 13MW1 and 13MW2)	Z1PDI-SO-006-0002	705449.2674	1180843.187	0 to 2 ft	ETPH	1	(1)(2)(3)(4)	(5) Surface sample to address I/C DEC (6) To address PMC
Z1PDI-006	Z1PDI-SO-006-0204	705449.2674	1180843.187	2 to 4 ft	ETPH	1	(1)(2)(3)(4)	(5) Surface sample to address I/C DEC (6) To address PMC
Z1PDI-006	Z1PDI-SO-006-0810	705449.2674	1180843.187	8 to 9.5 f	ETPH	1	(1)(2)(3)(4)	(6) To address PMC (7) To quantify LNAPL
Z1PDI-006 Total =						**3**		
Z1PDI-007	Z1PDI-SO-007-0405	705094.704	1180583.944	4 to 5 f	ETPH	1	(1)(2)(3)(4)	(6) To address PMC (7) To quantify LNAPL
Z1PDI-007 Total =						**1**		
Z1PDI-008	Z1PDI-SO-008-0002	705459.1983	1180569.383	0 to 2 ft	ETPH, PAHs(11)	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (6) To address PMC

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z1PDI-008	Z1PDI-SO-008-0405	705459.1983	1180569.383	4 to 5 f	ETPH, PAHs(11)	1	(1)(2)(3)(4)	(6) To address PMC (7) To quantify LNAPL
Z1PDI-008	Z1PDI-SO-008-0910	705459.1983	1180569.383	9 to 10 ft	ETPH	1	(1)(2)(3)(4)	(7) To quantify LNAPL
Z1PDI-008 Total =						**3**		
Z1PDI-009	Z1-PDI-SO-009-0002	705503.0385	1180574.417	0 to 2 ft	PAHs(11)	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas (9) To bound COC/Zone
Z1PDI-009	Z1-PDI-SO-009-0406	705503.0385	1180574.417	4 to 6 ft	PAHs(11), SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC (9) To bound COC/Zone
Z1PDI-009	Z1PDI-SO-009-0809	705503.0385	1180574.417	8 to 9 ft	PAHs(11)	1	(1)(2)(3)(4)	(6) To address PMC (9) To bound COC/Zone
Z1PDI-009 Total =						**3**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z1PDI-010	Z1-PDI-SO-010-0002	705473.5124	1180430.195	0.25 to 2 ft	PAHs(11)	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas (9) To bound COC/Zone
Z1PDI-010	Z1PDI-SO-010-0405	705473.5124	1180430.195	4 to 4.75 ft	PAHs(11)	1	(1)(2)(3)(4)	(6) To address PMC (9) To bound COC/Zone
Z1PDI-010 Total =						**2**		
Z1PDI-011	Z1-PDI-SO-011-0002	705201.394	1180500.87	1 to 2 ft	PAHs(11)	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z1PDI-011	Z1PDI-SO-011-0405	705201.394	1180500.87	4 to 5 ft	PAHs(11)	1	(1)(2)(3)(4)	(6) To address PMC
Z1PDI-011 Total =						**2**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z1PDI-012	Z1-PDI-SO-012-0002	705295.104	1180446.318	1.5 to 2 ft	PAH[11]	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z1PDI-012	Z1-PDI-SO-012-0204	705295.104	1180446.318	2 to 4 ft	PAHs[11]	1	(1)(2)(3)(4)	(6) To address PMC
Z1PDI-012 Total =						**2**		
Z1PDI-013	Z1-PDI-SO-013-0002	705417.4102	1180723.03	0 to 2 ft	ETPH	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas
Z1PDI-013	Z1-PDI-SO-013-0204	705417.4102	1180723.03	2 to 4 ft	ETPH	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas
Z1PDI- 013 Total =						**2**		
Z1PDI-014	Z1-PDI-SO-014-0002	705253.6138	1180644.51	0 to 2 ft	ETPH	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (6) To address PMC
Z1PDI-014	Z1-PDI-SO-014-0204	705253.6138	1180644.51	2 to 4 ft	ETPH	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (6) To address PMC

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z1PDI-014	Z1PDI-SO-014-0608	705253.6138	1180644.51	6 to 8 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC (7) To quantify LNAPL
Z1PDI-014	Z1PDI-SO-014-0810	705253.6138	1180644.51	8 to 9.5 ft	ETPH	1	(1)(2)(3)(4)	(7) To quantify LNAPL
Z1PDI-014 Total =						**4**		
Zone 1 Total =						**40**		
Z2PDI-001	Z2PDI-SO-001-0002	704970.8576	1180676.849	0 to 2 ft	ETPH PAHs SPLP Lead Lead SPLP Antimony Antimony	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (6) To address PMC
Z2PDI-001	Z2PDI-SO-001-0204	704970.8576	1180676.849	2 to 4 ft	ETPH	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (6) To address PMC

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z2PDI-001	Z2PDI-SO-001-0506	704970.8576	1180676.849	5 to 6.5ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC
Z2PDI-001 Total =						**3**		
Z2PDI-002 (near 13MW11)	Z2-PDI-SO-002-0204	704689.6619	1180751.91	2 to 4 ft	SPLP Lead	1	(1)(2)(3)(4)	(14) To address PMC lead issue
Z2PDI-002 Total =						**1**		
Zone 2 Total						**4**		
Z3PDI-001	Z3-PDI-SO-001-0002	704619.7072	1180767.746	1 to 2 ft	Lead, SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z3PDI-001	Z3-PDI-SO-001-0204	704619.7072	1180767.746	2 to 4 ft	SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC
Z3PDI-001 Total =						**2**		
Z3PDI-002	Z3-PDI-SO-002-0002	704597.7132	1180780.272	0.75 to 2 ft	Lead, SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z3PDI-002	Z3-PDI-SO-002-0406	704597.7132	1180780.272	4 to 5.5 ft	SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC
Z3PDI-002 Total =						**2**		
Z3PDI-003	Z3-PDI-SO-003-0002	704521.9733	1180810.613	1 to 2 ft	Lead, SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z3PDI-003	Z3-PDI-SO-003-0204	704521.9733	1180810.613	2 to 4 ft	SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC
Z3PDI-003 Total =						**2**		
Z3PDI-004 Total =						**0**		
Z3PDI-005	Z3-PDI-SO-005-0002	704484.8401	1180831.054	0 to 2 ft	Lead, SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z3PDI-005 Total =						**1**		
Zone 3 Total =						**7**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z4PDI-001	Z4PDI-SO-001-0002	704391.0416	1180978.435	0.25 to 2 ft	ETPH, Lead SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC
Z4PDI-001	Z4PDI-SO-001-0405	704391.0416	1180978.435	4 to 5.5 ft	ETPH, Lead SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC
Z4PDI-001 Total =						**2**		
Z4PDI-002	Z4PDI-SO-002-0002	704324.1046	1181141.116	0.25 to 2 ft	ETPH	1	(1)(2)(3)(4)	(5) Surface sample to address I/C DEC in unpaved areas (6) To address PMC
Z4PDI-002	Z4PDI-SO-002-0204	704324.1046	1181141.116	2 to 4 ft	ETPH	1	(1)(2)(3)(4)	(5) Surface sample to address I/C DEC in unpaved areas (6) To address PMC
Z4PDI-002	Z4PDI-SO-002-0405	704324.1046	1181141.116	4 to 5 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC
Z4PDI-002 Total =						**3**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z4PDI-003	Z4-PDI-SO-003-0002	704262.1967	1180971.581	0.25 to 2 ft	Lead, Chromium species	1	(1)(2)(3)(4)	(8) To address surface soil I/C DEC in paved areas (PAH) (10) To address residential DEC (lead) (15) To address chromium speciation
Z4PDI-003 Total =						**1**		
Z4PDI-004	Z4-PDI-SO-004-0002	704129.8982	1181091.068	1 to 2 ft	PAHs(11)	1	(1)(2)(3)(4)	(8) To address surface soil I/C DEC in paved areas (9) To bound COC/Zone
Z4PDI-004 Total =						**1**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z4PDI-005	Z4-PDI-SO-005-0002	704086.9796	1180999.588	0.5 to 2 ft	PAHs(11)	1	(1)(2)(3)(4)	(8) To address surface soil I/C DEC in paved areas (9) To bound COC/Zone
Z4PDI-005 Total =						**1**		
Z4PDI-006	Z4-PDI-SO-006-0002	704338.9112	1181029.587	0.25 to 2 ft	Lead, SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z4PDI-006	Z4-PDI-SO-006-0406	704338.9112	1181029.587	4 to 6 ft	SPLP Lead Chromium species	1	(1)(2)(3)(4)	(6) To address PMC (15) To address chromium speciation
Z4PDI-006 Total =						**2**		
Z4PDI-007	Z4-PDI-SO-007-0002	704440.6363	1180994.871	0.5 to 2 ft	Lead, SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z4PDI-007	Z4-PDI-SO-007-0204	704440.6363	1180994.871	2 to 4 ft	SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC
Z4PDI-007 Total =						**2**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z4PDI-008	Z4-PDI-SO-008-0002	704398.8628	1180874.704	1 to 2 f	Lead, SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z4PDI-008	Z4-PDI-SO-008-0204	704398.8628	1180874.704	2 to 4 ft	SPLP Lead Chromium species	1	(1)(2)(3)(4)	(6) To address PMC (15) To address chromium speciation
Z4PDI-008 Total =						**2**		
Z4PDI-009	Z4-PDI-SO-009-0002	704234.2575	1180983.291	0.5 to 2 ft	PAHs[11]	1	(1)(2)(3)(4)	(8) To address surface soil I/C DEC in paved areas
Z4PDI-009 Total =						**1**		
Zone 4 Total =						**15**		
Z5PDI-001	Z5PDI-SO-001-0002	708321.8179	1180193.426	0 to 2 ft	ETPH	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (6) To address PMC

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z5PDI-001	Z5PDI-SO-001-0204	708321.8179	1180193.426	2 to 4 ft	ETPH	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (6) To address PMC
Z5PDI-001 Total =						**2**		
Z5PDI-002	Z5PDI-SO-002-0002	708365.4742	1180162.408	0.75 to 2 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z5PDI-002	Z5PDI-SO-002-0204	708365.4742	1180162.408	2 to 4 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC
Z5PDI-002 Total =						**2**		
Z5PDI-003	Z5PDI-SO-003-0002	708325.9225	1180164.399	0.5 to 2 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z5PDI-003	Z5PDI-SO-003-0204	708325.9225	1180164.399	2 to 4 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC
Z5PDI-003 Total =						**2**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z5PDI-004	Z5PDI-SO-004-0002	708337.2796	1180135.803	0.5 to 2 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z5PDI-004	Z1PDI-SO-004-0204	708337.2796	1180135.803	2 to 4 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC
Z5PDI-004 Total =						**2**		
Z5PDI-005	Z5PDI-SO-005-0002	708571.52	1180188.929	0 to 2 ft	ETPH	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (6) To address PMC
Z5PDI-005	Z5PDI-SO-005-0204	708571.52	1180188.929	2 to 4 ft	ETPH	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (6) To address PMC
Z5PDI-005 Total =						**2**		
Zone 5 Total =						**10**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z6PDI-001	Z6PDI-SO-001-0002	707843.4903	1180167.357	1 to 2 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z6PDI-001	Z6PDI-SO-001-0405	707843.4903	1180167.357	4 to 5.5 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC
Z6PDI-001 Total =						**2**		
Z6PDI-002	Z6PDI-SO-002-0002	707763.9039	1180167.43	1.25 to 2 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z6PDI-002	Z6PDI-SO-002-0405	707763.9039	1180167.43	4 to 5.5 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC
Z6PDI-002 Total =						**2**		
Z6PDI-003	Z6PDI-SO-003-0002	707800.1842	1180149.539	1 to 2 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z6PDI-003	Z6PDI-SO-003-0304	707800.1842	1180149.539	3 to 4 ft	ETPH	1	(1)(2)(3)(4)	(6) To address PMC
Z6PDI-003 Total =						**2**		
Z6PDI-004	Z6PDI-SO-004-0002	707802.5871	1180219.792	0 to 2 ft	ETPH	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (6) To address PMC
Z6PDI-004	Z6PDI-SO-004-0204	707802.5871	1180219.792	2 to 4 ft	ETPH	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (6) To address PMC
Z6PDI-004 Total = =						**2**		
Zone 6 Total =						**8**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z7PDI-001	Z7PDI-SO-001-0002	706668.8306	1180356.396	0.25 to 2 ft	Lead, SPLP Lead, Antimony, SPLP Antimony, PAHs [(11)], Chromium species	1	(1)(2)(3)(4)	6) To address PMC (8) To address surface soil I/C DEC in paved areas (15) To address chromium speciation
Z7PDI-001	Z7PDI-SO-001-0204	706668.8306	1180356.396	2 to 4 ft	Lead, SPLP Lead, Antimony, SPLP Antimony	1	(1)(2)(3)(4)	(6) To address PMC (13) To address residential DEC (lead)
Z7PDI-001	Z7PDI-SO-001-0607	706668.8306	1180356.396	6 to 7 ft	Lead, SPLP Lead, Antimony, SPLP Antimony	1	(1)(2)(3)(4)	(6) To address PMC (13) To address residential DEC (lead)
Z7PDI-001 Total =						**3**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z7PDI-002	Z7PDI-SO-002-0002	706555.705	1180404.057	0.5 to 2 ft	Lead, SPLP Lead, Antimony, SPLP Antimony, PAHs (11)	1	(1)(2)(3)(4)	6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z7PDI-002	Z7PDI-SO-002-0607	706555.705	1180404.057	6 to 6.5 ft	Lead, SPLP Lead, Antimony, SPLP Antimony, PAHs (11)	1	(1)(2)(3)(4)	(6) To address PMC (13) To address residential DEC (lead)
Z7PDI-002 Total = =						**2**		
Z7PDI-003 (Near MW5-7RI)	Z7PDI-SO-003-0002	706358.9462	1180442.326	0.5 to 2 ft	Lead, PAHs (11)	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas (13) High previous mass lead at depth
Z7PDI-003 (Near MW5-7RI)	Z7PDI-SO-003-0204	706358.9462	1180442.326	2 to 4 ft	SPLP Antimony , Chromium species	1	(1)(2)(3)(4)	(6) To address PMC (15) To address chromium speciation

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z7PDI-003 (Near MW5-7RI)	Z7PDI-SO-003-0506	706358.9462	1180442.326	5 to 6 ft	SPLP Antimony	1	(1)(2)(3)(4)	(6) To address PMC
Z7PDI-003 Total =						**3**		
Z7PDI-004 (Near 20MW6)	Z7PDI-SO-004-0002	706617.1105	1180348.974	0.25 to 2 ft	Lead, SPLP Lead, Antimony, SPLP Antimony, PAHs (11)	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas (13) To address surface soil above previous high data
Z7PDI-004 (Near 20MW6)	Z7PDI-SO-004-0304	706617.1105	1180348.974	3 to 4 ft	SPLP Lead, Antimony, SPLP Antimony	1	(1)(2)(3)(4)	(6) To address PMC
Z7PDI-004 (Near 20MW6)	Z7PDI-SO-004-0406	706617.1105	1180348.974	4 to 6 ft	SPLP Lead, Antimony SPLP, Antimony, PAHs (11)	1	(1)(2)(3)(4)	6) To address PMC
Z7PDI-004 Total =						**3**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z7PDI-005 (Near 20TB7)	Z7PDI-SO-005-0002	706597.1127	1180479.468	0 to 2 ft	Lead, PAHs (11), Chromium species	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (15) To address chromium speciation
Z7PDI-005 (Near 20TB7)	Z7PDI-SO-005-0204	706597.1127	1180479.468	2 to 3.5 ft	Lead, PAHs (11), Chromium species	1	(1)(2)(3)(4)	(5) To address surface soil I/C DEC in unpaved areas (15) To address chromium speciation
Z7PDI-005 Total =						**2**		
Z7PDI-006	Z7PDI-SO-006-0002	706747.8449	1180420.9	0.25 to 2 ft	Lead	1	(1)(2)(3)(4)	(12) To address residential DEC (lead)
Z7PDI-006 Total =						**1**		
Z7PDI-007	Z7PDI-SO-007-0002	706470.0641	1180439.012	0.5 to 2 ft	Lead, SPLP Lead, Antimony, SPLP Antimony, PAHs (11)	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z7PDI-007	Z7PDI-SO-007-0506	706470.0641	1180439.012	5 to 6 ft	Lead, SPLP Lead, Antimony, SPLP Antimony	1	(1)(2)(3)(4)	(6) To address PMC
Z7PDI-007 Total =						**2**		
Z7PDI-008	Z7PDI-SO-008-0002	706442.274	1180496.951	0 to 2 ft	Lead, PAHs (11)	1	(1)(2)(3)(4)	(9) To bound COC/Zone (10) To address residential DEC (lead)
Z7PDI-008	Z7PDI-SO-008-0507	706442.274	1180496.951	5 to 7 ft	Lead SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC (9) To bound COC/Zone (12) To address residential DEC (lead)
Z7PDI-008 Total =						**2**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z7PDI-009	Z7PDI-SO-009-0002	706545.3692	1180332.174	1 to 2 ft	Lead, Antimony, SPLP Antimony, PAHs (11)	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved area (12) To address residential DEC (lead)
Z7PDI-009	Z7PDI-SO-009-0607	706545.3692	1180332.174	6 to 6.5 ft	Lead, SPLP Lead, Antimony, SPLP Antimony, Chromium Species	1	(1)(2)(3)(4)	(6) To address PMC (12) To address residential DEC (lead) (15) To address chromium speciation
Z7PDI-009 Total =						**2**		
Z7PDI-010	Z7PDI-SO-010-0002	706332.8575	1180425.144	0.25 to 2 ft	Lead, Antimony, SPLP Antimony, PAHs (11)	1	(1)(2)(3)(4)	6) To address PMC (12) To address residential DEC (lead)

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z7PDI-010	Z7PDI-SO-010-0204	706332.8575	1180425.144	2 to 4 ft	SPLP Lead, Antimony, SPLP Antimony	1	(1)(2)(3)(4)	(6) To address PMC
Z7PDI-010 Total =						**2**		
Z7PDI-011	Z7PDI-SO-011-0002	706374.6019	1180508.872	0.75 to 2 ft	Lead, PAHs (11)	1	(1)(2)(3)(4)	(9) To bound COC/Zone
Z7PDI-011	Z7PDI-SO-011-0204	706374.6019	1180508.872	2 to 4 ft	SPLP Lead, PAHs (11)	1	(1)(2)(3)(4)	(6) To address PMC (9) To bound COC/Zone
Z7PDI-011 Total =						**2**		
Z7PDI-012	Z7PDI-SO-012-0002	706190.1505	1180409.889	0.25 to 2 ft	PAHs (11)	1	(1)(2)(3)(4)	(8) To address surface soil I/C DEC in paved areas
Z7PDI-012 Total =						**1**		
Z7PDI-013	Z7PDI-SO-013-0002	706239.9668	1180511.486	0.5 to 2 ft	PAHs (11)	1	(1)(2)(3)(4)	(13) To address surface soil above historic high data
Z7PDI-013	Z7PDI-SO-013-0406	706239.9668	1180511.486	4 to 6.5 ft	PAHs (11)	1	(1)(2)(3)(4)	(6) To address PMC
Z7PDI-013 Total =						**2**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z7PDI-014	Z7PDI-SO-014-0002	706365.0322	1180224.972	1 to 2 ft	PAHs (11)	1	(1)(2)(3)(4)	(13) To address surface soil above historic high data
Z7PDI-014	Z7PDI-SO-014-0204	706365.0322	1180224.972	2 to 4 ft	PAHs (11)	1	(1)(2)(3)(4)	(6) To address PMC
Z7PDI-014 Total =						**2**		
Z7PDI-015	Z7PDI-SO-015-0002	706322.7264	1180184.495	0.75 to 2 ft	PAHs (11), SPLP Lead	1	(1)(2)(3)(4)	(13) To address surface soil above historic high data (6) To address PMC
Z7PDI-015	Z7PDI-SO-015-0204	706322.7264	1180184.495	2 to 4.75 ft	PAHs (11), SPLP Lead	1	(1)(2)(3)(4)	(6) To address PMC
Z7PDI-015 Total =						**2**		
Z7PDI-016	Z7PDI-016-0002	706292.2595	1180219.311	0.75 to 2 ft	PAHs (11)	1	(1)(2)(3)(4)	(13) To address surface soil above historic high data
Z7PDI-016	Z7PDI-016-0204	706292.2595	1180219.311	2 to 4.25 ft	PAHs (11)	1	(1)(2)(3)(4)	(6) To address PMC
Z7PDI-016 Total =						**2**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z7PDI-017	Z7PDI-SO-017-0002	706416.6132	1180380.5	0.5 to 2 ft	Antimony, SPLP Antimony	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z7PDI-017	Z7PDI-SO-017-0406	706416.6132	1180380.5	4 to 6.5 ft	Antimony, SPLP Antimony Lead SPLP Lead Chromium species	1	(1)(2)(3)(4)	(6) To address PMC ((15) To address chromium speciation
Z7PDI-017 Total =						**2**		
Z7PDI-018	Z7PDI-SO-018-0002	706269.2991	1180213.742	1 to 2 ft	PAHs (11)	1	(1)(2)(3)(4)	(8) To address surface soil I/C DEC in paved areas
Z7PDI-018 Total =						**1**		
Z7PDI-019	Z7PDI-SO-019-0002	706136.4897	1180223.846	0.5 to 2 ft	PAHs (11)	1	(1)(2)(3)(4)	(8) To address surface soil I/C DEC in paved areas
Z7PDI-019 Total =						**1**		

TABLE 2-2

SOIL SAMPLE LOCATIONS, DEPTHS, AND ANALYSES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Sampling Location/ ID Number	Sample ID	Northing (NAD83)	Easting (NAD83)	Sample Depth Interval	Analytical Group	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
Z7PDI-020	Z7PDI-SO-020-0002	706295.0187	1180534.298	0.25 to 2 ft	PAHs (11)	1	(1)(2)(3)(4)	(6) To address PMC (8) To address surface soil I/C DEC in paved areas
Z7PDI-020	Z7PDI-SO-020-0406	706295.0187	1180534.298	4 to 6.5 ft	PAHs (11), Chromium Species	1	(1)(2)(3)(4)	(6) To address PMC (15) To address chromium speciation
Z7PDI-020 Total =						**2**		
Zone 7 Total =						**39**		
Total for All Zones =						**123**		

1 Tetra Tech Standard Operating Procedure (SOP) for Sample Nomenclature (CT-04).
2 Tetra Tech SOP for Data Base Records and Quality Assurance (CT-05).
3 Tetra Tech SOP for Soil Sampling (SA-1.3) and Direct Push Technology (SA-2.5).
4 Tetra Tech SOP for Field Documentation (SA-6.3).
5 Sampling location and depth chosen to quantify the volume of contaminated surface soil in unpaved areas. Industrial/Commercial Direct Exposure Criteria apply from 0 to 4 feet below ground surface beneath unpaved areas.
6 Sampling location and depth chosen to quantify the volume of soil with concentrations greater than Pollutant Mobility Criteria.
7 Sampling location and depth chosen to quantify the volume of light non-aqueous phase liquid (LNAPL).
8 Sampling location and depth chosen to quantify the volume of contaminated surface soil in paved areas. Industrial/Commercial Direct Exposure Criteria apply from 0 to 2 feet below ground surface beneath paved areas.
9 Sampling location and depth chosen to bound a chemical of concern (COC) or zone.
10 Sampling location and depth chosen to quantify the volume of soil remaining with concentrations greater than the residential lead criterion.

11 PAHs include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, carbazole, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene.
12 Sampling location and depth chosen to quantify the volume of contaminated soil with concentrations greater than the residential lead criterion.
13 Sample located above previous sample with high contaminant concentration. No previous surface sampling at this location.
14 Near previous sample with mass lead concentration less than Direct Exposure Criterion, but toxicity characteristic leaching procedure (TCLP) lead greater than Pollutant Mobility Criteria.
15 Sampling location and depth chosen for chromium speciation (total, trivalent, and hexavalent chromium analyses) based on 10 previous highest total chromium concentrations in Zones 4 and 7.

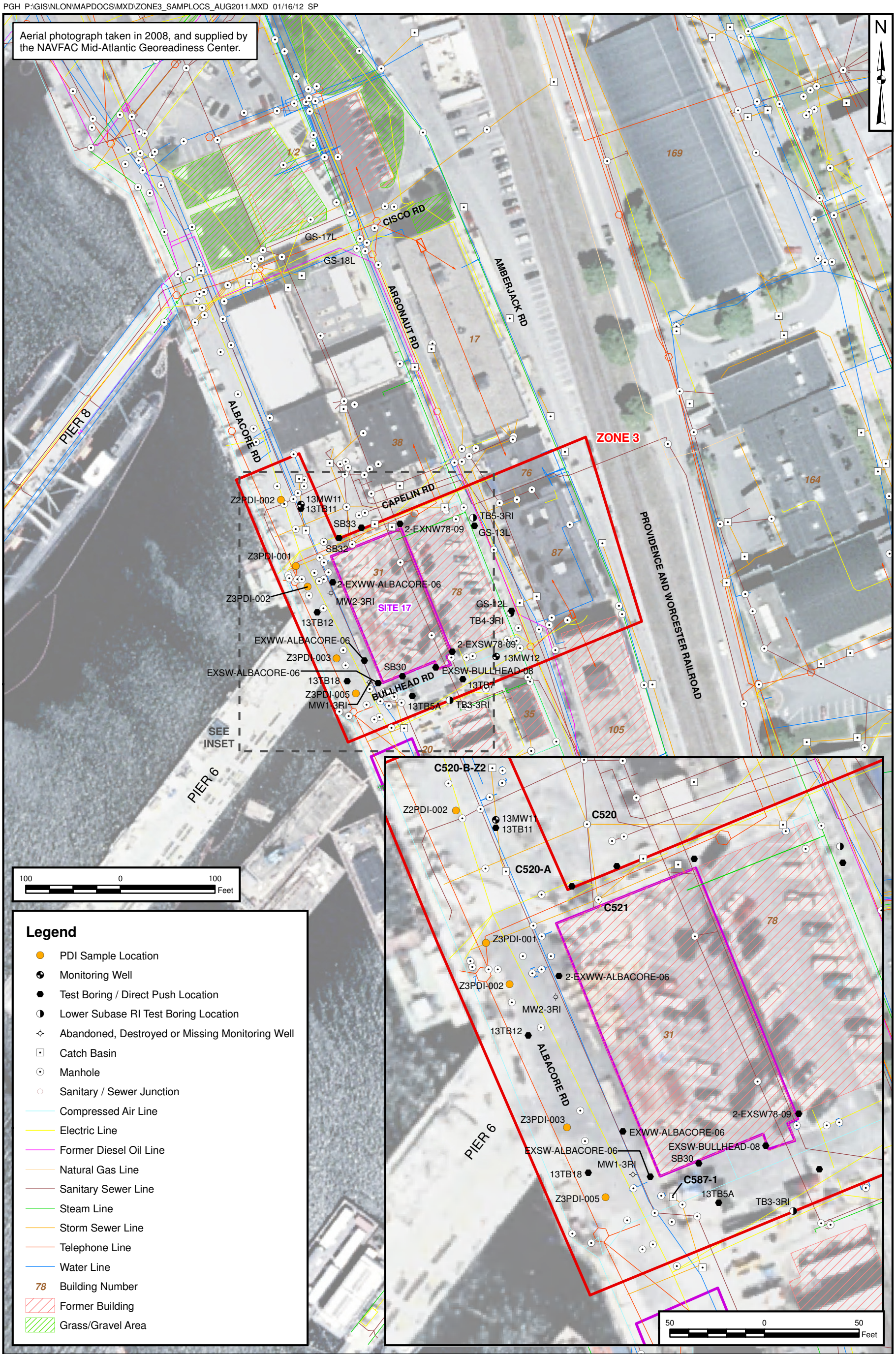
PGH P:\GIS\NLON\MAPDOCS\MXD\ZONE1_SAMPLOCS_AUG2011.MXD 12/9/11 KM

DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	08/10/11		3271	WE57
CHECKED BY	DATE	ZONE 1	APPROVED BY	DATE
N. BASALMO	12/9/11	SOIL SAMPLE LOCATION MAP	CAR	08/11/11
REVISED BY	DATE	LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM	APPROVED BY	DATE
___	___	NSB-NLON, GROTON, CONNECTICUT	___	___
SCALE			FIGURE NO.	REV
AS NOTED			FIGURE 2-1	0

PGH P:\GIS\NLON\MAPDOCS\MXD\ZONE2_SAMPLOCS_AUG2011.MXD 01/12/12 SP

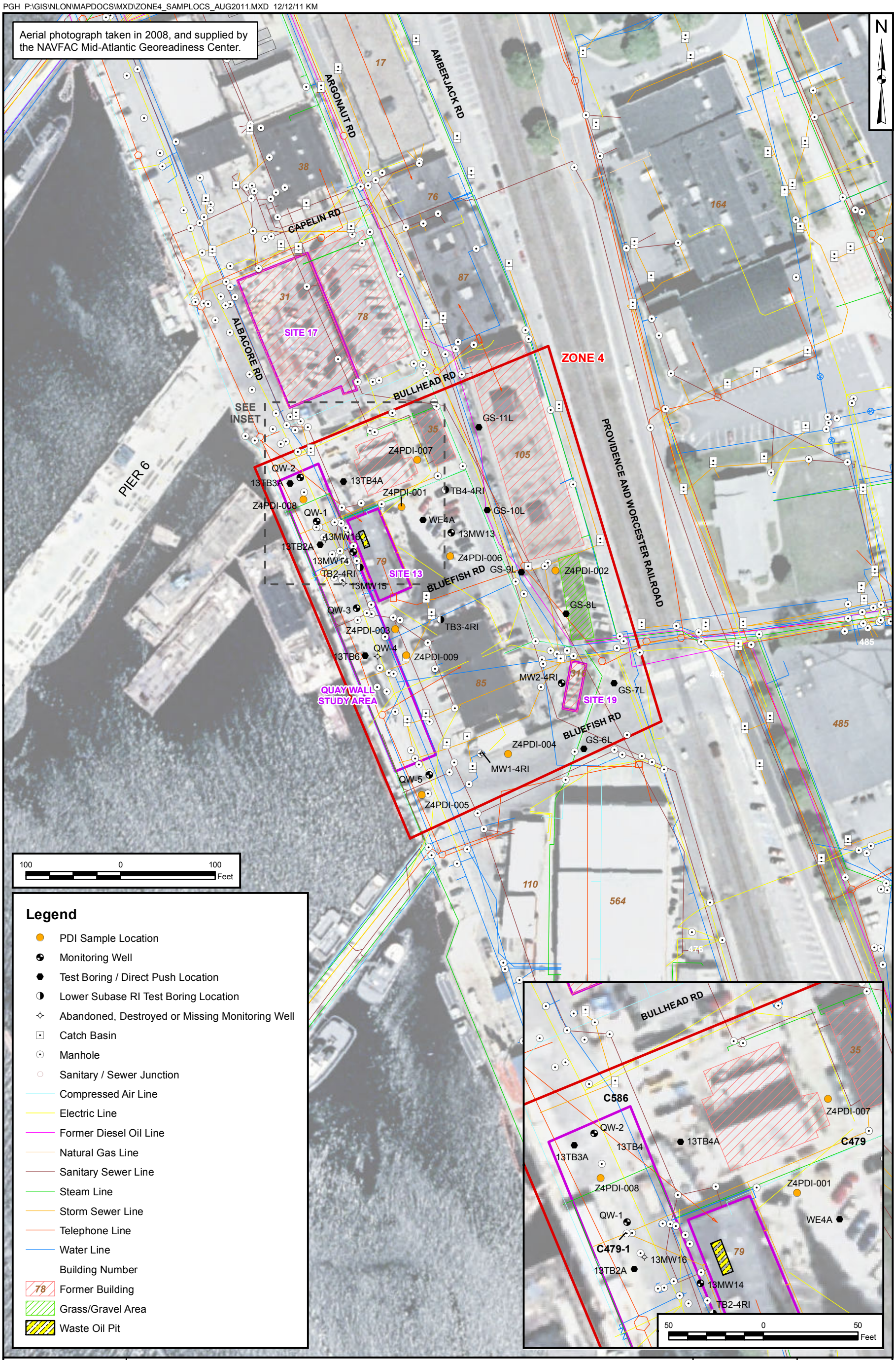
DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	08/10/11		3271	WE57
CHECKED BY	DATE	ZONE 2	APPROVED BY	DATE
N. BALSAMO	01/12/12	SOIL SAMPLE LOCATION MAP	CAR	08/11/11
REVISED BY	DATE	LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM	APPROVED BY	DATE
S. PAXTON	01/12/12	NSB-NLON, GROTON, CONNECTICUT	—	—
SCALE			FIGURE NO.	REV
AS NOTED			FIGURE 2-2	0

PGH P:\GIS\NLON\MAPDOCS\MXD\ZONE3_SAMPLOCS_AUG2011.MXD 01/16/12 SP



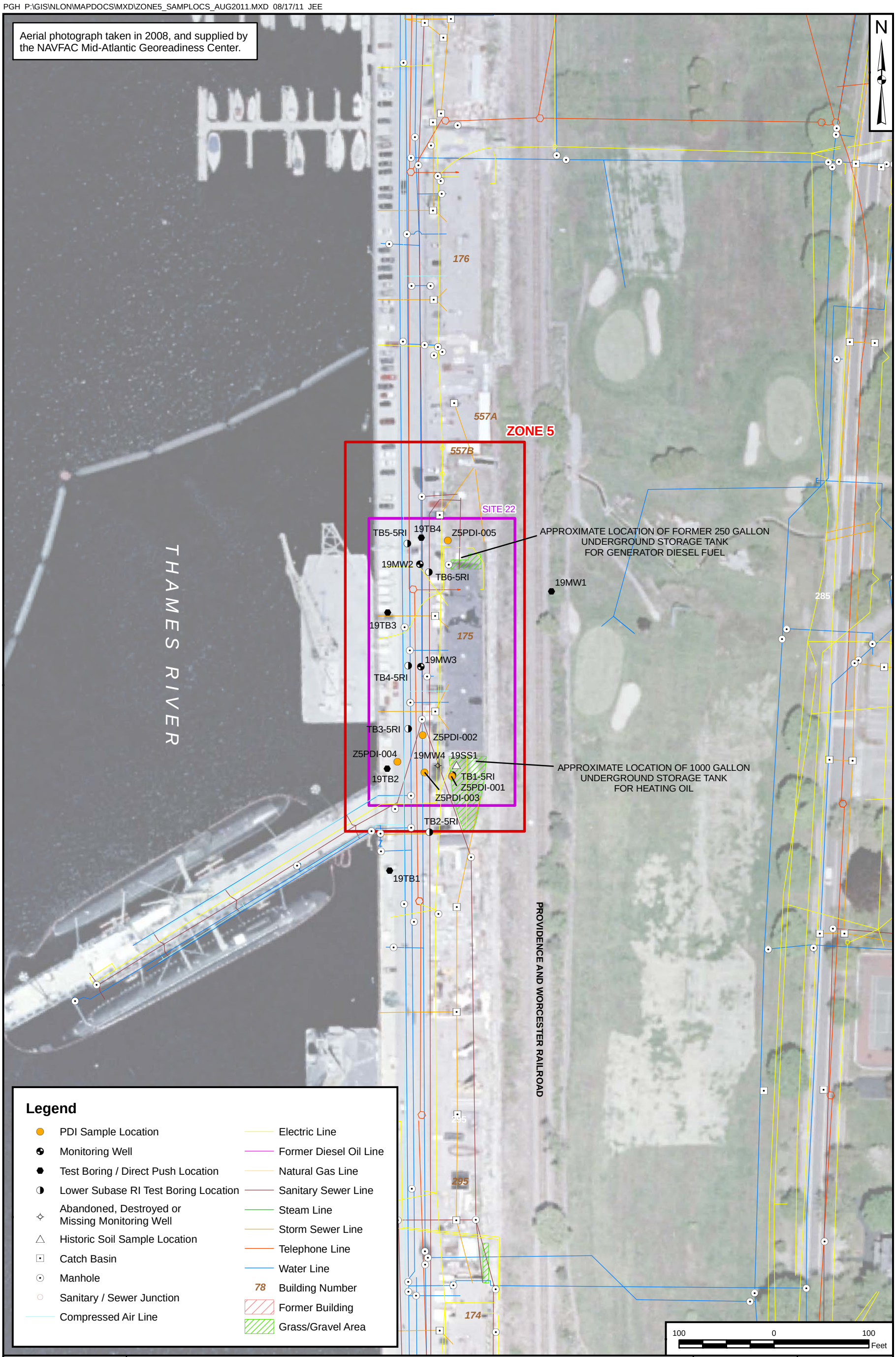
DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	08/10/11		3271	WE57
CHECKED BY	DATE	ZONE 3	APPROVED BY	DATE
N. BALSAMO	01/16/12	SOIL SAMPLE LOCATION MAP	CAR	08/11/11
REVISED BY	DATE	LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM	APPROVED BY	DATE
S. PAXTON	01/16/12	NSB-NLON, GROTON, CONNECTICUT	—	—
SCALE			FIGURE NO.	REV
AS NOTED			FIGURE 2-3	0

PGH P:\GIS\NLON\MAPDOCS\MXD\ZONE4_SAMPLOCS_AUG2011.MXD 12/12/11 KM



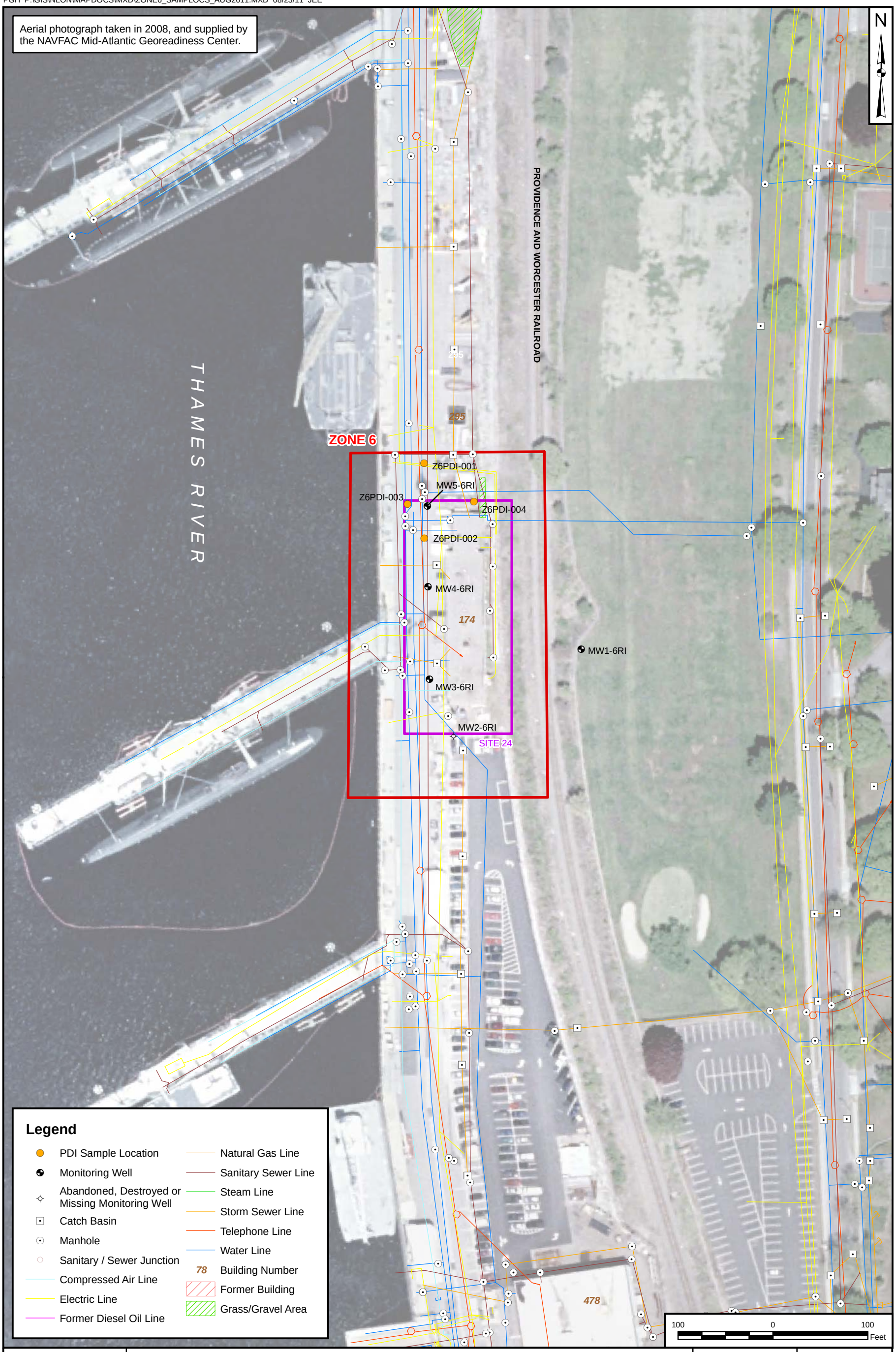
DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	08/10/11		3271	WE57
CHECKED BY	DATE	ZONE 4	APPROVED BY	DATE
N. BALSAMO	12/12/11	SOIL SAMPLE LOCATION MAP	CAR	08/11/11
REVISED BY	DATE	LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM	APPROVED BY	DATE
—	—	NSB-NLON, GROTON, CONNECTICUT	—	—
SCALE			FIGURE NO.	REV
AS NOTED			FIGURE 2-4	0

PGH P:\GIS\NLON\MAPDOCS\MXD\ZONE5_SAMPLOCS_AUG2011.MXD 08/17/11 JEE



DRAWN BY J. ENGLISH	DATE 08/10/11	TETRA TECH	CONTRACT NUMBER 3271 / CTO NUMBER WE57
CHECKED BY N. BALSAMO	DATE 08/17/11	ZONE 5 SOIL SAMPLE LOCATION MAP LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR / DATE 08/11/11
REVISED BY —	DATE —		APPROVED BY — / DATE —
SCALE AS NOTED			FIGURE NO. FIGURE 2-5 / REV 0

PGH P:\GIS\NLON\MAPDOCS\MXD\ZONE6_SAMPLOCS_AUG2011.MXD 08/23/11 JEE



DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	08/10/11		3271	WE57
CHECKED BY	DATE	ZONE 6	APPROVED BY	DATE
N. BALSAMO	08/23/11	SOIL SAMPLE LOCATION MAP	CAR	08/10/11
REVISED BY	DATE	LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM	APPROVED BY	DATE
—	—	NSB-NLON, GROTON, CONNECTICUT	—	—
SCALE			FIGURE NO.	REV
AS NOTED			FIGURE 2-6	0

PGH P:\GIS\NLON\MAPDOCS\MXD\ZONE7_SAMPLOCS_AUG2011.MXD 08/17/11 JEE

DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	08/10/11		3271	WE57
CHECKED BY	DATE	ZONE 7	APPROVED BY	DATE
N. BALSAMO	08/17/11	SOIL SAMPLE LOCATION MAP	CAR	08/11/11
REVISED BY	DATE	LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM	APPROVED BY	DATE
—	—		—	—
SCALE		NSB-NLON, GROTON, CONNECTICUT	FIGURE NO.	REV
AS NOTED			FIGURE 2-7	0

3.0 GROUNDWATER PDI FIELD ACTIVITIES

Field activities completed during the Lower Subase Groundwater PDI included the following:

- Mobilization/demobilization
- Utility clearance
- Monitoring well abandonment
- Monitoring well installation
- Monitoring well development
- Water-level measurements
- Groundwater purging
- Groundwater sampling
- Sample handling and shipping
- Equipment decontamination
- Surveying
- IDW management

Two rounds of field activities were conducted to complete the scope of work included in the Lower Subase Groundwater PDI SAP (Tetra Tech, 2010a). The first round was completed in April 2010 and the second in August 2010. All work was completed in accordance with the Groundwater PDI SAP and Health and Safety Plan (Tetra Tech, 2009). Figures 3-1 through 3-4 show the locations of the wells where water levels and/or groundwater samples were collected in Zones 1, 4, 5, and 7, respectively, during the Groundwater PDI. Not all field activities listed above were completed during each round. Detailed descriptions of the tasks performed during each round are provided below. The SOPs and field documents referenced below were included in the Groundwater PDI SAP.

3.1 ROUND 1

3.1.1 Mobilization/Demobilization

A brief field team orientation meeting was conducted in Tetra Tech's Pittsburgh, Pennsylvania, office prior to the start of fieldwork to familiarize personnel with the site's health and safety requirements, objectives and scope of the field activities, and chain of command. The meeting was attended by the Field Operations Leader (FOL)/Site Safety Officer (SSO), Project Manager (PM), and project chemist.

Tetra Tech's FOL/SSO mobilized to NSB-NLON on April 19, 2010, and the field technician mobilized on April 20, 2010, to complete Round 1 of the Groundwater PDI. The FOL acquired necessary field supplies

and sample bottleware and met with the New London PWD Environmental Restoration Program Manager (ERPM) and Facilities Engineering and Acquisition Department (FEAD) field inspector on April 19, 2010. The FOL also met with the New London Hazardous Waste Program Manager to set up a staging area for equipment, supplies, and IDW. The FOL and field technician also received Radiation Control (RADCON) training, cleared drilling locations, and reviewed final dig permits and drilling locations.

Tetra Tech conducted 1-hour health and safety meetings with its subcontractors (two utility clearance subcontractors, driller, surveyor, and waste disposal subcontractor) prior to initiating on-site activities. Tetra Tech also coordinated acquisition of subcontractor passes, security and access issues, and daily activities with the ERPM and FEAD field inspector.

Demobilization for Round 1 was conducted on April 30, 2010. Efforts included performing general site cleanup, confirming that all subcontractor activities were complete, shipping field equipment and supplies, organizing and finalizing field paperwork, and transporting field personnel back to Pittsburgh, Pennsylvania.

3.1.2 Utility Clearance

On April 20, 2010, the Tetra Tech FOL completed One Call for the well drilling work. The FOL also met with the utility clearance subcontractor (ACCUMARK) and facilitated their receipt of RADCON training. The FOL obtained Navy dig permits and ACCUMARK located and marked utilities at the four proposed well locations (MW1-1PDI, MW1-4PDI, MW1-5PDI, and MW1-7PDI). Representatives from NSB-NLON Public Works field verified the marked utilities and cleared the drilling locations.

Because a force-main sewer was encountered during drilling of the initial boring for well MW1-5PDI, the ERPM and FEAD field inspector decided on April 23, 2010, that the remaining well locations should be re-cleared for utilities using GPR. This modification to the final Groundwater PDI SAP (Tetra Tech, 2010a) required Tetra Tech to procure a new subcontractor. Procurement was completed, and on April 27, 2010, the new utility clearance contractor (Hager-Richter) mobilized to the site. The Tetra Tech FOL facilitated site access issues for them. Hager-Richter completed utility clearance at the proposed locations for MW1-1PDI, MW1-4PDI, and MW1-7PDI using a combination of geophysical methods including GPR and precision utility location equipment. GPR was used to detect and identify both metallic and non-metallic objects. The precision utility location equipment was used to locate subsurface utilities by searching for signals from active electric lines and by tracing utilities from direct connections to surface features such as valves and conduits. The effort included clearing a 20-foot by 20-foot area centered on each proposed boring location. Utility anomalies were found at the original location proposed for MW1-7PDI, and it was subsequently moved northwest of the original location. Minor utility anomalies were found at the

MW1-1PDI and MW1-4PDI locations, but the locations were able to be cleared with only minor changes to the proposed locations.

3.1.3 Monitoring Well Abandonment

Monitoring well 13MW7 was located in Zone 1 along the western side of Building 29 and was scheduled for abandonment because a 2007 well survey showed that the well was damaged beyond repair. During Round 1 of the Groundwater PDI, well 13MW7 could not be located using available coordinates; however, there were three distinct circular cuts in the pavement in the vicinity of the well that were backfilled with concrete. It is likely that the well was impacted by these activities; however, the actual abandonment status of well 13MW7 is unknown (Figure 5-9).

Monitoring well 19MW4 was located in Zone 5 near the southwestern corner of Building 175. This well was also scheduled for abandonment because the 2007 well survey showed that the well was damaged beyond repair. Based on informal interviews during Round 1 with Navy personnel working in Building 175, the area was recently paved and the well was most likely covered. Several attempts were made to locate the well using the Zone 5 sample location map provided in the final Groundwater PDI SAP (Tetra Tech, 2010a) and moving materials stored in the immediate vicinity. In addition, per Tetra Tech's direction, their drilling subcontractor (Drilex) cut through the pavement at a few locations in an attempt to find the well, but no well was located. The pavement cuts were subsequently repaired. The abandonment status of well 19MW4 is also unknown (Figure 5-13).

3.1.4 Monitoring Well Installation

On April 21, 2010, the FOL facilitated site access issues with the drilling subcontractor (Drilex) and coordinated Navy RADCON training. After training, Tetra Tech performed oversight of the drilling of the boring for monitoring well MWI-5PDI by Drilex using a CME-55 hollow-stem auger drill rig. Split-spoon samples were collected during drilling to document lithology. During drilling, an obstruction was encountered at 4.25 to 4.35 feet bgs, and the hole filled with water. Based on discussions with NSB-NLON PWD, the obstruction was thought to be an abandoned utility line and a concrete patch would be sufficient to address it. Per direction from NSB-NLON PWD, Tetra Tech's drilling subcontractor applied a concrete patch to the bottom of the borehole, backfilled the borehole with bentonite-concrete slurry, and applied an asphalt patch to the top. The location of MW1-5PDI was moved approximately 3 feet to the west, a new boring was completed, and a 2-inch inside diameter (ID) Schedule 40 polyvinyl chloride (PVC) well was installed to the same general specifications as the well it replaced, 19MW4 per the Groundwater PDI SAP.

On April 22, 2010, the drillers reported that the plug in the initial borehole for MW1-5PDI was unsuccessful and that water was pooling on the ground surface. After further discussions with NSB-NLON PWD and review of additional utility drawings, it was determined that a force-main sanitary sewer line was damaged and leaking. The leak was handled as a spill, with the water pumped and discharged to an adjacent sanitary sewer manhole. Per direction received from New London PWD Environmental Department personnel, Tetra Tech applied a bleach solution with a hand sprayer to sanitary water at the spill area to mitigate any potential bacterial issues. A New London PWD contactor arrived on-site, repaired the broken sanitary sewer line, and backfilled the excavated area. The New London PWD Engineering Manager and Engineering Technician stated that the design drawings were incorrect and that the sanitary line should have been 18 feet west of the location where the line was encountered; therefore, Tetra Tech was not at fault for the incident. The Sanitary Sewer Incident Report is provided in Appendix B.1.1.

After additional utility clearance activities were performed, Drilex installed wells MW1-1PDI, MW1-4PDI, and MW1-7PDI on April 28, 2010, under the supervision of Tetra Tech. Three 2-inch ID Schedule 40 PVC wells were installed at each location to the same general specifications of the wells being replaced (i.e., 13MW7 (Figure 5-9), 13MW15 (Figure 5-12), and 20MW7 (Figure 5-15), respectively). Boring logs and monitoring well construction diagrams for the newly installed wells are included in Appendices B.1.2 and B.1.3, respectively.

Because the new monitoring wells are located in areas that may be tidally influenced, consideration was given to the predicted tide heights and tidal range (daily, average, and seasonal fluctuations) during drilling and installation activities to gauge the productivities of the new wells. The well screens were set so that the average tidal elevation range was within the screened interval, and the high tide level did not rise above the top of the screened interval. Field personnel checked daily tidal conditions to estimate monitoring well productivity at low tide. Based on previous water-level data, MW1-5PDI was not expected to be tidally influenced, and MW1-1PDI, MW1-4PDI, and MW1-7PDI were expected to be tidally influenced.

All wells were installed in general accordance with Tetra Tech SOP GH-2.8 and applicable Connecticut regulations. Wells were installed through a hollow-stem auger (4.25-inch ID and 9-inch outer diameter) that allowed for a minimum 2-inch-thick sand pack in the annular space between all sides of each new well and the sidewalls of the borehole. Monitoring wells were constructed of 2-inch ID, flush-threaded, PVC well screen and riser pipe. The well screens had a slot size of 0.010-inch and were 5 to 10 feet in length. A filter pack consisting of clean silica sand was installed flush to slightly deeper than the bottom of the well to varying distances (0.25 to 2 feet) above the top of the well screen depending on the available clearance. The sand used in the filter packs for wells MW1-1PDI, MW1-4PDI, and MW1-7PDI

was No. 1 silica sand, and the sand used in the filter pack for well MW1-5PDI was No. 4 global silica sand. The sizes of both sands were the same; they were from different manufacturers. A seal of sodium bentonite pellets was installed above the filter pack and hydrated with potable water, and bentonite pellets were also used to backfill the annular space from the seal to the top of the riser pipe. A concrete pad (minimum of 6 inches thick and approximately 3 feet by 3 feet square) and 8-inch protective steel road box equipped with a locking cap were installed above the bentonite seal and around the casing at each well. The top of the riser pipe was placed from 5 to 7 inches bgs, depending on the well, and the annular space between the existing ground surface and protective casing was filled with concrete. J-plugs were installed in the tops of the riser pipes, and the wells were secured by bolting on the lids to the road boxes. Keyed-alike locks were not available and were not installed.

3.1.5 Monitoring Well Development

The four new monitoring wells were developed and 11 existing monitoring wells were redeveloped prior to groundwater sampling to remove fine material and sediment from the sand packs. Well development records are provided in Appendix B.1.4. One well (NESO10) was developed on April 20, 2010, seven wells (FOMW14, NESO11, 13MW13, 13MW20, 13MW21, MW1-5PDI, and MW4-7PDI) were developed on April 21, 2010, four wells (13MW14, 13MW19, 19MW3, and MW3-7RI) were developed on April 22, 2010, and three wells (MW1-1PDI, MW1-4PDI, and MW1-7PDI) were developed on April 28, 2010.

The method used to develop all of the wells, with the exception of 13MW19, was surging and pumping with a 2-inch submersible pump. For well 13MW19, the riser pipe was slightly bent, which prevented insertion of the surge block and pump, so a peristaltic pump was used.

All monitoring well development was completed in general accordance with Tetra Tech SOP GH 2-8. The wells were developed until a minimum of three standing well volumes in the well casing plus three times the water volume in the saturated sand pack were removed or until the discharge water was visibly clear and temperature, pH, and specific conductivity readings had stabilized with 10-percent variance for three consecutive measurements or as determined by FOL. Best efforts were made to develop each well so that groundwater turbidity was less than 10 nephelometric turbidity units (NTUs). All Round 1 wells were developed until turbidities were less than 10 NTUs except wells MW1-1PDI and NESO10. At MW1-1PDI, 80 gallons of water were removed during development, and turbidity decreased from greater than 1,000 to 45 NTUs. At well NESO10, turbidity stabilized at 29 NTUs after removing 15 gallons of water. All water-quality measurements taken and volumes of water removed during development were recorded for each well on a well development record (see Appendix B.1.4).

All water generated during development activities was containerized and managed as IDW.

3.1.6 Water-Level Measurements

After the monitoring wells were developed and allowed to recover, a comprehensive round of water-level measurements was taken on April 30, 2010, from the 15 monitoring wells investigated during the Groundwater PDI and 10 other existing monitoring wells located in the Lower Subase. All water-level measurements were recorded within a short time period (approximately 2 hours) of consistent weather and near low tide conditions to minimize atmospheric/precipitation effects on groundwater levels. Water-level measurements were completed in accordance with Tetra Tech SOP GH-1.2 and recorded in the field logbook. Water-level measurements were recorded to the nearest 0.01 foot. A summary table of the measurements is provided in Appendix B.1.5 and copies of the project logbooks are provided in Appendix B.1.6

3.1.7 Groundwater Purging

All monitoring wells were purged before sampling using a peristaltic pump and dedicated polyethylene tubing following low-flow procedures provided by Tetra Tech SOP SA-1.1 and USEPA SOP EQASOP-GW001 (2010a). The tubing intake was set at the midpoint of the saturated screen interval. The water level and total depth of each monitoring well were measured before the start of purging. Purging began approximately 2 hours before low tide was predicted in the adjacent Thames River using tidal predictions for Station 8461490 at New London, Connecticut. A time-adjustment factor (approximately 10 minutes) was added to the time predicted to account for the location difference between Station 8461490 and the Lower Subase. Purging occurred immediately before each well was sampled.

During purging, temperature, pH, specific conductance, dissolved oxygen (DO), and salinity were measured with a YSI water-quality meter, and turbidity was measured with a LaMotte meter. These measurements were taken at the start of purging and approximately every 5 to 10 minutes thereafter until temperature, specific conductance, salinity, and water level (except in tidal wells) readings generally stabilized within 10 percent over a minimum of three readings, and turbidity was less than 10 NTUs. Turbidity was less than 10 NTUs in all wells after purging and prior to sampling. All data collected during purging were recorded on either groundwater sample log sheets or a separate low-flow purge data sheet. These forms are included in Appendix B.1.7. Calibration logs maintained for the YSI water-quality meters are included in Appendix B.1.8.

Water removed during well purging was containerized and handled as IDW.

3.1.8 Groundwater Sampling

Groundwater samples were collected from the following 15 wells using the low-flow procedures provided by Tetra Tech SOP SA-1.1 and USEPA SOP EQASOP-GW001 (2010a) during Round 1 of the Groundwater PDI:

Zone 1	Zone 4	Zone 5	Zone 7
13MW19	13MW13	19MW3	MW1-7PDI
13MW20	13MW14	MW1-5PDI	MW3-7RI
13MW21	MW1-4PDI		MW4-7RI
FOMW14	NESO10		
MW1-1PDI	NESO11		

Samples were collected using peristaltic pumps and dedicated tubing. Field personnel took reasonable precautions to minimize cross-contamination of samples from environmental sources during sampling. Methods discussed in USEPA Method 1640 (April 1997) and USEPA Method 1669 (July 1996) were considered by field personnel.

Both total and dissolved groundwater samples were collected for select metals analysis (SW 846 Method 1640 and SW 846 Method 6020). A 0.45-micron membrane filter was used during collection of dissolved metals samples. A new filter was used to collect each filtered sample. Samples were collected in general accordance with Tetra Tech SOPs SA-1.1 and SA-6.1.

Sampling activities were completed between April 22 and April 30, 2010, as the schedule permitted. Groundwater sample log sheets and chain-of-custody forms for Round 1 are provided in Appendix B.1.7 and B.1.9, respectively. Daily activities were also documented in the logbooks and copies of the logbooks are provided in Appendix B.1.6.

The Round 1 samples were collected in April 2010 to represent wetter spring hydrologic conditions. In addition, all samples were collected near low tide to minimize salinity and contaminant dilution impacts on the samples and therefore provide the most representative sampling. Depending on the results of purging, sampling was generally conducted within a 2-hour window bracketing the time of the predicted low tide (i.e., approximately 1 hour prior to and 1 hour after low tide).

Quality Control Samples – Field QA/QC samples were collected as part of the investigation. Duplicate groundwater samples were collected in accordance with the field QA/QC sample summary provided in Worksheet #20 of the Groundwater PDI SAP. Two field duplicate samples were collected during

Round 1, one from FOMW14 and one from MW3-7RI. Also, additional sample volume was collected from well MW4-7RI to provide the laboratory with sufficient sample volume to complete QC analysis (MS).

3.1.9 Sample Handling and Shipping

Sample handling and shipping procedures presented in Tetra Tech SOP SA-6.1 were followed. Sample log sheets were prepared for each sample collected and included sample-specific information, as well as information documenting sampling activities. Sample log sheets were signed and dated, and the appropriate chain-of-custody procedures were followed until the samples reached the analytical laboratory (Columbia Analytical Services of Kelso, Washington). Chain-of-custody forms are provided in Appendix B.1.9. All samples were shipped to the laboratory via FedEx for overnight delivery.

3.1.10 Equipment Decontamination

The decontamination procedures presented in Tetra Tech SOP SA-7.1 were followed for this project. To minimize decontamination efforts, wells were sampled using dedicated tubing, which eliminated the need for equipment decontamination. The water-level meter and electronic interface probe used to measure water levels and depths to the bottoms of the wells were decontaminated by washing with an Alconox (soap) solution and rinsing with potable water followed by deionized water.

Drilling equipment (augers and well construction equipment) was decontaminated prior to beginning work and between locations at a decontamination pad that was constructed from 2-inch by 8-inch wood framing, double plastic liner, and plywood sheeting. The pad had dimensions of approximately 8 feet by 16 feet and was located in Zone 7. The driller completed decontamination of the equipment using a pressure washer, Alconox solution, and clean water rinse. Decontamination water collected at the pad was pumped using a sump pump into a 55-gallon drum for temporary storage and subsequent characterization and disposal.

3.1.11 Surveying

The horizontal locations and ground surface and top of casing elevations for the four wells installed during Round 1 of the Groundwater PDI were surveyed by Tetra Tech's subcontractor, CME Associates, Inc. The work performed by CME was conducted under the supervision of a professional surveyor licensed in the State of Connecticut. The horizontal coordinates for the wells were determined in the 1983 Connecticut SPCS to an accuracy of 0.1 foot. The groundwater and top of well casing elevations were determined relative to the 1988 NAVD to an accuracy of 0.01 foot. The survey information is provided in Appendix B.1.9.

3.1.12 IDW Management

Solid and liquid IDW generated during Round 1 drilling, development, purging, sampling, and decontamination activities was containerized in separate Department of Transportation (DOT)-approved 55-gallon drums. A total of five drums of solid IDW and eight drums of liquid IDW were generated during Round 1 field work. Each drum was properly labeled with appropriate information (e.g., contents, date of generation, location, and unique drum number) and New London personnel collected and transported the drums to the base's temporary waste storage facility for staging. The drums were sampled by Tetra Tech's waste disposal subcontractor, NEDT, on April 30, 2010, to characterize the waste for disposal. The analytical results indicated that the both the solid and liquid waste were non-hazardous. NEDT collected the drums on May 27, 2010, and transported the drums of solid IDW to Vexor Technology, Inc., in Medina, Ohio, and the drums of liquid IDW to Dynecol, Inc. in Detroit, Michigan, for treatment and disposal. These facilities are approved to accept waste from CERCLA sites under the CERCLA Off-Site Rule. Supporting information, including manifests, waste characterization profiles, analytic data, and chain-of-custody forms, are provided in Appendix B.1.11.

Used PPE and general project refuse generated during Round 1 activities were collected and double bagged and disposed of in an approved dumpster at the facility.

3.2 ROUND 2

3.2.1 Mobilization/Demobilization

A brief field team orientation meeting was conducted in Tetra Tech's Pittsburgh, Pennsylvania, office prior to the start of Round 2 groundwater PDI fieldwork to familiarize personnel with the site's health and safety requirements, objectives and scope of the field activities, and chain of command. The Soil PDI field work was also discussed during the meeting. The meeting was attended by the FOL/SSO, PM, and project chemist.

Tetra Tech mobilized to NSB-NLON on August 23, 2010, to conduct Round 2 of the PDI groundwater sampling. The Tetra Tech FOL and field technician picked up NSB-NLON personnel identification passes and vehicle passes and met with the New London FEAD field inspector prior to conducting site-specific health and safety training. The sample team also met with the New London Hazardous Waste Program Manager to set up a staging area for equipment, supplies, and IDW. Field supplies and sample bottleware was inventoried and stored at the staging area. Prior to commencing field activities, the sample team received RADCON training at Building 135, conducted a site tour, discussed access requirements, PPE requirements, work hours, and vehicle parking with NSB-NLON personnel. The field

team was also issued “off hours” work permits to allow access to Lower Subase at times required to fulfill low-tide sampling requirements.

At the completion of the Round 2 PDI groundwater sampling event, all field equipment was packed and returned to the appropriate rental companies, and the field staff demobilized from the site. All rented groundwater sampling equipment was shipped on August 30, 2010.

3.2.2 Water-Level Measurements

A synoptic round of water-level measurements was collected on August 27, 2010, from 14 of the monitoring wells identified in SAP Worksheet#18 and 16 other existing monitoring wells located in the Lower Subase. (Additional wells were taken during Round 2 because of the monitoring well inventory that was conducted in association with the Soil PDI SAP). The water level of monitoring well WE1 measured during Round 1 in April 2010 but was covered with asphalt before the Round 2 sampling in August 2010. All water-level measurements were taken within a short time period of approximately 1 hour to minimize the effects of weather and tidal conditions. Water-level measurements were completed in accordance with Tetra Tech SOP GH-1.2 and recorded in the field logbook. A summary table of the measurements is provided in Appendix B.2.1.

3.2.3 Groundwater Purging

During Round 2, all monitoring wells were purged using the same equipment and procedures identified in Section 3.1.7 for Round 1. All data collected during purging were recorded on either a groundwater sample log sheet or separate low-flow purge data sheet. These forms are included in Appendix B.2.2. Calibration logs maintained for the YSI water-quality meters and LaMotte meters are included in Appendix B.2.3.

Water removed during well purging was containerized and handled as IDW.

3.2.4 Groundwater Sampling

Groundwater samples were collected during Round 2 from the same wells and following the same procedures identified in Section 3.1.8 for Round 1.

Sampling activities were completed between August 26 and August 30, 2010, as the schedule permitted. Groundwater sample log sheets and chain-of-custody forms for Round 2 are provided in Appendix B.2.2 and B.2.4, respectively. Daily activities were also documented in the logbooks and copies of the logbooks are provided in Appendix B.2.6.

The Round 2 samples were collected in August 2010 to represent drier summer hydrologic conditions. In addition, all samples were collected near low tide to minimize salinity and contaminant dilution impacts on the samples and therefore provide the most representative sampling. Depending on the results of purging, sampling was generally conducted within a 2-hour window bracketing the time of the predicted low tide (i.e., approximately 1 hour prior to and 1 hour after low tide).

Quality Controls Samples - Duplicate groundwater samples were collected during Round 2 in accordance with the field QA/QC sample summary provided in Worksheet #20 of the Groundwater PDI SAP. Two field duplicate samples were collected during Round 2, one from MW1-5PDI and one from MW3-7RI. Also, additional sample volume was collected from well MW1-7PDI to provide the laboratory with sufficient sample volume to complete QC analysis (MS).

3.2.5 Sample Handling and Shipping

Sample handling and shipping procedures presented in Tetra Tech SOP SA-6.1 were followed. Sample log sheets were prepared for each sample collected and included sample-specific information, as well as information documenting sampling activities. Sample log sheets were signed and dated, and the appropriate chain-of-custody procedures were followed until the samples reached the analytical laboratory. Chain-of-custody forms are provided in Appendix B.2.4. All samples were packed and shipped via FedEx for overnight delivery to Columbia Analytical Services in Kelso, Washington for analysis on August 30, 2010.

3.2.6 Equipment Decontamination

Similar to Round 1, the water-level meter and electronic interface probe used to measure the water level and total depth of each well were decontaminated by washing with an Alconox solution and rinsing with potable water and deionized water, in accordance with Tetra Tech SOP SA-7.1. All monitoring wells were sampled with dedicated sampling equipment; therefore, no decontamination of sampling equipment was necessary.

3.2.7 IDW Management

Liquid IDW generated during Round 2 purging, sampling, and decontamination activities was containerized in one DOT-approved 55-gallon drum along with liquid IDW generated during Soil PDI activities. The drum was properly labeled with its contents, and New London personnel collected and transported it to the base's temporary waste storage facility. The drum was subsequently sampled by Tetra Tech's waste disposal subcontractor, NEDT, on September 15, 2010, to characterize the waste for

disposal. The analytical results indicated that the liquid waste was non-hazardous. The drummed liquid IDW was collected by NEDT on October 29, 2010, and transported off site for treatment/disposal at Dynecol in Detroit, Michigan, which is approved to accept waste from CERCLA sites under the CERCLA Off-Site Rule. Supporting information, including manifests, waste characterization profiles, analytic data, and chain-of-custody forms, are provided in Appendix A.5.

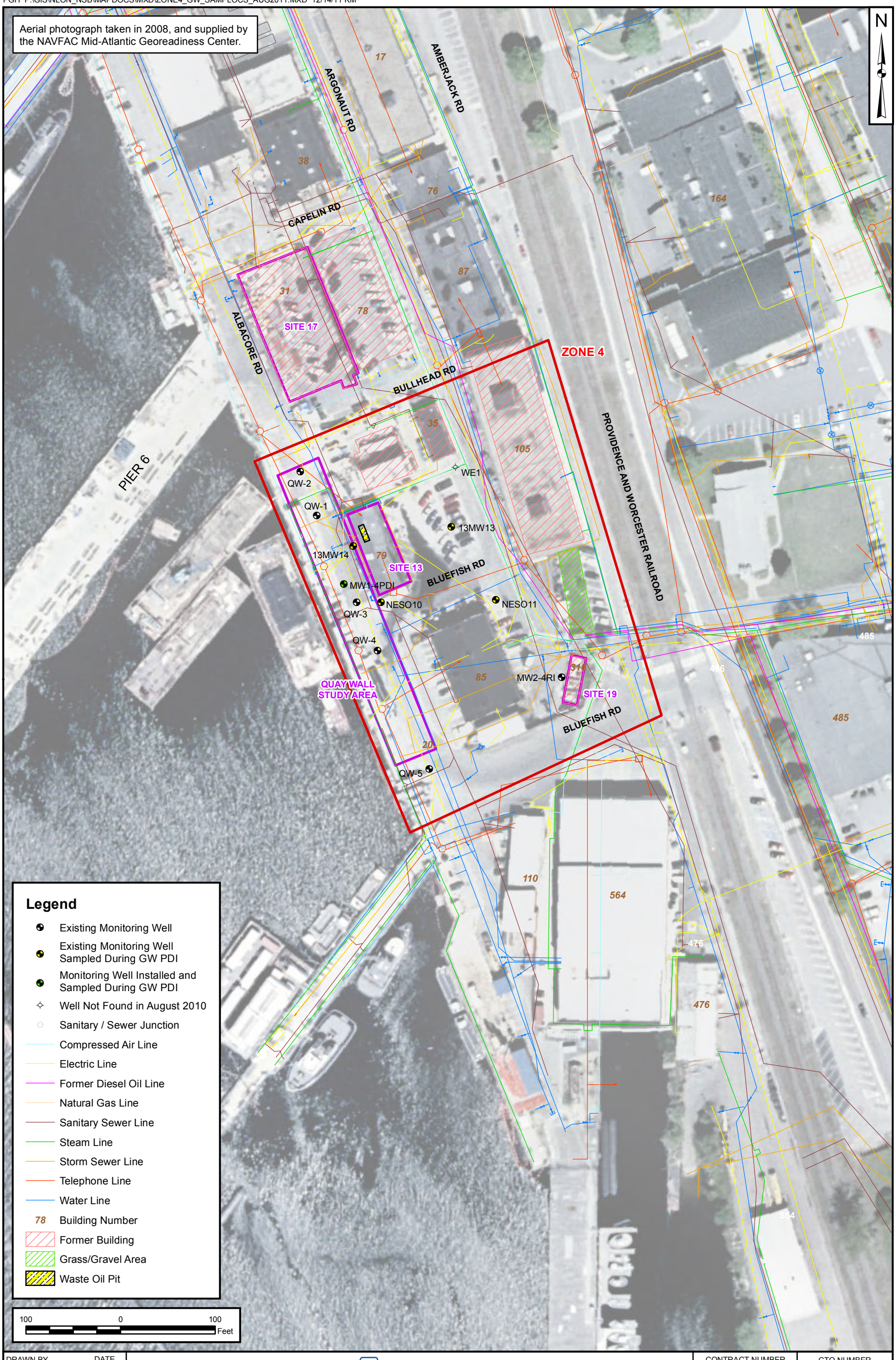
3.2.8 Well Inventory/Inspection

A Lower Subase well inventory/inspection was conducted on August 25, 2010, in accordance with the Lower Subase Soil PDI SAP (Tetra Tech, 2010b). A total of 62 monitoring wells, including 42 existing monitoring wells and four new monitoring wells installed during the Groundwater PDI, were included in the inspection. Four of the 42 wells were found to be not accessible due to obstacles covering the wells (e.g., equipment, jersey barriers etc.). The conditions of the remaining 37 CERCLA wells and one UST-program well were assessed by opening each well and inspecting the surface features (casing, cap, surface, and label), measuring the depth to water, total well depth, and depth to free product (if applicable), and taking PID readings to determine the concentration of organic vapors. The results of the inspections were recorded directly onto working copies of Tables 14-1, 14-3, and 14-4 from the Soil PDI SAP as per the recommended procedures on SAP Worksheet #14. Copies of the hand-marked tables are provided in Appendix B.2.6.

PGH P:\GIS\NLON\MAPDOCS\MXD\ZONE1_GW_SAMPLOCS_AUG2011.MXD 12/9/11 KM

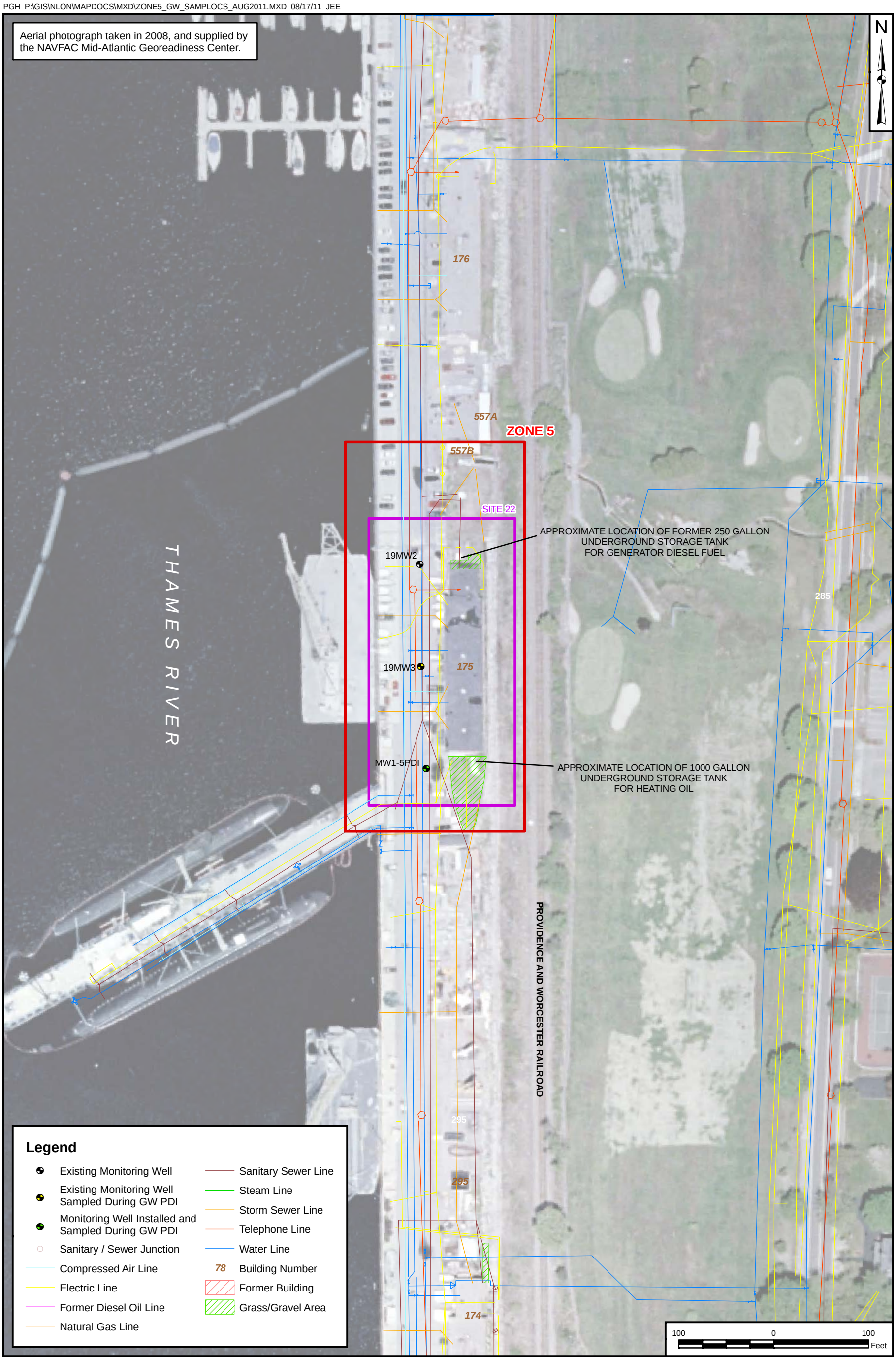
DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	08/11/11		3271	WE57
CHECKED BY	DATE	ZONE 1 GROUNDWATER PDI MONITORING WELL AND SAMPLE LOCATION MAP	APPROVED BY	DATE
N. BALSAMO	12/9/11		CAR	08/17/11
REVISED BY	DATE	LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM	APPROVED BY	DATE
___	___		___	___
SCALE		NSB-NLON, GROTON, CONNECTICUT	FIGURE NO.	REV
AS NOTED			FIGURE 3-1	0

PGH P:\GIS\NLON_NSB\MAPDOCS\MXD\ZONE4_GW_SAMPLOCS_AUG2011.MXD 12/14/11 KM



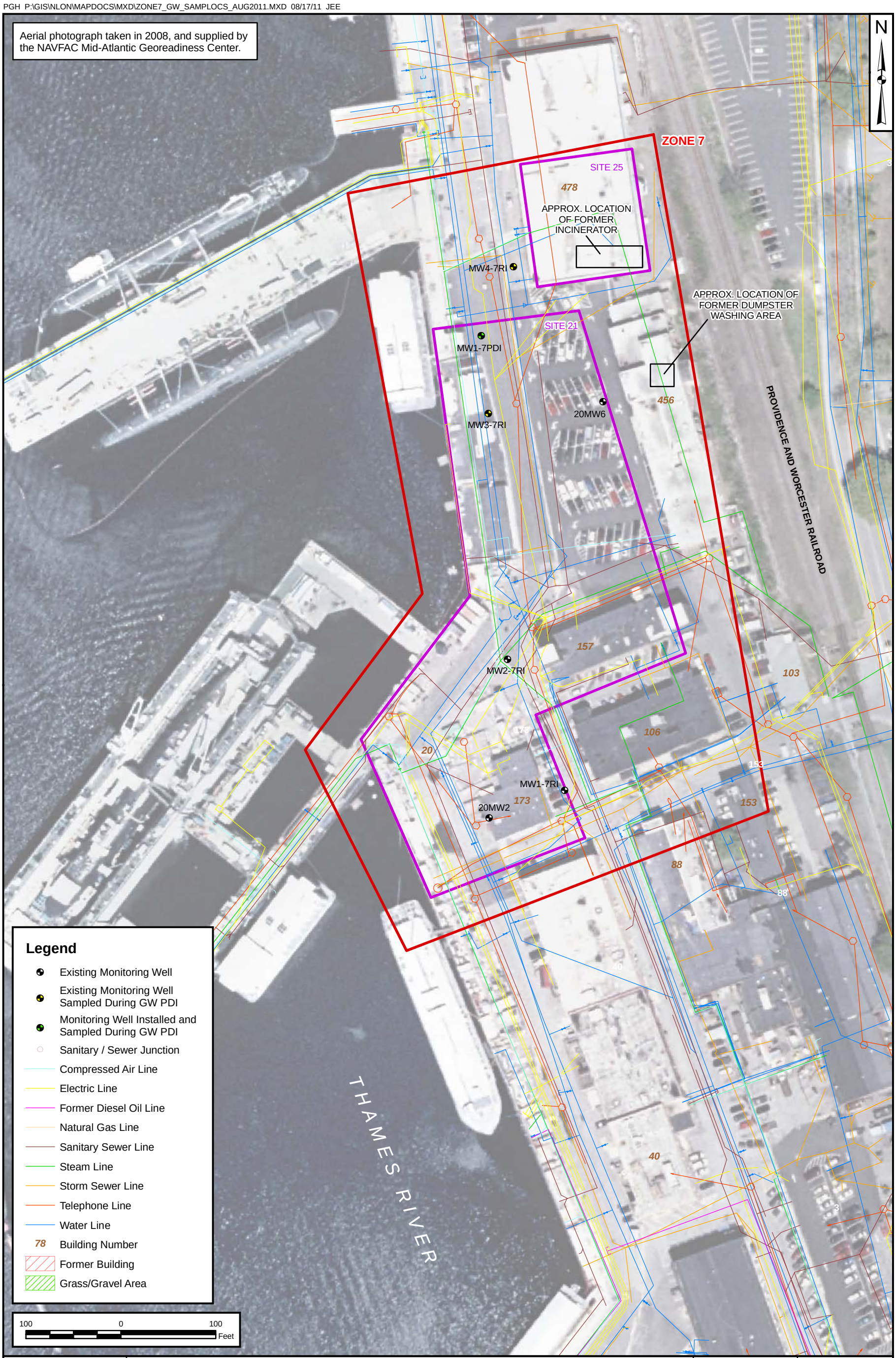
DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	08/10/11		3271	WE57
CHECKED BY	DATE	ZONE 4 GROUNDWATER PDI MONITORING WELL AND SAMPLE LOCATION MAP	APPROVED BY	DATE
N. BALSAMO	12/14/11		CAR	08/17/11
REVISED BY	DATE	LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM	APPROVED BY	DATE
K. MOORE	12/14/11		—	—
SCALE		NSB-NLON, GROTON, CONNECTICUT	FIGURE NO.	REV
AS NOTED			FIGURE 3-2	0

PGH P:\GIS\NLON\MAPDOCS\MXD\ZONE5_GW_SAMPLOCS_AUG2011.MXD 08/17/11 JEE



DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	08/10/11		3271	WE57
CHECKED BY	DATE	ZONE 5 GROUNDWATER PDI MONITORING WELL AND SAMPLE LOCATION MAP	APPROVED BY	DATE
N. BALSAMO	08/17/11		CAR	08/17/11
REVISED BY	DATE	LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM	APPROVED BY	DATE
—	—		—	—
SCALE		NSB-NLON, GROTON, CONNECTICUT	FIGURE NO.	REV
AS NOTED			FIGURE 3-3	0

PGH P:\GIS\NLON\MAPDOCS\MXD\ZONE7_GW_SAMPLOCS_AUG2011.MXD 08/17/11 JEE



DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	08/10/11		3271	WE57
CHECKED BY	DATE	ZONE 7 GROUNDWATER PDI MONITORING WELL AND SAMPLE LOCATION MAP	APPROVED BY	DATE
N. BALSAMO	08/17/11		CAR	08/17/11
REVISED BY	DATE	LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM	APPROVED BY	DATE
—	—		—	—
SCALE		NSB-NLON, GROTON, CONNECTICUT	FIGURE NO.	REV
AS NOTED			FIGURE 3-4	0

4.0 SOIL PDI RESULTS

This section describes the soil data quality review (DQR) process for Soil PDI analytical results. The DQR process considered the data validation process, use of data qualifiers, data completeness, sensitivity, accuracy, precision, comparability, representativeness, and data usability. The method and results of kriging performed with the updated database and the nature and extent of contamination in each zone, as determined by the updated database, are also described in this section. Soil PDI sample locations are shown on Figures 2-1 through 2-7.

4.1 DATA QUALITY REVIEW

A description of the data review processes used to determine whether analytical laboratory data were of acceptable technical quality for use in decision making is presented in this DQR section. The review began with data verification and validation. Verification is a process used to ensure that contractual requirements were satisfied, and validation is a comparison of data quality indicators (DQIs) to prescribed acceptance criteria to assess analytical method performance. The DQIs used are measures to assess the bias and precision of the analytical calibrations and sample analyses. Together, verification and validation are the first steps in evaluating data completeness, accuracy, sensitivity, comparability, and representativeness. The data review process culminates with a data usability assessment during which the final usability of the data is established relative to the intended data use.

4.1.1 Data Validation Process for 2010 PDI Results

All of the results from analytical laboratory samples were validated according to several specifications. Assignment of data qualification flags conformed to rules established in Region I EPA's Data Validation Functional Guidelines - Part II (USEPA, 1996b), National Functional Guidelines for Inorganic Review (USEPA, 2008), and the Department of Defense (DoD) document entitled Quality Systems Manual (QSM) for Environmental Laboratories (DoD, 2006) to the greatest extent practicable for non-Contract Laboratory Program data. Numerical criteria used in conjunction with these rules were specified in the Soil PDI SAP (Tetra Tech, 2010b).

The qualification flags used are defined as follows:

U – Indicates that the chemical was not detected at the numerical detection limit noted. Non-detected results are reported with a "U" qualifier when received from the laboratory. Additionally, a "U" qualifier is added to a result (reported by the laboratory) if the detected concentration is determined to be attributable to contamination introduced during field sampling or laboratory analysis.

UJ – Indicates that the chemical was not detected. However, the detection limit (sample-specific quantitation limit) is considered to be estimated based on problems encountered during laboratory analysis. The associated numerical detection limit is regarded as inaccurate.

J – Indicates that the chemical was detected. However, the associated numerical result may not be an accurate representation of the amount that is actually present in the sample. The laboratory-reported concentration is considered to be an estimate of the true concentration.

R – Indicates that the chemical may or may not be present. The analytical result reported by the laboratory is considered to be unreliable and unusable. The “R” qualifier is applied in cases of gross technical deficiencies (i.e., holding times missed by two times the specified time limit, severe calibration non-compliances, and extremely low QC recoveries).

UR – Indicates that the chemical may or may not be present. The non-detected analytical result reported by the laboratory is considered to be unreliable and unusable. The “UR” qualifier is applied in cases of gross technical deficiencies (i.e., holding times missed by two times the specified time limit, severe calibration non-compliances, and extremely low QC recoveries).

The preceding data qualifiers may be categorized as indicative of major or minor problems. Major problems are defined as issues that result in the rejection of data and qualification with “UR” or “R” data validation qualifiers. Rejected data are considered invalid and are not used for decision-making purposes unless used in a qualitative way and the use is justified and documented. Less severe deficiencies, associated with “U,” “J,” and “UJ” data validation qualifiers, are defined as issues resulting in the estimation of data. Estimated analytical results are considered to be suitable for decision-making purposes unless the data use requirements are very stringent and the qualifier indicates a deficiency that is incompatible with the intended data use.

If no qualifier is assigned to a result that has been validated, the data user is assured that no analytical performance deficiencies were identified during validation. In addition, a “U” qualifier does not necessarily indicate that a data deficiency exists because all non-detect values are flagged with the “U” qualifier regardless of whether a quality deficiency has been detected.

No data points were rejected during validation of Lower Subase Soil PDI data, therefore no data had “R” or “UR” qualifiers. Any impacts to the project based on the results of the data evaluation are discussed in the remainder of this review. Data users should be aware that any qualified data, even if it is considered usable, may be less accurate or less precise than non-qualified data.

4.1.2 Data Validation Outputs for 2010 PDI Results

After laboratory data were validated, a list was developed of non-conformities requiring data qualifier flags that were used to alert the data user to inaccurate or imprecise data. For situations in which several QC criteria were out of specification, the data validator made professional judgments and/or comments on the validity of the overall data package. The reviewer then prepared a technical memorandum presenting qualification of the data, if necessary, and the rationale for making such qualifications. The net result was a data package that had been carefully reviewed for its adherence to prescribed technical requirements. Data validators incorporated data qualifiers into the electronic database and submitted the information to the Tetra Tech Data Management Group. Data tables of all results and data validation reports for soil are included in Appendix C.1. Pertinent quality estimates are summarized in a more quantitative format in the following sections.

4.1.3 General Data Quality Review for Soil PDI Results

The DQR was designed to provide an overall quantitative measure of analytical performance not provided by data validation. The analytical performance quantitative evaluations are frequently analyte specific and reflect deficiencies such as biases associated with the quantification of particular analytes in a particular sample matrix. The data user must be aware that different chemicals in the same analytical fraction (e.g., arsenic and lead in the metals fraction) may exhibit different degrees of quality.

4.1.3.1 Completeness

Completeness is a measure of the number of valid samples or measurements that are available relative to the number of samples or measurements that were intended to be generated. For this project, completeness was measured on two different bases, samples collected and laboratory measurements, as follows:

- Sample collection completeness was a measure of the usable samples collected as compared to those intended to be collected.

- Laboratory measurement completeness was a measure of the amount of usable, valid, laboratory measurements per matrix obtained for each target analyte.

Usable valid samples (or results) were those judged, after data assessment, to represent the sampling populations and to have not been disqualified for use through data validation or additional data review. Completeness was determined using the following equation:

$$\%C = \frac{V}{T} x 100$$

where	%C	=	percent completeness
	V	=	number of samples (or results) determined to be valid
	T	=	total number of planned samples (or results)

Soil sample collection completeness was evaluated for each zone defined in the Soil PDI SAP in Table 4-1. Sample collection completeness for soil QC samples is also presented in Table 4-1. Laboratory measurement completeness for environmental soil samples and QC samples is presented in Table 4-2. Discussions pertaining to sample collection and laboratory measurement percent completeness deficiencies (i.e., percent completeness values less than 95 percent) are provided below.

Sample collection completeness deficiencies were noted for soil (see Table 4-1). For Zone 1, one subsurface sample was not collected for PAH analysis and six subsurface samples were not collected for ETPH analysis as indicated in the Soil PDI SAP (Tetra Tech, 2010b) because the sample depths were not reached due to refusal. In addition, one surface ETPH sample was not collected because there was no soil in the top 2 feet, only asphalt, concrete, and wood. For Zone 3, one location was not sampled for total lead (one sample) and SPLP lead analysis (two samples) because the location did not pass utility clearance. A subsurface sample from Zone 3 was not collected for SPLP lead analysis due to refusal before reaching the sample depth. A subsurface sample from Zone 7 was not collected for total lead, SPLP metals, and PAH analyses due to sample refusal. One MS/MSD sample was planned but not collected for total lead and antimony analysis. MS/MSD recoveries were non-compliant for antimony in several soil samples. The affected results were qualified as estimated. Because data were not rejected due to MS/MSD non-compliances, the impact of collecting fewer QC samples than expected is minimal and does not affect data usability. Instead of collecting a field duplicate for only total antimony and SPLP antimony analyses, one field duplicate was collected for total antimony and lead and SPLP antimony and lead analyses; therefore, sufficient field duplicates were collected for total and SPLP antimony.

No laboratory measurement completeness deficiencies were noted for the Soil PDI data. An MS/MSD sample was collected for hexavalent chromium analysis but was not analyzed because an MS/MSD is not required for the method. Also, one surface soil sample from Zone 2, which was only to be analyzed for ETPH, was mistakenly also analyzed for total and SPLP metals and PAHs due to an error on the chain-of-custody form.

4.1.3.2 Sensitivity

The detection limits reported by the laboratory were less than the project action limits (PALs) provided in the SAP for soil data (Tetra Tech, 2010b). Three SPLP antimony and SPLP lead results for soil samples were qualified as non-detected due to blank contamination; however, this did not elevate the detection limits above the lowest criteria evaluated (i.e., 60 and 150 µg/L for antimony and lead, respectively, from CTDEEP Pollutant Mobility Criterion for groundwater classified as GB).

4.1.3.3 Laboratory Accuracy

Accuracy in the laboratory was measured through comparison of a spiked sample or laboratory control sample (LCS)/laboratory control sample duplicate (LCSD) result to a known or calculated value and is expressed as a percent recovery (%R). Accuracy was also assessed by monitoring the analytical recovery of select surrogate compounds added to samples that are analyzed by organic chromatographic methods and the analytical recovery of calibration standards for all analyses. LCSs were used to assess the accuracy of laboratory operations with minimal sample matrix effects. MS/MSD and surrogate compound analyses measure the combined accuracy effects of the sample matrix, sample preparation, and sample measurement. LCS and MS analyses were performed at a frequency of 1 per 20 associated samples of like matrix. Laboratory accuracy was assessed by comparing %R values to accuracy control limits specified by the laboratory method.

%R is calculated by the laboratory using the following equation:

$$\%R = \frac{Ss - So}{S} \times 100$$

where	%R	=	percent recovery
	Ss	=	result of spiked sample
	So	=	result of non-spiked sample
	S	=	concentration of spiked amount

%R is determined by the laboratory to assess the accuracy of laboratory procedures. ETPH results in 18 soil samples (including two field duplicates) and antimony results in five soil samples (including one field duplicate) were qualified as estimated due to LCS/LCSD non-compliance. The data qualified due to LCS non-compliance were not rejected and are therefore considered usable. ETPH results in one soil sample and antimony results in 14 soil samples (including two field duplicates) were qualified as estimated due to MS/MSD non-compliance. MS non-compliance indicates sample matrix interference with the accurate quantitation of target analytes. Inorganic analytes are qualified for MS non-compliance by sample

delivery group (SDG). This means, for example, that if the MS %R for analyte "A" is non-compliant with the applicable %R criterion, then analyte "A" results are qualified for MS non-compliance in that sample and all other samples in the same SDG. Although an SDG comprises samples of similar matrix, if different samples in a batch have different matrix compositions, such as different relative proportions of clay or sand, the spiked sample may not represent matrix effects in all samples of the SDG. This effect is most pronounced on soil and sediment samples, which have a significant potential for compositional differences. Results for organic compounds are qualified only for the sample exhibiting the non-compliant %R values. These differences in qualification protocol emphasize qualification of inorganic data more than organic data. This can lead to conclusions that inorganic data are of lesser quality than organic data quality even though the quality is similar for inorganic and organic analyses.

Other laboratory accuracy indicators including surrogate recovery, internal standard recovery, and calibration recovery recoveries indicated that laboratory analyses were sufficiently accurate for project data use. PAHs (8 of 10 chemicals) were qualified as estimated due to surrogate recovery non-compliance in one soil sample. PAHs (one to five chemicals) were qualified as estimated due to internal standard recovery non-compliance in eight soil samples. PAHs (one to three chemicals) were qualified as estimated due to calibration non-compliance in most soil samples.

The ETPH concentration in one sample (Z2PDI-SO-001-0002) was qualified due to a holding time exceedance. This sample was analyzed outside of holding time for ETPH due to an error on the chain-of-custody form. Upon consideration of the matrix, the affected analyte, and the applicable storage conditions, loss of analyte due to delayed analysis was considered not to be a significant concern. The ETPH data qualified due to the holding time exceedance are considered acceptable for the usability assessment.

4.1.3.4 Laboratory Precision

Precision is a measure of the degree to which two or more measurements are in agreement and describes the reproducibility of measurements of the same parameter for samples analyzed under similar conditions.

Precision for chemical parameters is expressed as a Relative Percent Difference (RPD), which is defined as the ratio of the difference to the mean for the two values being evaluated. RPDs are used to evaluate both field and laboratory duplicate precision and are calculated by the laboratory as follows:

$$RPD = \frac{|V1 - V2|}{(V1 + V2)/2} \times 100$$

where RPD = relative percent difference
V1, V2 = two results obtained by analyzing duplicate samples

RPD is determined by the laboratory to assess the precision of laboratory procedures, and RPD is also determined through data validation to assess the precision of sample collection (i.e., field duplicates). The precision estimates obtained from duplicate field samples encompass the combined uncertainty associated with sample collection, homogenization, splitting, handling, laboratory and field storage (as applicable), preparation for analysis, and analysis. In contrast, precision estimates obtained from analyzing duplicate laboratory samples incorporate only homogenization, subsampling, preparation for analysis, laboratory storage (if applicable), and analysis uncertainties.

Total antimony concentrations were qualified as estimated for one field duplicate pair (Z7PDI-SO-009-0607/Z7PDI-SO-009-0607-D), and SPLP antimony concentrations were qualified as estimated for one field duplicate pair (Z7PDI-SO-10-0204/Z7PDI-SO-10-0204-D). Total lead and SPLP lead results were qualified as estimated for one field duplicate pair (Z4PDI-SO-001-0002/Z4PDI-SO-001-0002-D), and total lead results were qualified as estimated in three samples. Most PAH results were qualified as estimated in the following three of five field duplicate pairs analyzed for PAHs (Z7PDI-SO-012-0002/Z7PDI-SO-012-0002-D, Z7PDI-SO-013-0002/Z7PDI-SO-013-0002-D, and Z7PDI-SO-018-0002/Z7PDI-SO-018-0002-D). No data were rejected due to field duplicate imprecision; therefore, the data are considered usable.

4.1.3.5 Comparability

Comparability is defined as the confidence with which one data set can be compared with another (e.g., among sampling points and among sampling events). Comparability was achieved by using standardized sampling and analysis methods, as well as standardized data reporting formats. Comparability of laboratory measurements was achieved primarily through the use and documentation of standard sampling and analytical methods. Results were reported in units that ensured comparability with current state and federal standards and guidelines. Comparability of laboratory measurements was assessed primarily through the use of QC samples and through adherence to the Soil PDI SAP (Tetra Tech, 2010b).

4.1.3.6 Representativeness

Representativeness is an expression of the degree to which data accurately and precisely depict the actual characteristics of a population or environmental condition existing at the site. Compliance with the Soil PDI SAP (Tetra Tech, 2010b) and use of standardized sampling, sample handling, sample analysis, and data reporting procedures ensured that the final data would be accurate representations of actual site conditions. The DQR found the data collected to be representative of targeted populations.

4.1.4 Data Usability

The following findings affect project data usability and must be considered by project data users.

Sample collection completeness was less than 95 percent at several locations where soil samples could not be collected because the location was did not pass utility clearance or did not contain soil or the sample depth was unavailable due to refusal during drilling (see Table 4-1). One MS/MSD sample was planned but not collected for total lead and antimony. Because data were not rejected due to MS/MSD non-compliances, the impact of collecting fewer QC samples than expected is minimal and was determined not to affect data usability.

4.2 NATURE AND EXTENT OF CONTAMINATION

This section discusses the nature and extent of soil contamination in Zones 1 through 7 at the Lower Subase. Soil sampling was conducted in each of these zones during the PDI. Soil sampling was previously conducted during the Phase I, Phase II, and Lower Subase RIs and other investigations detailed in Section 1 of the Lower Subase FS (Tetra Tech, 2010d). All historical data are tabulated in Appendix H of the Lower Subase RI (Tetra Tech, 1999). This section is an update of the nature and extent of contamination discussion provided in the Lower Subase FS (Tetra Tech, 2010d) based on data from the Soil PDI. An evaluation of the effectiveness of the PDI in refining the nature and extent of contamination is provided in Section 4.3

4.2.1 Kriging

The concentration contours of contaminants were estimated by the statistical method of three-dimensional kriging for the primary contaminants (PAHs, lead, and TPH) in Zones 1, 2, 3, 4, and 7 as a tool to assist in the determinations of sample locations for the PDI. A memorandum summarizing the kriging approach is provided in Appendix E.1. Because Zones 1 through 4 are contiguous, analytical data from these zones were kriged together. Zones 5 and 6 did not have enough sample results for three-dimensional statistical evaluations, so post-PDI kriging was not performed for those zones.

Concentrations of multiple carcinogenic PAHs were represented by benzo(a)pyrene (BaP) equivalent (EQ) concentrations to simplify the kriging effort for PAHs. Carcinogenic PAHs are found as mixtures in contaminated media. Because carcinogenic PAHs have a common toxicity mechanism but display difference toxic potencies, a toxicity equivalency factor (TEF) approach was used to convert individual PAH site concentrations into a single concentration of the index chemical, BaP. TEFs based on the potency of each carcinogenic PAH relative to that of BaP are presented in USEPA's Provisional Guidance

for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993). The TEFs were used to convert individual carcinogenic PAH concentrations into an equivalent concentration of BaP and then equivalent concentrations were summed to generate the BaPEQ concentrations.

Upon completion of the Soil PDI, data from the 2010 database (combined historical and PDI data) was kriged for this Completion Report and FS Addendum. Kriging results for both pre-PDI (2009 kriged data) and 2010 data (combined historical and PDI data) are presented on plan view figures in Appendix E.1. On each Appendix E figure, only the locations of samples analyzed for the specific COC are shown. For example, soil from location GS-6L in Zone 4 was analyzed for TPH but not PAHs, therefore location GS-6L is shown on Figures E.1.9 through E.1.18 and Figure E.1.20 but not on Figures E.1.1 through E.1.8.

For BaPEQ and lead concentrations, kriging results are presented for 2-foot elevation intervals from the ground surface to the interval that includes mean high water, Elevation 1.2 [North American Vertical Datum of 1988 (NAVD88)]. Ground surface contours were developed from PDI and historical well and boring ground surface elevations. These contours show that the Lower Subase generally slopes from east to west. Kriging data for Elevation 8 to 10 feet are only shown along the eastern edge of Zones 1 through 4, where the ground surface is higher than Elevation 8 (Figures E.1.1, E.1.9, and E.1.22). Kriging data for the Elevation 6 to 8 feet interval are shown for all of Zones 1 through 4 except the western edge, where the ground surface is below Elevation 6 (Figures E.1.2, E.1.10, and E.1.23). Kriging data are shown across all of Zones 1 through 4 for the Elevation 4 to 6 feet, 2 to 4 feet, and 0 to 2 feet intervals.

For TPH, kriging included data derived by both the ETPH method and Method 418.1. TPH data are presented for intervals both above and below mean high water to estimate the extent of LNAPL (Figures E.1.14, E.1.15, E.1.16, and E.1.17).

To further evaluate the three-dimensional distribution of contamination, vertical cross-sections were developed for each COC. Cross-section figures, such as Figures E.1.7 and E.1.8, are preceded by plan views showing the cross-section locations, such as Figure E.1.6. As shown on Figure E.1.7, samples that are offset from the cross-section are indicated by narrower borings and smaller sample markers, with offset distances shown.

Kriging figures are color coded to depict contaminant concentrations. Blue indicates the areas of lowest concentrations, with yellow, orange, red and purple indicating progressive increases in COC concentrations.

4.2.2 Zone 1

Detected PDI results and calculated BaPEQ concentrations from Zone 1 surface soil samples (0 to 2 feet bgs) and subsurface samples (greater than 2 feet bgs) are summarized in Tables 4-3 and 4-4, respectively. The Zone 1 minimum and maximum concentrations, samples with maximum concentrations, frequencies of detection, and ranges of non-detects for surface and subsurface soil PDI samples are presented in Tables 4-5 and 4-6, respectively, and for all samples, including both historical and PDI data, in Tables 4-7 and 4-8, respectively.

During previous investigations, volatile organic compounds (VOCs) were detected in Zone 1 surface and subsurface soil samples infrequently and at low concentrations (e.g., maximum of 1.29 micrograms (µg)/kilogram (kg) xylenes and 5 µg/kg carbon disulfide in one of one and one of eight samples, respectively), and several detections were likely attributable to laboratory contamination (e.g., acetone and methylene chloride). Therefore, VOCs were not investigated further during the PDI.

Detected semi-volatile organic compounds (SVOCs) consisted mainly of PAHs. PAH concentrations in Zone 1 were generally greater in surface than subsurface soil, with the maximum PDI BaPEQ concentration [7.96 milligrams (mg)/kg] detected in surface soil at Z1PDI-004 (Table 4-3). Figures E.1.1, E.1.2, and E.1.3 indicate that the area of the greatest BaPEQ concentrations in surface soil extends from east of Site 11 to the Thames River in the northern half of Zone 1. In deeper soil, the maximum BaPEQ was at TB2-1RI (Figures E.1.4 and E.1.5).

TPH contamination is widespread in subsurface soil in Zone 1 and is most likely the result of historical releases from fuel lines and USTs at Sites 10 and 11. Surface concentrations of TPH (maximum of 2,200 mg/kg at Z1PDI-006, Table 4-7) are significantly less than subsurface concentrations. The highest TPH concentrations (including maximum of 51,600 mg/kg at 13MW18, Table 4-8) were detected in subsurface soil in the vicinity of the USTs at Sites 10 and 11. A significant area of petroleum contamination was also identified in the vicinity of the historical fuel pipeline along Corvina Road, near the intersection of Albacore Road. Fluorescence spectroscopy data from the Phase I RI identified the petroleum contamination as No. 2 fuel oil, diesel fuel, and waste lubricating oil. This information suggests that both waste oil (CERCLA) and virgin petroleum (non-CERCLA) were released to the subsurface in Zone 1 and are currently co-mingled in the subsurface.

Kriging of the TPH data shows low TPH concentrations at elevation intervals above mean high water (Figures E.1.9, through E.1.11) and greater concentrations below groundwater (Figures E.1. 13 through E.1.17). Cross-sections A-A, B-B, and C-C (Figures E.1.19, E.1.20 and E.1.21, respectively) show that greater TPH concentrations begin just below the mean high water level. This is consistent with tanks or pipelines leaking petroleum and the petroleum being deposited in a “smear zone” where the groundwater

fluctuates between high and low tide. The two locations with TPH greater than 22,500 mg/kg are 13MW18 and GS-32L.

Kriging shows TPH concentrations greater than 500 mg/kg in the northeastern corner of Zone 1 at elevations above the water table because kriging extrapolated TB6-1RI concentrations into that area, not because of analytical results in that area. Similarly, the high concentrations of TPH at great depths shown on cross-sections A-A, B-B, and C-C are the result of the deepest TPH concentrations being extrapolated into depths at which there are no data.

Maximum concentrations of a majority of inorganics detected in Zone 1 subsurface soil were reported in the sample collected during installation of well 13MW4, located northeast of Building 29, at the intersection of an existing fuel pipeline and sanitary sewer line. Lead concentrations detected in Zone 1 surface soil (maximum of 7.7 mg/kg, Table 4-7) were less than concentrations detected in subsurface soil (maximum of 383 mg/kg, Table 4-8). Toxicity Characteristic Leaching Procedure (TCLP) lead concentrations were low except for a subsurface result of 1.7 mg/liter (L) at 13MW4 (Table 4-8). The SPLP result from nearby subsurface sample Z1PDI-009 (Figure 2-1) was 0.0027 mg/L (Table 4-4).

4.2.3 Zone 2

PDI results from the Zone 2 surface soil sample are shown in Table 4-9, and PDI subsurface soil sample results are shown in Table 4-10. Zone 2 minimum and maximum concentrations, samples with maximum concentrations, frequencies of detection, and ranges of non-detects for PDI surface and subsurface soil samples are presented in Tables 4-11 and 4-12, respectively, and for all samples, including both historical and PDI data, in Tables 4-13 and 4-14, respectively.

No surface soil samples collected in Zone 2 were analyzed for VOCs. VOCs in subsurface soil samples were detected infrequently and at low concentrations [e.g., maximum of 2 µg/kg of methylene chloride (common laboratory contaminant) and 1 µg/kg of trichloroethene in one of four samples] (Table 4-14); therefore, VOCs were not investigated further during the PDI.

The PAH and TPH data are suggestive of fuel oil impacts, perhaps from the former fuel oil distribution pipeline running through Zone 2 to Pier 8. The majority of maximum PAH concentrations in subsurface soil were detected in the sample collected from TB3-2RI at 6 to 8 feet bgs (sample LS2SB0030201, Table 4-14), located near Zone 1. The surface soil sample collected during the PDI (Z2-PDI-001) had a low BaPEQ concentration (429 µg/kg) and very low TPH concentration (37 mg/kg) (Table 4-9). The maximum concentration of TPH was detected in deeper subsurface soil at location GS-22L (8,210 mg/kg in sample FPTB22L-07, Table 4-14). The two subsurface PDI samples had low TPH concentrations. In general, high molecular weight PAHs were detected more frequently and at greater concentrations than

low molecular weight PAHs in Zone 2 soil, indicating the presence of heavy fuel oils or tar/asphalt, although the absence of low molecular weight PAHs may due to degradation. Kriging of BaPEQ data (Figures E.1.1 through E.1.8) indicate that the BaPEQ concentrations are less than 1,000 µg/kg (1 mg/kg) throughout Zone 2. Kriging of TPH (Figures E.1.9 through E.1.20) indicates concentrations are less than 500 mg/kg throughout most of Zone 2, with the exception of the northwestern corner of Zone 2. All soil samples with concentrations of TPH greater than 2,500 mg/kg were below mean high water.

Metals concentrations in Zone 2 soil were low, and the maximum concentration of soil lead was 150 mg/kg, of TCLP lead was 0.2 mg/L, and of SPLP lead was 0.0015J mg/L. Kriging indicates low lead concentrations throughout Zone 2 in soil above mean high water (Figures E.1.22 through E.1.29).

4.2.4 Zone 3

PDI results from Zone 3 surface and subsurface soil samples are summarized in Tables 4-15 and 4-16, respectively. Zone 3 minimum and maximum concentrations, samples with maximum concentrations, frequencies of detection, and ranges of non-detects for PDI surface and subsurface soil samples are presented on Tables 4-17 and 4-18, respectively, and for all samples, including both historical and PDI data, in Tables 4-19 and 4-20, respectively.

VOCs were detected at low concentrations in Zone 3 surface and subsurface soil samples (Tables 4-19 and 4-20) and several VOCs were likely attributable to laboratory contamination (e.g., acetone and methylene chloride); therefore, VOCs were not investigated further in the PDI.

SVOCs were detected primarily in Zone 3 subsurface soil and consisted mainly of PAHs. Maximum concentrations of most SVOCs were detected in the sample collected from boring TB4-3RI. Based on the distribution of SVOC concentrations, it appears that the SVOCs may be associated with leaks from the former fuel distribution pipeline that ran along the eastern side of former Building 78. Kriging of BaPEQ data (Figures E.1.1. thought E.1.8) indicates surface soil concentrations exceeding 1 mg/kg near TB4-3RI and subsurface soil concentrations greater than 1 mg/kg at TB5-3RI, also along the former fuel line.

The maximum concentration of TPH (3,400 mg/kg) was detected in soil from the 13MW12 well boring at 8 to 10 feet bgs. TPH was detected in soil along Bullhead Road from Argonaut Road to Albacore Road, and along Albacore Road from Chaplin Road to Bullhead Road. Trace levels of No. 2 and No. 6 fuel oils were detected in soil samples from WE2 and 13MW12. Sources of the petroleum are likely leaks from the historical fuel distribution pipeline within Zones 3 and 4 and releases from previous USTs within Zone 4. Kriging shows TPH concentrations greater than 500 mg/kg in surface soil in the western portion of Zone 3 and in deeper soil on the southern end of Zone 3, near Zone 4 (Figures E.1.10 to E.1.17).

Kriging cross-sections (Figures E.1.19 and E.1.20) indicate that soil with TPH concentrations greater than 2,500 mg/kg is below mean high water.

Various inorganics were detected in Zone 3 surface and subsurface soil samples; however, lead was the primary inorganic detected at elevated concentrations. Lead was detected at maximum concentrations greater than 4,000 mg/kg in both surface and subsurface soil. The lead detections are most likely the result of past battery overhaul operations at Building 31. Soil to a depth of 7 feet bgs (estimated mean low tide level) beneath former Building 31 that exceeded the project criteria of mass lead greater than 500 mg/kg or TCLP lead greater than 5 mg/L was remediated by solidification in 1994 [Halliburton NUS Corporation (HNUS), 1995]. This treatment process reduced the leachability of lead in the treated soil, but it did not reduce the overall mass of lead in the soil. The results of pre-remediation sampling showed that mass concentrations of lead in the soil beneath Building 31 ranged from 10 to 16,900 mg/kg, with an average concentration of 3,360 mg/kg, and post-remediation TCLP lead leachate concentrations ranged from less than the detection limit of 1 µg/L to 990 µg/L, with an average concentration of 79 µg/L. After remediation, the Building 31 concrete floor was replaced. Building 31 was subsequently demolished but the concrete floor was left intact and covered with asphalt.

Maximum TCLP lead concentrations in Zone 3 surface and subsurface samples were 2.89 mg/L (SB25) and 8.6 mg/L (13MW11), respectively. The TCLP concentration in the subsurface soil samples from sample locations SB17 (5.88 mg/L) and 13MW11 exceeded the RCRA lead TCLP limit of 5.0 mg/L for hazardous waste identification. Three RI subsurface soil samples were analyzed for SPLP lead, and the resulting concentrations ranged from 0.0402 to 0.478 mg/L. The maximum SPLP lead concentration detected during the Lower Subase RI was 0.478 mg/L. The TCLP and SPLP lead concentrations suggest that some of the lead in Zone 3 soil is leachable and could impact groundwater.

Soil beneath former Building 31 that exceeded project criteria (lead concentrations greater than 500 mg/kg or TCLP lead concentrations greater than 5 mg/L) was excavated, stabilized with cement, and replaced in the excavation. Soil around the perimeter of Building 31 that exceeded project criteria was excavated up to 7 feet bgs and replaced with clean fill. As shown on Figure 4-1, these excavations were in the space between Building 31 and 78, south of Building 31 in Bullhead Road, and west of Building 31 in Albacore Road. The Bullhead Road excavation was extended south until in-situ soil met criteria. Albacore Road was excavated west of Building 31, but excavation was discontinued prior to meeting project criteria because excavation activities interfered with Subase operations.

Lead concentrations in Zone 3 soil were further investigated during the PDI at five locations between Building 31 and the Thames River. Surface soil samples were analyzed for lead and SPLP lead at four PDI locations, and subsurface soil samples were analyzed for mass lead at four locations. Mass lead and

SPLP lead results were low in the northwestern area of Zone 3 at Z3PDI-001 and -002. The SPLP lead result at Z2PDI-002, in the northwestern area of Zone 3 near 13MW11, was also low. The maximum detected lead concentration during the PDI was 1,540 mg/kg (Z3PDI-005 surface soil, Table 4-15), and the maximum SPLP lead concentration during the PDI was 0.60 mg/L (Z3PDI-003 subsurface soil, Table 4-16); both samples were from the southwestern portion of Zone 3 (Figure 2-3).

Kriging of the updated database is shown in the panel called "2010 Kriging Data." This figure indicates that lead concentrations in soil are high on the eastern half of Albacore Road and moderately high on the western half of Albacore Road, with the exception of the northwestern corner, where lead concentrations are low (Figures E.1.24 through E.1.26).

4.2.5 Zone 4

PDI results from Zone 4 surface and subsurface soil samples are summarized in Tables 4-21 and 4-22, respectively. Zone 4 minimum and maximum concentrations, samples with maximum concentrations, frequencies of detection, and ranges of non-detects for PDI surface and subsurface soil samples are presented in Tables 4-23 and 4-24, respectively, and for all samples, including both historical and PDI data, in Tables 4-25 and 4-26, respectively.

Surface soil samples from Zone 4 were not analyzed for VOCs, but subsurface soil VOC concentrations were low (Table 4-26). One subsurface soil sample, collected from boring QW-1 and analyzed for pesticides/polychlorinated biphenyls (PCBs) had endrin at 6.7 µg/kg. Due to low concentrations during previous investigations, VOCs and pesticides were not investigated further during the PDI.

PAHs were the primary SVOCs detected in Zone 4 surface soil, with maximum concentrations from the MW1-4RI well boring (sample LS4SB0010101, Table 4-25). Subsurface soil SVOC concentrations were less than surface soil concentrations, with maximum subsurface SVOC concentrations at TB3-4RI from 2 to 4 feet bgs (sample LS4SB0030101, Table 4-26). Kriging shows that BaPEQ concentrations greater than 1 mg/kg are limited to the immediate vicinity of MW1-4RI (Figures E.1.1 through E.1.8). PAHs were analyzed at three surface soil locations (Z4PDI-004, Z4PDI-005, and Z4PDI-009) during the PDI. BaPEQ concentrations were less than 1,000 µg/kg at all three PDI locations (Table 4-21).

The maximum TPH concentration in Zone 4 surface soil was 3,440 mg/kg (13TB4A, Table 4-25), and the maximum TPH concentration in subsurface soil was 11,800 mg/kg (13TB2A, Table 4-26). Kriging shows that TPH concentrations greater than 500 mg/kg in surface soil are limited to the northwestern portion of Zone 4 (Figures E.1.9 through E.1.11). In deeper soil, TPH is more prevalent (Figures E.1.12 through E.1.17), and concentrations exceed 2,500 mg/kg below mean high water at two locations, 13TB2A and GS-9L (Figures E.1.14 through E.1.20). TPH was analyzed for at two surface soil locations (Table 4-21)

and three subsurface soil locations (Table 4-22) during the PDI. The maximum PDI TPH concentration (220 mg/kg) was detected in the surface soil sample at Z4PDI-001 (Tables 4-23 and 4-24).

During the Phase I RI, Zone 4 samples were analyzed by fluorescence spectroscopy to identify the type of oil present. An area of subsurface soil west of and adjacent to Building 79 contained a mixture of heavy residual fuel oil (No. 6 fuel oil) and waste oil. In addition, product recovered during a removal action at the Zone 4 Quay Wall in 1994 was analyzed and contained metals and petroleum. These data suggest that both waste oil (CERCLA) and virgin petroleum (non-CERCLA) were released to the subsurface in Zone 4 and are currently co-mingled in the subsurface.

Lead was detected in Zone 4 at a maximum concentration of 10,600 mg/kg (WE4A) in surface soil (Table 4-25). Lead concentrations in subsurface soil ranged from 25.2 to 8,240 mg/kg (Table 4-26). Kriging estimates that lead concentrations in surface soil are greater in the northwestern portion of Zone 4 and east of Building 79 (Figures E.1.22 through E.1.24) and in subsurface soil in the northwestern portion of Zone 4 (Figures E.1.25 through E.1.29). PDI surface lead concentrations ranged from 160 to 1,370 mg/kg (Table 4-23), and the PDI subsurface sample had a low lead concentration of 128 mg/kg (Table 4-22).

Three Zone 4 soil samples had lead TCLP results that exceeded the RCRA TCLP criterion of 5 mg/L for identification of hazardous waste. The surface soil sample from WE4A had a TCLP lead concentration of 143.0 mg/L, and subsurface soil samples from 13TB3A and QW-1 had TCLP lead concentrations of 150 mg/L and 51.9 mg/L, respectively. Prior to the PDI, SPLP lead concentrations in surface and subsurface soil samples were all less than 0.11 mg/L. In surface soil, the maximum PDI lead SPLP result was 2.18 mg/L at Z4PDI-008 (Table 4-23), and in subsurface soil, the maximum PDI lead SPLP result was 0.55 mg/L at Z4PDI-008 (Table 4-24).

One surface and two subsurface PDI samples from Zone 4 were analyzed for total and hexavalent chromium (Tables 4-21 and 4-22). Total chromium was detected in all three samples, and the maximum total chromium concentration was 12.7 mg/kg. Hexavalent chromium was not detected in any of the samples.

4.2.6 Zone 5

PDI results from Zone 5 surface and subsurface soil samples are summarized in Tables 4-27 and 4-28, respectively. Zone 5 minimum and maximum concentrations, samples with maximum concentrations, frequencies of detection, and ranges of non-detects for PDI surface and subsurface soil samples are presented on Tables 4-29 and 4-30, respectively, and for all samples, including both historical and PDI data, in Tables 4-31 and 4-32, respectively.

Eleven SVOCs were detected in Zone 5 subsurface soil at maximum concentrations at TB4-5RI (sample LS5SB0040201, Table 4-32), located on Amberjack Road just outside the western boundary of Site 22. SVOC concentrations ranged from 1 µg/kg (anthracene) to 23,000 µg/kg (2-methylnapthalene). 2-Methylnapthalene was detected at concentrations greater than 9,500 µg/kg in subsurface soil samples collected from TB1-5RI, 19MW3, and 19MW4. The data also indicate that the former tank on the southern side of Building 175 impacted a portion of Zone 5. This may have been from a historical UST leak or from spillage during UST filling. The Navy has since removed and replaced the UST. VOCs ethylbenzene (38 µg/kg), toluene (10 µg/kg), and xylenes (150 µg/kg) were detected in the surface soil sample from boring 19MW4. Minor oil staining or sheens were observed in surface and subsurface soil samples from borings 19MW3, 19MW4, and 19TB2. To a lesser degree, constituents originating from the UST adjacent to and north of Building 175 are also evident based on analytical results for SVOCs in soil samples.

TPH was detected in all six Zone 5 shallow soil samples for which TPH analysis was performed. The maximum concentration (6,800 mg/kg) was detected in shallow soil sample 19SS1 from 0 to 0.5 foot bgs. This sample was collected from an area of stained soil adjacent to and south of Building 175. Surface and subsurface samples were collected from five PDI locations four of which (Z1PDI-001 through -004) were located near 19SS1 (Figure 2-5). The maximum TPH subsurface concentration near 19SS1 was 2,100 mg/kg at Z5PDI-004 (Table 4-28, Figure 2-5). The PDI samples, along with the TB1-5RI sample (59 mg/kg at 2 to 4 feet bgs) indicate that the area and depth of soil near 19SS1 with elevated TPH concentrations are very small.

The maximum subsurface TPH concentration was 6,200 mg/kg at 19TB2 (6 to 8 feet bgs). Subsurface TPH concentrations at 19MW3 (4 to 6 feet bgs) and 19MW4 (6 to 8 feet bgs) were also greater than 2,500 mg/kg. All other subsurface TPH results were less than 2,500 mg/kg. Ground surface elevations at Zone 5 vary from El. 4.9 feet to 5.7 feet NAVD88. Because mean high water is at El 1.2 feet NAVD88 throughout the Lower Subase, and the depth to mean high water varies from 3.7 to 4.5 feet bgs in this area, tall subsurface TPH results greater than 2,500 mg/kg were deeper than mean high water.

Aroclor-1260 was detected in historic Zone 5 subsurface soil samples from borings 19MW2, 19TB4, and 19TB2 at concentrations ranging from 42 to 140 µg/kg.

Concentrations of inorganics in Zone 5 soil were generally low compared to other zones. Lead concentrations were all less than 100 mg/kg. The maximum lead concentration detected in surface soil (48.4 mg/kg) was less than the maximum concentration in subsurface soil (91.2 mg/kg).

Zone 5 soil samples were analyzed for TCLP lead during the Pier 33 and Berth 16/Former Incinerator Site Investigation [Atlantic Environmental Services, Inc. (Atlantic), 1995] and SPLP lead during the Lower Subase RI (Tetra Tech, 1999) and Soil PDI. TCLP lead results were less than the CTDEEP Remediation Standard Regulations (RSR) for pollutant mobility of 0.15 mg/L, except at 19SS1 (0.173 mg/L at 0 to 0.5 foot bgs) and 19MW2 (0.42 mg/L at 4 to 6 feet bgs). TB6-5RI, located near 19MW2, had very low SPLP lead results (0.002J mg/L at 2 to 4 feet bgs and 0.0016 mg/L at 5.5 to 6.5 feet bgs). The maximum lead SPLP result was 0.01 mg/L at TB1-5RI from 2 to 4 feet bgs.

4.2.7 Zone 6

PDI results from Zone 6 surface and subsurface soil samples are summarized in Tables 4-33 and 4-34, respectively. Zone 6 minimum and maximum concentrations, samples with maximum concentrations, frequencies of detection, and ranges of non-detects for PDI surface and subsurface soil samples are presented in Tables 4-35 and 4-36, respectively, and for all samples, including both historical and PDI data, in Tables 4-37 and 4-38, respectively.

Surface and subsurface soil samples in Zone 6 contained one VOC (surface soil only), various SVOCs (mainly PAHs), TPH, and inorganics. PAHs were detected in 5 of 10 analyzed samples, and concentrations were generally low (Tables 4-37 and 4-38).

TPH was detected in all seven Zone 6 surface samples and 9 of 11 subsurface samples (Tables 4-37 and 4-38), with a maximum soil concentration of 4,000 mg/kg at MW5-6RI at 0.5 to 2 feet bgs. The maximum TPH concentration in surface and subsurface PDI samples collected north, south, east and west of MW5-6RI was 570 mg/kg (Tables 4-33 and 4-34), indicating that the area of soil around MW5-6RI with elevated TPH concentrations is small.

Maximum concentrations of a majority of inorganics were similar in Zone 6 surface and subsurface soil samples. Many detected concentrations were near background concentrations. SPLP analysis for inorganics was performed on both surface and subsurface soil samples. SPLP inorganics were not detected in five of six samples, with one detection of 0.003 mg/kg, indicating that inorganics in Zone 6 soil do not pose a soil-to-groundwater migration concern.

4.2.8 Zone 7

PDI results from Zone 7 surface and subsurface soil samples are summarized in Tables 4-39 and 4-40, respectively. Zone 7 minimum and maximum concentrations, samples with maximum concentrations, frequencies of detection, and ranges of non-detects for PDI surface and subsurface soil samples are

presented in Tables 4-41 and 4-42, respectively, and for all samples, including both historical and PDI data, in Tables 4-43 and 4-44, respectively.

Surface and subsurface soil samples from Zone 7 contained various VOCs, SVOCs, pesticides, TPH, and inorganics. VOCs were detected infrequently and at low concentrations (e.g., maximum of 12 µg/kg methylene chloride and 7 µg/kg carbon disulfide), and some detections may be attributable to laboratory contamination (e.g., acetone); therefore VOCs were not investigated further in the PDI.

SVOCs, primarily PAHs, were detected in Zone 7 surface and subsurface soil samples. The surface sample with the maximum concentrations of PAHs was Z7-PDI-003 (Table 4-43), with a BaPEQ concentration of 14.66 mg/kg (Table 4-39). Relatively high BaPEQ concentrations are indicated on Figures E.1.30 and E.1.31, and cover much of Zone 7. Maximum concentrations of PAHs in subsurface soil were detected in the same area west of Building 456 at location 20MW6 (Table 4-44, Figure 2-7).

Pesticides [4,4'-dichlorodiphenyldichloroethane (DDD), 4,4'-dichlorodiphenyldichloroethylene (DDE), 4,4'-dichlorodiphenyltrichloroethane (DDT), alpha-chlordane, gamma-chlordane, and heptachlor epoxide] were also detected in surface and subsurface soil samples collected from three borings (20MW1, 20TB6, and 20TB7) along the eastern boundary of Zone 7. Based on analytical results from the upgradient surface soil sample (20MW1) and on-site subsurface soil samples, it is likely that the source of pesticides is associated with historical pest control or lawn maintenance activities off site and east of Zone 7.

Only one shallow soil sample collected in Zone 7 was analyzed for TPH, and the resulting concentration was 1,500 mg/kg. The sample was collected at MW4-7RI in the area west of Building 478. TPH in subsurface soil is widespread in Zone 7 but at low to moderate concentrations. The maximum concentration of TPH in subsurface soil (2,600 mg/kg) was in the soil sample collected from MW5-7RI in the area east of Building 175.

Lead was detected in surface and subsurface soil at elevated concentrations over most of the eastern half of Zone 7. The area of lead-contaminated soil extends from the southern end of Building 478, along the western side of Building 456, to the northern ends of Buildings 103 and 106. The maximum concentration of lead in surface soil (31,400 mg/kg) was detected near the southwestern corner of Building 456 at Z7PDI-007 (Figure E. 1. 38, Table 4-41). The maximum SPLP lead concentration in surface soil (1.04 mg/L) was also detected at Z7PDI-007. The maximum lead concentration in subsurface soil was 189,000 mg/kg from location 20MW6 to the west of Building 456. Kriged areas with the greatest lead concentrations in subsurface soil are identified on Figure E.1.39. The maximum TCLP lead concentration was detected in the sample from 20MW5 at a depth of 6 to 8 feet (45.9 mg/L), and it exceeded the RCRA TCLP criterion of 5 mg/L. Concentrations of lead in soil within this area are greater

than lead concentrations reported in soil in any of the other Lower Subase zones. The lead detected in Zone 7 soil may be associated with historical use or maintenance of batteries for submarines, historical use of lead ballast by the Navy, or construction debris or ash and cinders, possibly from the former incinerator, noted in Zone 7 borings.

The vast majority of Zone 7 soil consists of sand; however, borings logs occasionally mention brick, wood, asphalt, metal, or glass (Figure E.1.44). Boring logs from previous investigations indicate ash and cinders at 20TB4 at 14 to 16 feet (9,770 mg/kg lead, 0.66 mg/L TCLP lead) and 20MW6 at 2 to 4 feet bgs (189,000 mg/kg lead). Of 20 Zone 7 PDI borings, three boring logs mention ash/cinders. Z7PDI-003 lists sand with ash/cinders at 2 to 4.5 feet (not analyzed for lead), Z7PIDI-007 lists sand and ash/cinders at 0 to 2 (31,400 mg/kg lead, 1.04 mg/L SPLP lead) and 5 to 6 feet (23,800 mg/kg lead, 0.22 mg/L SPLP lead), and Z7PDI-008 lists sand with gravel and trace ash/cinders at 3.5 to 5 feet (not analyzed for lead). Overall, where present, ash and cinders are generally a minor component of the fill (sand being the predominant component), whereas pure ash and cinders occurred only at 20MW6. A former incinerator was located at Site 25 and is the likely source of the ash and cinders. Some very high mass lead and leachate lead results correspond to locations where ash and cinders are noted in the boring logs. A cross-section of Zone 7 through the area of maximum lead concentrations is shown as Figure E.1.44. Figure E.1.44 denotes generalized lead concentrations by color, individual SPLP and TCLP lead leachate concentrations, mean high water table, and select boring log notations.

Antimony was detected in surface and subsurface soil at Zone 7. Antimony is generally found in automobile brake pads, plastics, flame retardants, electronics, and solder. Antimony is also commonly mixed (alloyed) with other metals such as lead to make the lead harder and stronger for use in lead-acid batteries. Therefore, it is possible that the antimony detected in Zone 7 may be associated with historical use or maintenance of batteries for submarines by the Navy at the Lower Subase. Antimony was detected in 7 of 12 surface soil samples, with a maximum concentration of 50.6 mg/kg in soil boring Z7PDI-007 (Table 4-43). Antimony was detected in 17 of 39 subsurface soil samples, with a maximum concentration of 1,820 mg/kg in soil boring 20TB4 at a depth of 14 to 16 feet bgs.

Surface soil SPLP antimony results ranged from 0.0027 to 0.377 mg/kg, and subsurface SPLP antimony results ranged from 0.0027 to 0.627 mg/kg. Maximum surface and subsurface SPLP antimony concentrations were detected at Z7PDI-010.

Total chromium was detected in both surface soil samples (Table 4-41) and five out of five subsurface samples (Table 4-42), with an overall maximum concentration of 17.4 mg/kg at Z7PDI-005, east of Building 456. Hexavalent chromium was detected in one of two surface samples at a concentration of

0.78 mg/kg at Z7PDI-005, and in two of five samples in subsurface soil, with a maximum concentration of 0.53 mg/kg at Z7PDI-003, southeast of Building 157.

Six soil samples, ranging in depth from 0 to 2 to 8 to 10 feet bgs, were collected in the vicinity of Site 25 during the Pier 33 and Berth 16/Former Incinerator Site Investigation (Atlantic, 1995) and analyzed for dioxins. The results of the investigation were included in the Lower Subase RI. Dioxin was detected in only one sample from location 20MW6 (2 to 4 feet bgs) at a 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) equivalent concentration of 0.16 ng/kg. The methodology for calculating 2,3,7,8-TCDD equivalent concentrations has changed since the Lower Subase RI was prepared. Based on current methodology, the 2,3,7,8-TCDD equivalent concentration would be 0.49 ng/kg. This concentration is less than the USEPA residential regional screening level of 4.5 nanograms (ng)/kg (USEPA, 2010c) and is also less than the Office of Solid Waste and Emergency Response (OSWER) action level of 1 µg/kg for residential exposures and the range of 5 to 20 µg/kg for industrial exposures (USEPA, 1998). Therefore, the data indicate that dioxins are not a concern for Zone 7. The analytical results for dioxins were not validated; consequently, they were not used in the HHRAs included in the Lower Subase RI or this FS.

4.3 CONCLUSIONS AND RECOMMENDATIONS

The Soil PDI was designed to address the following specific concerns or needed information for use in the FS Addendum:

- To delineate contamination above and below mean high water. Whether or not soil contamination is above or below mean high water has regulatory significance. Some historical samples straddled mean high water table, and insufficient data was available for Zone 1 TPH above mean high water, leaving uncertainty as to where relevant contamination existed. The PDI provided sufficient results to delineate contamination above and below mean high water.

- To provide additional surface sample results. Surface samples were required to address specific regulatory concerns. The PDI provided sufficient surface soil results in each zone to address these concerns in the FS Addendum.

- To provide additional soil samples in unpaved areas. An emphasis on surface soil samples in unpaved areas was required to address regulatory concerns. The PDI provided sufficient surface soil results to address this concern.

- To provide additional stratigraphic (boring log) information regarding ash and cinders in Zone 7. Previous borings indicated ash and cinders in Zone 7 but did not provide enough information to evaluate the extent of these materials. PDI boring logs provided sufficient additional information to

determine that where present, ash and cinders are generally a minor component of the fill (sand being the predominant component), whereas pure ash and cinders occurred only at 20MW6. Ash and cinders were not present in the majority of either the PDI or historical borings.

- To provide SPLP antimony (Zone 7 only) and additional SPLP lead results. Metals leachate results are needed to address specific regulatory concerns for soil above mean high water. The PDI provided sufficient quantity of results to address these concerns.

- To provide total and hexavalent chromium sample results within PAL restrictions. PDI chromium results are sufficient to evaluate human health risks associated with hexavalent and trivalent chromium.

- To provide sufficient data to effectively bound estimated areas of contaminated soil. The PDI provided “clean” data to refine the boundaries of contamination.

The PDI provided sufficient results such that areas and volumes of each soil contaminant exceeding regulatory criteria can be estimated. Overall, the results of the PDI, combined with historical data, provide a sufficient understanding of nature and extent of soil contamination in Zones 1 through 7 to support the FS Addendum.

Residual areas needing additional information regarding the nature and extent of contamination are minimal, and can be easily addressed in association with planned future work, rather than an extension of the PDI. It is recommended that the PDI be considered complete and the FS Addendum be completed using the existing set of data (historical and PDI). Sufficient data have been collected to support the selection of a final remedy and to proceed to a remedial design. Minor information needs can be addressed, if necessary, with supplemental investigations to support the remedial design. Collection of additional soil data may also be required in the future if a confirmation sampling program is required as part of remedial alternatives (e.g., excavation).

TABLE 4-1
SAMPLE COLLECTION COMPLETENESS EVALUATION - SOIL
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Zone 1 - Soil

Analytical Fraction	Planned Environmental Samples	Environmental Samples Collected	Environmental Sample Collection Percent Completeness	Rationale for Percent Completeness < 95%
PAHs	17	16	94	A subsurface sample could not be collected due to refusal.
ETPH	38	31	82	One surface sample could not be collected because there was no soil in the top 2 feet and several subsurface samples could not be collected due to refusal.
SPLP Metals - Lead	1	1	100	

Zone 2 - Soil

Analytical Fraction	Planned Environmental Samples	Environmental Samples Collected	Environmental Sample Collection Percent Completeness
PAHs	0	1	NA
ETPH	3	3	100
Metals - Lead and antimony	0	1	NA
SPLP Metals - Lead	1	1	100
SPLP Metals - Lead and antimony	0	1	NA

Zone 3 - Soil

Analytical Fraction	Planned Environmental Samples	Environmental Samples Collected	Environmental Sample Collection Percent Completeness	Rationale for Percent Completeness < 95%
Metals - Lead	5	4	80	Location did not pass utility clearance.
SPLP Metals - Lead	10	7	70	One location did not pass utility clearance (two samples) and one subsurface sample could not be collected due to refusal.

TABLE 4-1
SAMPLE COLLECTION COMPLETENESS EVALUATION - SOIL
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Zone 4 - Soil

Analytical Fraction	Planned Environmental Samples	Environmental Samples Collected	Environmental Sample Collection Percent Completeness
PAHs	3	3	100
ETPH	5	5	100
Metals - Lead	6	6	100
SPLP Metals - Lead	8	8	100
Hexavalent Chromium	3	3	100
Total Chromium	3	3	100

Zone 5 - Soil

Analytical Fraction	Planned Environmental Samples	Environmental Samples Collected	Environmental Sample Collection Percent Completeness
ETPH	10	10	100

Zone 6 - Soil

Analytical Fraction	Planned Environmental Samples	Environmental Samples Collected	Environmental Sample Collection Percent Completeness
ETPH	8	8	100

Zone 7 - Soil

Analytical Fraction	Planned Environmental Samples	Environmental Samples Collected	Environmental Sample Collection Percent Completeness	Rationale for Percent Completeness < 95%
PAHs	28	27	96	A subsurface sample could not be collected due to refusal.
Metals - Lead	8	7	88	A subsurface sample could not be collected due to refusal.
Metals - Antimony	4	4	100	
Metals - Lead and antimony	12	12	100	
SPLP Metals - Lead	4	4	100	
SPLP Metals - Antimony	5	5	100	
SPLP Metals - Lead and antimony	14	13	93	A subsurface sample could not be collected due to refusal.
Hexavalent Chromium	7	7	100	
Total Chromium	7	7	100	

TABLE 4-1
SAMPLE COLLECTION COMPLETENESS EVALUATION - SOIL
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

QC Samples - Soil

Analytical Fraction	Field Duplicates Expected	Field Duplicates Collected	Field Duplicate Percent Completeness	Planned Rinsate Blanks	Rinsate Blanks Collected	Rinsate Blank Percent Completeness	Planned MS/MSD	MS/MSD Collected	MS/MSD Percent Completeness
PAHs	5	5	100	TBD	2	100	3	3	100
ETPH	7	7	100	TBD	2	100	4	4	100
Metals - Lead	2	2	100	TBD	(1)	NA	1	1	100
Metals - Antimony	2	1	50	TBD	(1)	NA	1	1	100
Metals - Lead and antimony	1	2	200	TBD	2	100	1	0	0
SPLP Metals - Lead	3	3	100	TBD	(2)	NA	2	2	100
SPLP Metals - Antimony	2	1	50	TBD	(2)	NA	1	1	100
SPLP Metals - Lead and antimony	1	3	300	TBD	2	100	1	2	200
Hexavalent Chromium	1	1	100	TBD	(3)	NA	1	1	100
Total Chromium	1	1	100	TBD	(3)	NA	1	1	100

Footnotes

(1) Included in "Metals - Lead and Antimony"

(2) Included in "SPLP Metals- Lead and antimony"

(3) Chromium not expected to present in equipment

Acronyms

ETPH - Extractable Total Petroleum Hydrocarbons

MS/MSD - matrix spike/matrix spike duplicate

NA - Not Applicable

PAHs - Polycyclic aromatic hydrocarbons

QC - Quality control

SPLP - Synthetic Precipitation Leaching Procedure

TBD - To be determined during sampling

TABLE 4-2
LABORATORY MEASUREMENT COMPLETENESS EVALUATION - SOIL
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Zone 1 - Soil

Analytical Fraction	Environmental Samples Collected	Number of Parameters	Valid Analytical Results (1)	Percent Completeness
PAHs	16	10	160	100
ETPH	31	1	31	100
SPLP Metals - Lead	1	1	1	100

Zone 2 - Soil

Analytical Fraction	Environmental Samples Collected	Number of Parameters	Valid Analytical Results (1)	Percent Completeness
PAHs	1	10	10	100
ETPH	3	1	3	100
Metals - Lead and antimony	1	2	2	100
SPLP Metals - Lead	1	1	1	100
SPLP Metals - Lead and antimony	1	2	2	100

Zone 3 - Soil

Analytical Fraction	Environmental Samples Collected	Number of Parameters	Valid Analytical Results (1)	Percent Completeness
Metals - Lead	4	1	4	100
SPLP Metals - Lead	7	1	7	Location did not pass utility clearance. Subsurface sample could not be collected due to refusal.

Zone 4 - Soil

Analytical Fraction	Environmental Samples Collected	Number of Parameters	Valid Analytical Results (1)	Percent Completeness
PAHs	3	10	30	100
ETPH	5	1	5	100
Metals - Lead	6	1	6	100
SPLP Metals - Lead	8	1	8	100
Hexavalent Chromium	3	1	3	100
Total Chromium	3	1	3	100

Zone 5 - Soil

Analytical Fraction	Environmental Samples Collected	Number of Parameters	Valid Analytical Results (1)	Percent Completeness
ETPH	10	1	10	100

TABLE 4-2
LABORATORY MEASUREMENT COMPLETENESS EVALUATION - SOIL
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Zone 6 - Soil

Analytical Fraction	Environmental Samples Collected	Number of Parameters	Valid Analytical Results (1)	Percent Completeness
ETPH	8	1	8	100

Zone 7 - Soil

Analytical Fraction	Environmental Samples Collected	Number of Parameters	Valid Analytical Results (1)	Percent Completeness
PAHs	27	10	270	100
Metals - Lead	7	1	7	100
Metals - Antimony	4	1	4	100
Metals - Lead and antimony	12	2	24	100
SPLP Metals - Lead	4	1	4	100
SPLP Metals - Antimony	5	1	5	100
SPLP Metals - Lead and antimony	13	2	26	100
Hexavalent Chromium	7	1	7	100
Total Chromium	7	1	7	100

QC Samples - Soil

Analytical Fraction	Field Duplicates Collected	Number of Parameters	Valid Analytical Results (1)	Field Duplicate Percent Completeness	Rinsate Blanks Collected	Valid Analytical Results (1)	Rinsate Blank Percent Completeness	MS/MSD Collected	Valid Analytical Results (1)	MS/MSD Percent Completeness
PAHs	5	10	50	100	2	20	100	3	30	100
ETPH	7	1	7	100	2	2	100	4	4	100
Metals - Lead	2	1	2	100	0	0	100	1	1	100
Metals - Antimony	1	1	1	100	0	0	100	1	1	100
Metals - Lead and antimony	2	2	4	100	2	4	100	1	2	100
SPLP Metals - Lead	3	1	3	100	0	0	100	2	1	100
SPLP Metals - Antimony	1	1	1	100	0	0	100	1	1	100
SPLP Metals - Lead and antimony	3	2	6	100	2	4	100	1	2	100
Hexavalent Chromium	1	1	1	100	0	0	100	1	0	NA; not required for method
Total Chromium	1	1	1	100	0	0	100	1	1	100

Footnotes

1. Valid Analytical Results = The number of parameters per matrix multipled by the number of samples collected.

Acronyms

ETPH - Extractable Total Petroleum Hydrocarbons
MS/MSD - matrix spike/matrix spike duplicate
NA - Not Applicable
PAHs - Polycyclic aromatic hydrocarbons
QC - Quality control
SPLP - Synthetic Precipitation Leaching Procedure
TBD - To be determined during sampling

TABLE 4-3

DETECTED CONCENTRATIONS IN PDI ZONE 1 SURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z1PDI-001 Z1PDI-SO-001-0002 20100908	Z1PDI-002 Z1PDI-SO-002-0002 20100911	Z1PDI-003 Z1PDI-SO-003-0002 20100908	Z1PDI-004 Z1PDI-SO-004-0002 20100908	Z1PDI-005 Z1PDI-SO-005-0002 20100912
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENTS	NA	477.85	NA	7955.30	NA
BENZO(A)ANTHRACENE	NA	430	NA	4100	NA
BENZO(A)PYRENE	NA	290	NA	5500	NA
BENZO(B)FLUORANTHENE	NA	460 J	NA	7000	NA
BENZO(K)FLUORANTHENE	NA	150	NA	3200	NA
CARBAZOLE	NA	140	NA	34	NA
CHRYSENE	NA	350 J	NA	3300 J	NA
DIBENZO(A,H)ANTHRACENE	NA	76	NA	1000 J	NA
INDENO(1,2,3-CD)PYRENE	NA	210	NA	3100	NA
PHENANTHRENE	NA	550	NA	240	NA
PYRENE	NA	940	NA	4500	NA
PETROLEUM HYDROCARBONS (MG/KG)					
TPH (C09-C36)[1]	45 J	170	37 J	390 J	43
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	90	90	78	93	94

1 - ETPH analytical method.

TABLE 4-3

DETECTED CONCENTRATIONS IN PDI ZONE 1 SURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z1PDI-006 Z1PDI-SO-006-0002 20100908	Z1PDI-008 Z1PDI-SO-008-0002 20100914	Z1PDI-009 Z1PDI-SO-009-0002 20100908	Z1PDI-010 Z1PDI-SO-010-0002 20100908	Z1PDI-011 Z1PDI-SO-011-0002 20100909
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENTS	NA	4016.40	131.42	67.13	88.57
BENZO(A)ANTHRACENE	NA	2600	71	28	43
BENZO(A)PYRENE	NA	2600	86	40	58
BENZO(B)FLUORANTHENE	NA	3700	120	55	83
BENZO(K)FLUORANTHENE	NA	1400	45	20 J	32
CARBAZOLE	NA	85	7.7 J	3.1 J	11 UJ
CHRYSENE	NA	2400	67 J	33 J	49 J
DIBENZO(A,H)ANTHRACENE	NA	560 J	20 J	15 J	13 J
INDENO(1,2,3-CD)PYRENE	NA	2100	58	36 J	46
PHENANTHRENE	NA	1100	39	19 J	21 J
PYRENE	NA	3800	130 J	50	53
PETROLEUM HYDROCARBONS (MG/KG)					
TPH (C09-C36)[1]	2200 J	710	NA	NA	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	92	94	96	94	92

1 - ETPH analytical method.

TABLE 4-3

DETECTED CONCENTRATIONS IN PDI ZONE 1 SURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z1PDI-012 Z1PDI-SO-012-0002 20100908	Z1PDI-013 Z1PDI-SO-013-0002 20100908	Z1PDI-014 Z1PDI-SO-014-0002 20100910
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)			
BAP EQUIVALENTS	178.44	NA	NA
BENZO(A)ANTHRACENE	140	NA	NA
BENZO(A)PYRENE	120	NA	NA
BENZO(B)FLUORANTHENE	180	NA	NA
BENZO(K)FLUORANTHENE	82	NA	NA
CARBAZOLE	2.9 J	NA	NA
CHRYSENE	120 J	NA	NA
DIBENZO(A,H)ANTHRACENE	19 J	NA	NA
INDENO(1,2,3-CD)PYRENE	65	NA	NA
PHENANTHRENE	11 J	NA	NA
PYRENE	120 J	NA	NA
PETROLEUM HYDROCARBONS (MG/KG)			
TPH (C09-C36)[1]	NA	180	250
MISCELLANEOUS PARAMETERS (%)			
TOTAL SOLIDS	93	93	85

1 - ETPH analytical method.

TABLE 4-4

DETECTED CONCENTRATIONS IN PDI ZONE 1 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z1PDI-001		Z1PDI-002	Z1PDI-003	
	Z1PDI-SO-001-0204 20100908	Z1PDI-SO-001-0810 20100908	Z1PDI-SO-002-0204 20100911	Z1PDI-SO-003-0406 20100908	Z1PDI-SO-003-0809 20100908
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENTS	NA	NA	775.45	NA	NA
BENZO(A)ANTHRACENE	NA	NA	580 J	NA	NA
BENZO(A)PYRENE	NA	NA	520 J	NA	NA
BENZO(B)FLUORANTHENE	NA	NA	630 J	NA	NA
BENZO(K)FLUORANTHENE	NA	NA	190 J	NA	NA
CARBAZOLE	NA	NA	200 J	NA	NA
CHRYSENE	NA	NA	550 J	NA	NA
DIBENZO(A,H)ANTHRACENE	NA	NA	100 J	NA	NA
INDENO(1,2,3-CD)PYRENE	NA	NA	320 J	NA	NA
PHENANTHRENE	NA	NA	860 J	NA	NA
PYRENE	NA	NA	1400 J	NA	NA
PETROLEUM HYDROCARBONS (MG/KG)					
TPH (C09-C36)[1]	630 J	82 J	300	16 J	150 J
SPLP METALS (UG/L)					
LEAD	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	95	94	90	93	94

1 - ETPH analytical method.

TABLE 4-4

DETECTED CONCENTRATIONS IN PDI ZONE 1 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z1PDI-003				Z1PDI-004
	Z1PDI-SO-003-0910 20100908	Z1PDI-SO-003-1012 20100908	Z1PDI-SO-003-1012-D 20100908	Z1PDI-SO-003-1214 20100908	Z1PDI-SO-004-0406 20100908
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENTS	NA	NA	NA	NA	2539.70
BENZO(A)ANTHRACENE	NA	NA	NA	NA	1400
BENZO(A)PYRENE	NA	NA	NA	NA	1700
BENZO(B)FLUORANTHENE	NA	NA	NA	NA	2300
BENZO(K)FLUORANTHENE	NA	NA	NA	NA	850
CARBAZOLE	NA	NA	NA	NA	21
CHRYSENE	NA	NA	NA	NA	1200 J
DIBENZO(A,H)ANTHRACENE	NA	NA	NA	NA	360
INDENO(1,2,3-CD)PYRENE	NA	NA	NA	NA	1000
PHENANTHRENE	NA	NA	NA	NA	250
PYRENE	NA	NA	NA	NA	1800
PETROLEUM HYDROCARBONS (MG/KG)					
TPH (C09-C36)[1]	10000 J	8100 J	7800 J	8200 J	54 J
SPLP METALS (UG/L)					
LEAD	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	93	90	93	90	93

1 - ETPH analytical method.

TABLE 4-4

DETECTED CONCENTRATIONS IN PDI ZONE 1 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z1PDI-004			Z1PDI-005	
	Z1PDI-SO-004-0809 20100908	Z1PDI-SO-004-0910 20100908	Z1PDI-SO-004-0910-D 20100908	Z1PDI-SO-005-0305 20100912	Z1PDI-SO-005-0507 20100912
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENTS	183.44	NA	NA	NA	NA
BENZO(A)ANTHRACENE	120	NA	NA	NA	NA
BENZO(A)PYRENE	120 J	NA	NA	NA	NA
BENZO(B)FLUORANTHENE	180 J	NA	NA	NA	NA
BENZO(K)FLUORANTHENE	54 J	NA	NA	NA	NA
CARBAZOLE	27	NA	NA	NA	NA
CHRYSENE	100 J	NA	NA	NA	NA
DIBENZO(A,H)ANTHRACENE	25 J	NA	NA	NA	NA
INDENO(1,2,3-CD)PYRENE	78 J	NA	NA	NA	NA
PHENANTHRENE	180	NA	NA	NA	NA
PYRENE	240	NA	NA	NA	NA
PETROLEUM HYDROCARBONS (MG/KG)					
TPH (C09-C36)[1]	180 J	1800 J	1900 J	7	2500
SPLP METALS (UG/L)					
LEAD	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	93	93	95	96	89

1 - ETPH analytical method.

TABLE 4-4

DETECTED CONCENTRATIONS IN PDI ZONE 1 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z1PDI-006		Z1PDI-007	Z1PDI-008	
	Z1PDI-SO-006-0204	Z1PDI-SO-006-0810	Z1PDI-SO-007-0405	Z1PDI-SO-008-0405	Z1PDI-SO-008-0910
	20100908	20100908	20100909	20100914	20100914
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENTS	NA	NA	NA	645.96	NA
BENZO(A)ANTHRACENE	NA	NA	NA	340	NA
BENZO(A)PYRENE	NA	NA	NA	420	NA
BENZO(B)FLUORANTHENE	NA	NA	NA	600	NA
BENZO(K)FLUORANTHENE	NA	NA	NA	160 J	NA
CARBAZOLE	NA	NA	NA	21	NA
CHRYSENE	NA	NA	NA	360	NA
DIBENZO(A,H)ANTHRACENE	NA	NA	NA	100 J	NA
INDENO(1,2,3-CD)PYRENE	NA	NA	NA	300	NA
PHENANTHRENE	NA	NA	NA	190	NA
PYRENE	NA	NA	NA	600	NA
PETROLEUM HYDROCARBONS (MG/KG)					
TPH (C09-C36)[1]	29 J	3.8 UJ	240	160	420
SPLP METALS (UG/L)					
LEAD	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	90	97	94	93	91

1 - ETPH analytical method.

TABLE 4-4

DETECTED CONCENTRATIONS IN PDI ZONE 1 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z1PDI-009		Z1PDI-010	Z1PDI-011	Z1PDI-012
	Z1PDI-SO-009-0406	Z1PDI-SO-009-0809	Z1PDI-SO-010-0405	Z1PDI-SO-011-0405	Z1PDI-SO-012-0204
	20100908	20100908	20100908	20100909	20100908
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENTS	11.55	10.00 U	299.07	1792.12	10.00 U
BENZO(A)ANTHRACENE	10 U	10 U	160	660	10 U
BENZO(A)PYRENE	10 U	10 U	190	1200	10 U
BENZO(B)FLUORANTHENE	10 U	10 U	240	1600	10 U
BENZO(K)FLUORANTHENE	10 U	10 U	93	550	10 U
CARBAZOLE	10 U	10 U	10 U	11 UJ	10 U
CHRYSENE	1.7 J	10 UJ	140 J	620 J	10 UJ
DIBENZO(A,H)ANTHRACENE	10 U	10 U	50	260	10 U
INDENO(1,2,3-CD)PYRENE	10 U	10 U	180	1000	10 U
PHENANTHRENE	10 U	10 U	530	28	10 U
PYRENE	2.8 J	10 UJ	390	910	10 U
PETROLEUM HYDROCARBONS (MG/KG)					
TPH (C09-C36)[1]	NA	NA	NA	NA	NA
SPLP METALS (UG/L)					
LEAD	2.7 J	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	98	94	92	89	95

1 - ETPH analytical method.

TABLE 4-4

DETECTED CONCENTRATIONS IN PDI ZONE 1 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z1PDI-013		Z1PDI-014		
	Z1PDI-SO-013-0204 20100908	Z1PDI-SO-013-0204-D 20100908	Z1PDI-SO-014-0204 20100910	Z1PDI-SO-014-0608 20100910	Z1PDI-SO-014-0810 20100910
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENTS	NA	NA	NA	NA	NA
BENZO(A)ANTHRACENE	NA	NA	NA	NA	NA
BENZO(A)PYRENE	NA	NA	NA	NA	NA
BENZO(B)FLUORANTHENE	NA	NA	NA	NA	NA
BENZO(K)FLUORANTHENE	NA	NA	NA	NA	NA
CARBAZOLE	NA	NA	NA	NA	NA
CHRYSENE	NA	NA	NA	NA	NA
DIBENZO(A,H)ANTHRACENE	NA	NA	NA	NA	NA
INDENO(1,2,3-CD)PYRENE	NA	NA	NA	NA	NA
PHENANTHRENE	NA	NA	NA	NA	NA
PYRENE	NA	NA	NA	NA	NA
PETROLEUM HYDROCARBONS (MG/KG)					
TPH (C09-C36)[1]	18	14	120	45	520
SPLP METALS (UG/L)					
LEAD	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	97	96	93	93	88

1 - ETPH analytical method.

TABLE 4-5

SUMMARY OF ZONE 1 SURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Detected Chemical	Frequency of Detection(2)	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(3)
PAHs (µg/kg)						
NA	BAP Equivalents	7/7	67.13	7955.30	Z1PDI-SO-004-0002	NA
56-55-3	Benzo(a)anthracene	7/7	28	4100	Z1PDI-SO-004-0002	NA
50-32-8	Benzo(a)pyrene	7/7	40	5500	Z1PDI-SO-004-0002	NA
205-99-2	Benzo(b)fluoranthene	7/7	55	7000	Z1PDI-SO-004-0002	NA
207-08-9	Benzo(k)fluoranthene	7/7	20 J	3200	Z1PDI-SO-004-0002	NA
86-74-8	Carbazole	6/7	2.9 J	140	Z1PDI-SO-002-0002	11
218-01-9	Chrysene	7/7	33 J	3300 J	Z1PDI-SO-004-0002	NA
53-70-3	Dibenzo(a,h)anthracene	7/7	13 J	1000 J	Z1PDI-SO-004-0002	NA
193-39-5	Indeno(1,2,3-cd)pyrene	7/7	36 J	3100	Z1PDI-SO-004-0002	NA
85-01-8	Phenanthrene	7/7	11 J	1100	Z1PDI-SO-008-0002	NA
129-00-0	Pyrene	7/7	50	4500	Z1PDI-SO-004-0002	NA
Petroleum Hydrocarbons (mg/kg)						
NA	TPH (C09 - C36)[4]	9/9	37 J	2200 J	Z1PDI-SO-006-0002	NA
Miscellaneous Parameters (%)						
NA	Total Solids	13/13	78	96	Z1PDI-SO-009-0002	NA

NA - Not applicable.
Note: All analyzed chemicals were detected.

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations
2 - Detected duplicates are considered one detection
3 - Values presented are sample-specific quantitation limits
4 - ETPH analytical method

Associated Samples:

Z1PDI-SO-001-0002	Z1PDI-SO-004-0002	Z1PDI-SO-008-0002	Z1PDI-SO-011-0002
Z1PDI-SO-002-0002	Z1PDI-SO-005-0002	Z1PDI-SO-009-0002	Z1PDI-SO-012-0002
Z1PDI-SO-003-0002	Z1PDI-SO-006-0002	Z1PDI-SO-010-0002	Z1PDI-SO-013-0002
			Z1PDI-SO-014-0002

TABLE 4-6

SUMMARY OF ZONE 1 SUBSURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Detected Chemical	Frequency of Detection[2]	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-Detects[3]
PAHs (µg/kg)						
NA	BAP Equivalents	7/9	11.55	2539.70	Z1PDI-SO-004-0406	10
56-55-3	Benzo(a)anthracene	6/9	120	1400	Z1PDI-SO-004-0406	10
50-32-8	Benzo(a)pyrene	6/9	120 J	1700	Z1PDI-SO-004-0406	10
205-99-2	Benzo(b)fluoranthene	6/9	180 J	2300	Z1PDI-SO-004-0406	10
207-08-9	Benzo(k)fluoranthene	6/9	54 J	850	Z1PDI-SO-004-0406	10
86-74-8	Carbazole	4/9	21	200 J	Z1PDI-SO-002-0204	10 - 11
218-01-9	Chrysene	7/9	1.7 J	1200 J	Z1PDI-SO-004-0406	10
53-70-3	Dibenzo(a,h)anthracene	6/9	25 J	360	Z1PDI-SO-004-0406	10
193-39-5	Indeno(1,2,3-cd)pyrene	6/9	78 J	1000	Z1PDI-SO-004-0406	10
193-39-5	Indeno(1,2,3-cd)pyrene	6/9	78 J	1000	Z1PDI-SO-011-0405	10
85-01-8	Phenanthrene	6/9	28	860 J	Z1PDI-SO-002-0204	10
129-00-0	Pyrene	7/9	2.8 J	1800	Z1PDI-SO-004-0406	10
Petroleum Hydrocarbons (mg/kg)						
NA	TPH (C09 - C36)[4]	21/22	7	10000 J	Z1PDI-SO-003-0910	3.8
SPLP Inorganics (µg/L)						
7439-92-1	Lead	1/1	2.7 J	2.7 J	Z1PDI-SO-009-0406	NA
Miscellaneous Parameters (%)						
NA	Total Solids	27/27	88	98	Z1PDI-SO-009-0406	NA

NA - Not applicable.

Note: All analyzed chemicals were detected.

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations
2 - Detected duplicates are considered one detection
3 - Values presented are sample-specific quantitation limits
4 - ETPH analytical method

TABLE 4-6

SUMMARY OF ZONE 1 SUBSURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Associated Samples:

Z1PDI-SO-001-0204	Z1PDI-SO-006-0204
Z1PDI-SO-001-0810	Z1PDI-SO-006-0810
Z1PDI-SO-002-0204	Z1PDI-SO-007-0405
Z1PDI-SO-003-0406	Z1PDI-SO-008-0405
Z1PDI-SO-003-0809	Z1PDI-SO-008-0910
Z1PDI-SO-003-0910	Z1PDI-SO-009-0406
Z1PDI-SO-003-1012	Z1PDI-SO-009-0809
Z1PDI-SO-003-1012-D	Z1PDI-SO-010-0405
Z1PDI-SO-003-1214	Z1PDI-SO-011-0405
Z1PDI-SO-004-0406	Z1PDI-SO-012-0204
Z1PDI-SO-004-0809	Z1PDI-SO-013-0204
Z1PDI-SO-004-0910	Z1PDI-SO-013-0204-D
Z1PDI-SO-004-0910-D	Z1PDI-SO-014-0204
Z1PDI-SO-005-0305	Z1PDI-SO-014-0608
Z1PDI-SO-005-0507	Z1PDI-SO-014-0810

TABLE 4-7
SUMMARY OF ALL ZONE 1 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
Volatile Organic Compounds (µg/kg)						
67-64-1	Acetone	1/1	54 B	54 B	Pipe Chase (94)	-
75-09-2	Methylene Chloride	1/1	15 B	15 B	Pipe Chase (94)	-
1330-20-7	Total Xylenes	1/1	1.29	1.29	Pipe Chase (94)	-
Semivolatile Organic Compounds (µg/kg)						
83-32-9	Acenaphthene	1/1	24 J	24 J	Pipe Chase (94)	-
120-12-7	Anthracene	1/1	30 J	30 J	Pipe Chase (94)	-
56-55-3	Benzo(a)anthracene	8/8	28 J	4,100	Z1PDI-SO-004-0002	-
50-32-8	Benzo(a)pyrene	8/8	40 J	5,500	Z1PDI-SO-004-0002	-
205-99-2	Benzo(b)fluoranthene	8/8	55 J	7,000	Z1PDI-SO-004-0002	-
191-24-2	Benzo(g,h,i)perylene	1/1	88 J	88 J	Pipe Chase (94)	-
207-08-9	Benzo(k)fluoranthene	8/8	20 J	3,200	Z1PDI-SO-004-0002	-
117-81-7	bis(2-Ethylhexyl) phthalate	1/1	97 J	97 J	Pipe Chase (94)	-
86-74-8	Carbazole	7/8	2.9 J	140	Z1PDI-SO-002-0002	11
218-01-9	Chrysene	8/8	33 J	3,300 J	Z1PDI-SO-004-0002	-
53-70-3	Dibenzo(a,h)anthracene	8/8	13 J	1,000 J	Z1PDI-SO-004-0002	-
193-39-5	Indeno(1,2,3-cd)pyrene	8/8	36 J	3,100	Z1PDI-SO-004-0002	-
85-01-8	Phenanthrene	8/8	11 J	1,100	Z1PDI-SO-008-0002	-
129-00-0	Pyrene	8/8	50 J	4,500	Z1PDI-SO-004-0002	-
Inorganics (mg/kg)						
7429-90-5	Aluminum	1/1	5,710	5,710	Pipe Chase (94)	-
7440-36-0	Antimony	1/1	0.64	0.64	Pipe Chase (94)	-
7440-39-3	Barium	1/1	20.5	20.5	Pipe Chase (94)	-
7440-41-7	Beryllium	1/1	0.2	0.2	Pipe Chase (94)	-
7440-43-9	Cadmium	1/1	0.34	0.34	Pipe Chase (94)	-
7440-70-2	Calcium	1/1	838	838	Pipe Chase (94)	-
15723-28-1	Total Chromium	1/1	4.9	4.9	Pipe Chase (94)	-
7440-50-8	Copper	1/1	8	8	Pipe Chase (94)	-
7439-89-6	Iron	1/1	6,810	6,810	Pipe Chase (94)	-
7439-92-1	Lead	1/1	7.7	7.7	Pipe Chase (94)	-
7439-95-4	Magnesium	1/1	1,420	1,420	Pipe Chase (94)	-
7439-96-5	Manganese	1/1	122	122	Pipe Chase (94)	-

TABLE 4-7
SUMMARY OF ALL ZONE 1 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
Inorganics (continued) (mg/kg)						
7440-02-0	Nickel	1/1	3.4	3.4	Pipe Chase (94)	-
7440-09-7	Potassium	1/1	1,280	1,280	Pipe Chase (94)	-
7440-22-4	Silver	1/1	0.54	0.54	Pipe Chase (94)	-
7440-23-5	Sodium	1/1	422	422	Pipe Chase (94)	-
7440-62-2	Vanadium	1/1	8.9	8.9	Pipe Chase (94)	-
7440-66-6	Zinc	1/1	18.3	18.3	Pipe Chase (94)	-
Petroleum Hydrocarbons (mg/kg)						
--	TPH (C09 - C36)[3]	9/9	37 J	2,200 J	Z1PDI-SO-006-0002	-
--	TPH[4]	1/1	10.8 U	10.8 U	Pipe Chase (94)	-

J = Estimated value

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - ETPH analytical method
4 - Method 418.1

Associated Samples
Pipe Chase (94)

Z1PDI-SO-001-0002	Z1PDI-SO-009-0002
Z1PDI-SO-002-0002	Z1PDI-SO-010-0002
Z1PDI-SO-003-0002	Z1PDI-SO-011-0002
Z1PDI-SO-004-0002	Z1PDI-SO-012-0002
Z1PDI-SO-005-0002	Z1PDI-SO-013-0002
Z1PDI-SO-006-0002	Z1PDI-SO-014-0002
Z1PDI-SO-008-0002	

TABLE 4-8
SUMMARY OF ALL ZONE 1 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Frequency of Detection	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-Detects[2]
Volatile Organic Compounds (µg/kg)						
75-15-0	Carbon Disulfide	1/8	5 J	5 J	110790-13MW7(8-10)	5 - 560
1330-20-7	Total Xylenes	1/10	0.657 J	0.657 J	Tank Grave-N (94)	1.07 - 560
Semivolatile Organic Compounds (µg/kg)						
105-67-9	2,4-Dimethylphenol	1/16	37 J	37 J	LS1SB0020101	330 - 460
91-57-6	2-Methylnaphthalene	8/18	32 J	1,500 J	LS1SB0020201	330 - 430
83-32-9	Acenaphthene	6/18	36 J	4,300 J	LS1SB0020201	330 - 430
208-96-8	Acenaphthylene	7/18	18 J	950	LS1SB0020101, LS1SB0040101	330 - 430
120-12-7	Anthracene	8/18	33 J	12,000	LS1SB0020101	330 - 430
56-55-3	Benzo(a)anthracene	20/27	20 J	21,000	LS1SB0020101	10 - 360
50-32-8	Benzo(a)pyrene	20/27	18 J	17,000	LS1SB0020101	10 - 360
205-99-2	Benzo(b)fluoranthene	18/27	31 J	17,000	LS1SB0020101	10 - 400
191-24-2	Benzo(g,h,i)perylene	13/18	20 J	9,000	LS1SB0020101	330 - 360
207-08-9	Benzo(k)fluoranthene	16/27	35 J	11,000 J	LS1SB0020201	10 - 360
117-81-7	bis(2-Ethylhexyl) phthalate	1/18	1,100	1,100	LS1SB0050301	330 - 460
85-68-7	Butyl Benzyl Phthalate	1/18	22 J	22 J	LS1SB0040301	330 - 460
86-74-8	Carbazole	8/27	21 J	5,200 J	LS1SB0020201	10 - 460
218-01-9	Chrysene	22/27	1.7 J	19,000	LS1SB0020101	10 - 360
84-74-2	di-n-Butyl Phthalate	2/18	130 J	680	LS1SB0080301	330 - 460
53-70-3	Dibenzo(a,h)anthracene	14/27	25 J	5,200	LS1SB0020101	10 - 360
132-64-9	Dibenzofuran	6/18	40 J	4,700 J	LS1SB0020201	330 - 430
206-44-0	Fluoranthene	14/18	23 J	44,000	LS1SB0020101	330 - 360
86-73-7	Fluorene	7/18	61 J	5,200 J	LS1SB0020201	330 - 430
193-39-5	Indeno(1,2,3-cd)pyrene	19/27	25 J	12,000	LS1SB0020101	10 - 360
91-20-3	Naphthalene	8/18	19 J	1,700 J	LS1SB0020201	330 - 430
85-01-8	Phenanthrene	20/27	20 J	42,000	LS1SB0020201	10 - 360
108-95-2	Phenol	1/16	29 J	29 J	LS1SB0020101	330 - 460
129-00-0	Pyrene	22/27	2.8 J	45,000	LS1SB0020101	10 - 360
Inorganics (mg/kg)						
7429-90-5	Aluminum	11/11	3,250	6,980	13MW5(10-12)	-
7440-38-2	Arsenic	10/11	0.53	12.3	LS1SB0020101	0.47 - 0.47

TABLE 4-8
SUMMARY OF ALL ZONE 1 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Frequency of Detection	Minimum Concentration[1]	Maximum Concentration[1]	Sample of Maximum Concentration	Range of Nondetects[2]
Inorganics (continued)						
7440-39-3	Barium	11/11	14.7	45.7	LS1SB0020101	-
7440-41-7	Beryllium	4/11	0.2 J	0.4	110790-13MW4(6-8)	0.18 - 0.24
7440-43-9	Cadmium	8/11	0.57 J	1.4 J	110790-13MW8(8-10)	0.03 - 0.04
7440-70-2	Calcium	11/11	539 J	19,900 J	LS1SB0060101	-
15723-28-1	Chromium	11/11	4.6	15.4	110590-13MW1(12-14)	-
7440-48-4	Cobalt	11/11	1.8	5.5	110790-13MW4(6-8), 110890-13MW5(10-12)	-
7440-50-8	Copper	11/11	7.7 J	64.5	LS1SB0010101	-
7439-89-6	Iron	11/11	3,770	11,600	LS1SB0020101	-
7439-92-1	Lead	20/20	2.6 J	383 J	110790-13MW4(6-8)	-
7439-95-4	Magnesium	11/11	1,310	3,020	110790-13MW4(6-8)	-
7439-96-5	Manganese	11/11	56.1	228	LS1SB0060101	-
7439-97-6	Mercury	3/11	0.12 J	83.4 J	LS1SB0020101	0.01 - 0.12
7440-02-0	Nickel	11/11	2.4	12	110790-13MW4(6-8)	-
7440-09-7	Potassium	11/11	1,170 J	2,830 J	110590-13MW1(12-14)	-
7440-22-4	Silver	1/11	2.2 J	2.2 J	110790-13MW4(6-8)	0.17 - 1.7
7440-23-5	Sodium	11/11	74 J	821 J	110790-13MW9(6-8)	-
7440-62-2	Vanadium	11/11	5.7	27.1	110790-13MW4(6-8)	-
7440-66-6	Zinc	11/11	20.3	70.4	110790-13MW4(6-8)	-
Petroleum Hydrocarbons (mg/kg)						
--	TPH (C09 - C36)[3]	21/22	7	10000 J	Z1PDI-SO-003-0910	3.8
--	TPH[4]	32/36	23.5 J	51,600 J	13MW18-0911	10.9 - 70
TCLP Inorganics (µg/L)						
7440-38-2	Arsenic	1/17	36.2	36.2	13TB16-0810	26 - 500
7440-39-3	Barium	17/17	45.3	330	110890-13MW5(10-12)	-
7440-43-9	Cadmium	2/17	2.5 J	2.9	110790-13MW8(8-10)	2
15723-28-1	Chromium	13/17	3.7 J	16 J	110590-13MW1(12-14)	3 - 5
7439-92-1	Lead	7/17	20	1,700	110790-13MW4(6-8)	20 - 100
7782-49-2	Selenium	5/17	25 J	64.4	13TB16-0810	24 - 200
7440-22-4	Silver	1/17	45 J	45 J	110590-13MW2(10-12)	2 - 7
SPLP Inorganics (µg/L)						
7439-92-1	Lead	1/1	2.7 J	2.7 J	Z1PDI-SO-009-0406	-

TABLE 4-8
SUMMARY OF ALL ZONE 1 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - ETPH analytical method
4 - Method 418.1

Associated Samples

Z1PDI-SO-001-0204	Z1PDI-SO-014-0810	LS1SB0020201
Z1PDI-SO-001-0810	110590-13MW1(12-14)	LS1SB0030101
Z1PDI-SO-002-0204	13MW18-0911	LS1SB0030201
Z1PDI-SO-003-0406	13TB16-0204	LS1SB0040101
Z1PDI-SO-003-0809	13TB16-0810	LS1SB0040301
Z1PDI-SO-003-0910	110590-13MW2(10-12)	LS1SB0050101
Z1PDI-SO-003-1012	13TB17-0406	LS1SB0050301
Z1PDI-SO-003-1012-D	13TB17-0608	LS1SB0060101
Z1PDI-SO-003-1214	13TB15-0305	LS1SB0060301
Z1PDI-SO-004-0406	13TB15-0709	LS1SB0070101
Z1PDI-SO-004-0809	110790-13MW3(12-14)	LS1SB0070401
Z1PDI-SO-004-0910	110790-13MW4(6-8)	LS1SB0070401-D
Z1PDI-SO-004-0910-D	110890-13MW5(10-12)	LS1SB0080101
Z1PDI-SO-005-0305	110790-13MW7(8-10)	LS1SB0080301
Z1PDI-SO-005-0507	110790-13MW8(8-10)	LS1SB0090101
Z1PDI-SO-006-0204	110790-13MW9(6-8)	LS1SB0090201
Z1PDI-SO-006-0810	13TB13-0305	Tank Grave-N (94)
Z1PDI-SO-007-0405	13TB13-0911	Tank Grave-S (94)
Z1PDI-SO-008-0405	FPTB25L-06	
Z1PDI-SO-008-0910	FPTB26L-05	
Z1PDI-SO-009-0406	FPTB28L-04	
Z1PDI-SO-009-0809	FPTB29L-07	
Z1PDI-SO-010-0405	FPTB29L-07-D	
Z1PDI-SO-011-0405	FPTB30L-07	
Z1PDI-SO-012-0204	FPTB31L-07	
Z1PDI-SO-013-0204	FPTB32L-11	
Z1PDI-SO-013-0204-D	LS1SB0010101	
Z1PDI-SO-014-0204	LS1SB0010201	
Z1PDI-SO-014-0608	LS1SB0020101	

TABLE 4-9

DETECTED CONCENTRATIONS IN PDI ZONE 2 SURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z2PDI-001 Z2PDI-SO-001-0002 20100912
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)	
BAP EQUIVALENTS	428.77
BENZO(A)ANTHRACENE	260
BENZO(A)PYRENE	270
BENZO(B)FLUORANTHENE	510
BENZO(K)FLUORANTHENE	150
CARBAZOLE	44
CHRYSENE	270
DIBENZO(A,H)ANTHRACENE	60
INDENO(1,2,3-CD)PYRENE	200
PHENANTHRENE	290
PYRENE	610
METALS (MG/KG)	
ANTIMONY	0.3 J
LEAD	110
PETROLEUM HYDROCARBONS (MG/KG)	
TPH (C09-C36)[1]	37 J
SPLP METALS (UG/L)	
LEAD	26.3
MISCELLANEOUS PARAMETERS (%)	
TOTAL SOLIDS	87

1 - ETPH analytical method.

TABLE 4-10

DETECTED CONCENTRATIONS IN PDI ZONE 2 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z2PDI-001	
	Z2PDI-SO-001-0204 20100912	Z2PDI-SO-001-0506 20100912
PETROLEUM HYDROCARBONS (MG/KG)		
TPH (C09-C36)[1]	19	3.3 J
SPLP METALS (UG/L)		
LEAD	NA	NA
MISCELLANEOUS PARAMETERS (%)		
TOTAL SOLIDS	96	97

1 - ETPH analytical method.

TABLE 4-11

SUMMARY OF ZONE 2 SURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Detected Chemical	Frequency of Detection[2]	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-detects[3]
PAHs (µg/kg)						
NA	BAP Equivalents	1/1	428.77	428.77	Z2PDI-SO-001-0002	NA
56-55-3	Benzo(a)anthracene	1/1	260	260	Z2PDI-SO-001-0002	NA
50-32-8	Benzo(a)pyrene	1/1	270	270	Z2PDI-SO-001-0002	NA
205-99-2	Benzo(b)fluoranthene	1/1	510	510	Z2PDI-SO-001-0002	NA
207-08-9	Benzo(k)fluoranthene	1/1	150	150	Z2PDI-SO-001-0002	NA
86-74-8	Carbazole	1/1	44	44	Z2PDI-SO-001-0002	NA
218-01-9	Chrysene	1/1	270	270	Z2PDI-SO-001-0002	NA
53-70-3	Dibenzo(a,h)anthracene	1/1	60	60	Z2PDI-SO-001-0002	NA
193-39-5	Indeno(1,2,3-cd)pyrene	1/1	200	200	Z2PDI-SO-001-0002	NA
85-01-8	Phenanthrene	1/1	290	290	Z2PDI-SO-001-0002	NA
129-00-0	Pyrene	1/1	610	610	Z2PDI-SO-001-0002	NA
Inorganics (mg/kg)						
7440-36-0	Antimony	1/1	0.3 J	0.3 J	Z2PDI-SO-001-0002	NA
7439-92-1	Lead	1/1	110	110	Z2PDI-SO-001-0002	NA
Petroleum Hydrocarbons (mg/kg)						
NA	TPH (C09 - C36)[4]	1/1	37 J	37 J	Z2PDI-SO-001-0002	NA
SPLP Inorganics (µg/L)						
7439-92-1	Lead	1/1	26.3	26.3	Z2PDI-SO-001-0002	NA
Miscellaneous Parameters (%)						
NA	Total Solids	1/1	87	87	Z2PDI-SO-001-0002	NA

NA - Not applicable.
Note: SPLP antimony was analyzed but not detected at one sample (2.1U µg/L).

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations
2 - Detected duplicates are considered one detection
3 - Values presented are sample-specific quantitation limits
4 - ETPH analytical method

Associated Sample:
Z2PDI-SO-001-0002

TABLE 4-12

SUMMARY OF ZONE 2 SUBSURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Detected Chemical	Frequency of Detection(2)	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(3)
Petroleum Hydrocarbons (mg/kg)						
NA	TPH (C09 - C36)[4]	2/2	3.3 J	19	Z2PDI-SO-001-0204	NA
Miscellaneous Parameters (%)						
NA	Total Solids	2/2	96	97	Z2PDI-SO-001-0506	NA

NA - Not applicable.

Note: All analyzed chemicals were detected.

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations
2 - Detected duplicates are considered one detection
3 - Values presented are sample-specific quantitation limits
4 - ETPH analytical method

Associated Samples:

Z2PDI-SO-001-0204
Z2PDI-SO-001-0506

TABLE 4-13

SUMMARY OF ALL ZONE 2 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Units	Sample of Maximum Concentration	Range of Nondetects(2)
PAHs (µg/kg)							
56-55-3	Benzo(a)anthracene	1/1	260	260	µg/kg	Z2PDI-SO-001-0002	-
50-32-8	Benzo(a)pyrene	1/1	270	270	µg/kg	Z2PDI-SO-001-0002	-
205-99-2	Benzo(b)fluoranthene	1/1	510	510	µg/kg	Z2PDI-SO-001-0002	-
207-08-9	Benzo(k)fluoranthene	1/1	150	150	µg/kg	Z2PDI-SO-001-0002	-
86-74-8	Carbazole	1/1	44	44	µg/kg	Z2PDI-SO-001-0002	-
218-01-9	Chrysene	1/1	270	270	µg/kg	Z2PDI-SO-001-0002	-
53-70-3	Dibenzo(a,h)anthracene	1/1	60	60	µg/kg	Z2PDI-SO-001-0002	-
193-39-5	Indeno(1,2,3-cd)pyrene	1/1	200	200	µg/kg	Z2PDI-SO-001-0002	-
85-01-8	Phenanthrene	1/1	290	290	µg/kg	Z2PDI-SO-001-0002	-
129-00-0	Pyrene	1/1	610	610	µg/kg	Z2PDI-SO-001-0002	-
Inorganics (mg/kg)							
7440-36-0	Antimony	1/1	0.3 J	0.3 J	mg/kg	Z2PDI-SO-001-0002	-
7439-92-1	Lead	1/1	110	110	mg/kg	Z2PDI-SO-001-0002	-
SPLP Inorganics (µg/L)							
7439-92-1	Lead	1/1	26.3	26.3	µg/L	Z2PDI-SO-001-0002	-
Petroleum Hydrocarbons (mg/kg)							
--	TPH (C09 - C36)[3]	1/1	37 J	37 J	mg/kg	Z2PDI-SO-001-0002	-

J = Estimated value

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - ETPH analytical method

Associated Samples
Z2PDI-SO-001-0002

TABLE 4-14

SUMMARY OF ALL ZONE 2 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-Detects[2]
Volatile Organic Compounds (µg/kg)						
75-09-2	Methylene Chloride	1/3	2 J	2 J	111290-13MW17(8-10)	5 - 12
79-01-6	Trichloroethene	1/3	1 J	1 J	111290-13MW17(8-10)	5 - 12
Semivolatile Organic Compounds (µg/kg)						
91-57-6	2-Methylnaphthalene	2/14	20 J	20 J	LS2SB0010101, LS2SB0030201	330 - 400
83-32-9	Acenaphthene	5/14	26 J	460	LS2SB0020201	330 - 400
208-96-8	Acenaphthylene	4/14	18 J	63 J	LS2SB0030201	330 - 400
120-12-7	Anthracene	8/14	20 J	180 J	LS2SB0020201, LS2SB0030201	330 - 400
56-55-3	Benzo(a)anthracene	11/14	18 J	650	LS2SB0030201	330 - 400
50-32-8	Benzo(a)pyrene	11/14	19 J	570	LS2SB0030201	330 - 400
205-99-2	Benzo(b)fluoranthene	11/14	19 J	680	LS2SB0030201	330 - 400
191-24-2	Benzo(g,h,i)perylene	11/14	20 J	400	LS2SB0030201	330 - 400
207-08-9	Benzo(k)fluoranthene	11/14	23 J	430	LS2SB0030201	330 - 400
86-74-8	Carbazole	5/14	22 J	65 J	LS2SB0030201	330 - 400
218-01-9	Chrysene	11/14	23 J	680	LS2SB0030201	330 - 400
84-74-2	di-n-Butyl Phthalate	2/14	17 J	18 J	LS2SB0030201	330 - 400
53-70-3	Dibenzo(a,h)anthracene	9/14	31 J	180 J	LS2SB0030201	330 - 400
132-64-9	Dibenzofuran	3/14	26 J	320 J	LS2SB0020201	330 - 400
84-66-2	Diethyl Phthalate	5/14	18 J	47 J	LS2SB0010201	330 - 360
206-44-0	Fluoranthene	11/14	34 J	1,300	LS2SB0030201	330 - 400
86-73-7	Fluorene	4/14	21 J	64 J	LS2SB0030201	330 - 400
193-39-5	Indeno(1,2,3-cd)pyrene	11/14	20 J	400	LS2SB0030201	330 - 400
91-20-3	Naphthalene	2/14	18 J	20 J	LS2SB0070101	330 - 400
85-01-8	Phenanthrene	10/14	18 J	750	LS2SB0030201	330 - 400
108-95-2	Phenol	1/14	50 J	50 J	LS2SB0040401	330 - 400
129-00-0	Pyrene	12/14	22 J	1,200	LS2SB0030201	330 - 400
Inorganics (mg/kg)						
7429-90-5	Aluminum	6/6	2,670	8,320	LS2SB0040401	-
7440-38-2	Arsenic	4/6	0.82 J	3 J	LS2SB0040401	0.61 - 0.71

TABLE 4-14

SUMMARY OF ALL ZONE 2 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
7440-39-3	Barium	3/6	15.3	39.6	111390-13MW6(14-16)	26.3 - 41.5
7440-41-7	Beryllium	1/6	0.32 J	0.32 J	LS2SB0040401	0.1 - 0.24
7440-43-9	Cadmium	3/6	0.6 J	1.2 J	111390-13MW6(14-16)	0.04 - 0.04
7440-70-2	Calcium	6/6	582 J	3,120 J	LS2SB0060301	-
15723-28-1	Chromium	6/6	3.9	13.4	LS2SB0040401	-
7440-48-4	Cobalt	6/6	2.2 J	4.1	LS2SB0040401	-
7440-50-8	Copper	6/6	6.6 J	10.8 J	LS2SB0040401	-
7439-89-6	Iron	6/6	4,310	9,070	LS2SB0040401	-
7439-92-1	Lead	8/8	2 J	150	13TB8-0103	-
7439-95-4	Magnesium	6/6	1,150 J	2,570 J	LS2SB0040401	-
7439-96-5	Manganese	6/6	94.5	208 J	111290-13MW17(8-10)	-
7440-02-0	Nickel	6/6	3.8	10.1	LS2SB0040401	-
7440-09-7	Potassium	6/6	1,120 J	2,570	111390-13MW6(14-16)	-
7440-23-5	Sodium	5/6	114 J	250 J	110890-13MW10(6-8)	64.2
7440-62-2	Vanadium	6/6	6	17.1	LS2SB0040401	-
7440-66-6	Zinc	6/6	14 J	24.5 J	111390-13MW6(14-16)	-
Petroleum Hydrocarbons (mg/kg)						
--	TPH (C09 - C36)[3]	2/2	3.3 J	19	Z2PDI-SO-001-0204	-
--	TPH[4]	13/20	16.3	8,210	FPTB22L-07	10.2 - 80
TCLP Inorganics (µg/L)						
7440-39-3	Barium	5/5	44	303	13TB8-0103	-
7440-43-9	Cadmium	1/5	2.6 J	2.6 J	13TB9-0103	2 - 5
15723-28-1	Chromium	2/5	3.2 J	10 J	110890-13MW10(6-8)	3 - 50
7439-92-1	Lead	3/5	104	200	110890-13MW10(6-8)	300
7440-22-4	Silver	1/4	8 J	8 J	111290-13MW17(8-10)	2 - 7
SPLP Inorganics (µg/L)						
7439-92-1	Lead	1/2	1.5 J	1.5 J	LS2SB0060301	1.3

J = Estimated value

TABLE 4-14

SUMMARY OF ALL ZONE 2 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - ETPH analytical method
4 - Method 418.1

Associated Samples

110890-13MW10(6-8)	LS2SB0010201	Z2PDI-SO-001-0204	LS2SB0060101	FPTB16L-11
111290-13MW17(8-10)	LS2SB0020101	Z2PDI-SO-001-0506	LS2SB0060301	FPTB17L-11
111390-13MW6(14-16)	LS2SB0020201		LS2SB0060301-D	FPTB18L-05
13TB8-0103	LS2SB0030101		LS2SB0070101	FPTB22L-07
13TB9-0103	LS2SB0030201		LS2SB0070201	FPTB24L-07
FPTB14L-04	LS2SB0040101			LS2SB0010101
FPTB15L-09	LS2SB0040401			
	LS2SB0050101			
	LS2SB0050301			

TABLE 4-15

DETECTED CONCENTRATIONS IN PDI ZONE 3 SURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z3PDI-001 Z3PDI-SO-001-0002 20100914	Z3PDI-002 Z3PDI-SO-002-0002 20100912	Z3PDI-003 Z3PDI-SO-003-0002 20100914	Z3PDI-005 Z3PDI-SO-005-0002 20100912
METALS (MG/KG)				
LEAD	106	156	473	1540
SPLP METALS (UG/L)				
LEAD	0.99 U	4 U	127	500
MISCELLANEOUS PARAMETERS (%)				
TOTAL SOLIDS	95	95	95	96

TABLE 4-16

DETECTED CONCENTRATIONS IN PDI ZONE 3 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z3PDI-001 Z3PDI-SO-001-0204 20100914	Z3PDI-002 Z3PDI-SO-002-0406 20100912	Z3PDI-003 Z3PDI-SO-003-0204 20100914	Z2PDI-002 Z2PDI-SO-002-0204 20100912
SPLP METALS (UG/L)				
LEAD	7.5 U	13.4	598	184

TABLE 4-17

SUMMARY OF ZONE 3 SURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Detected Chemical	Frequency of Detection[2]	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of No-Detects[3]
Inorganics (mg/kg)						
7439-92-1	Lead	4/4	106	1540	Z3PDI-SO-005-0002	NA
SPLP Inorganics (µg/L)						
7439-92-1	Lead	2/4	127	500	Z3PDI-SO-005-0002	0.99 - 4
Miscellaneous Parameters (%)						
NA	Total Solids	4/4	95	96	Z3PDI-SO-005-0002	NA

NA - Not applicable.

Note: All analyzed chemicals were detected.

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations
2 - Detected duplicates are considered one detection
3 - Values presented are sample-specific quantitation limits

Associated Samples:

Z3PDI-SO-001-0002
Z3PDI-SO-002-0002
Z3PDI-SO-003-0002
Z3PDI-SO-005-0002

TABLE 4-18

SUMMARY OF ZONE 3 SUBSURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Detected Chemical	Frequency of Detection[2]	Minimum Concentration[1]	Maximum Concentration[1]	Sample of Maximum Concentration	Range of Nondetects[3]
SPLP, Inorganics (µg/L)						
7439-92-1	Lead	3/4	13.4	598	Z3PDI-SO-003-0204	7.5

Note: All analyzed chemicals were detected.

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations
2 - Detected duplicates are considered one detection
3 - Values presented are sample-specific quantitation limits

Associated Samples:

Z3PDI-SO-001-0204
Z3PDI-SO-002-0406
Z3PDI-SO-003-0204
Z2PDI-SO-002-0204

TABLE 4-19

SUMMARY OF ALL ZONE 3 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-Detects[2]
Volatile Organic Compounds (µg/kg)						
67-64-1	Acetone	1/1	130	130	SB14-2.0	-
67-66-3	Chloroform	1/1	1 J	1 J	SB14-2.0	-
75-09-2	Methylene Chloride	1/1	4 J	4 J	SB14-2.0	-
Semivolatile Organic Compounds (µg/kg)						
117-81-7	bis(2-Ethylhexyl) phthalate	1/1	160 J	160 J	SB14-2.0	-
Inorganics (mg/kg)						
7429-90-5	Aluminum	1/1	8,790	8,790	SB14-2.0	-
7440-38-2	Arsenic	1/1	2.2	2.2	SB14-2.0	-
7440-39-3	Barium	1/1	43.8	43.8	SB14-2.0	-
7440-41-7	Beryllium	1/1	0.38	0.38	SB14-2.0	-
7440-43-9	Cadmium	1/1	0.46	0.46	SB14-2.0	-
7440-70-2	Calcium	1/1	2,500	2,500	SB14-2.0	-
15723-28-1	Chromium	1/1	16.9	16.9	SB14-2.0	-
7440-48-4	Cobalt	1/1	5	5	SB14-2.0	-
7440-50-8	Copper	1/1	12	12	SB14-2.0	-
7439-89-6	Iron	1/1	9,440	9,440	SB14-2.0	-
7439-92-1	Lead	35/35	2.8	4,390	2-EXWW-ALBACORE-06 (94)	-
7439-95-4	Magnesium	1/1	3,260	3,260	SB14-2.0	-
7439-96-5	Manganese	1/1	155	155	SB14-2.0	-
7440-02-0	Nickel	1/1	13.4	13.4	SB14-2.0	-
7440-09-7	Potassium	1/1	2,130	2,130	SB14-2.0	-
7440-23-5	Sodium	1/1	474	474	SB14-2.0	-
7440-62-2	Vanadium	1/1	18.9	18.9	SB14-2.0	-
7440-66-6	Zinc	1/1	20.4	20.4	SB14-2.0	-
TCLP Inorganics (µg/L)						
7439-92-1	Lead	8/8	29.3	2,890	SB25-2.0	-
SPLP Inorganics (µg/L)						
7439-92-1	Lead	2/4	127	500	SB25-2.0	0.99 - 4

TABLE 4-19

SUMMARY OF ALL ZONE 3 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

J = Estimated value

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.

Associated Samples

SB22-2.0	EXSW-BULLHEAD-08 (94)	SB12-2.0	2-EXNW09-06 (94)	Z3PDI-SO-001-0002
SB23-2.0	EXSW01-07 (94)	SB13-2.0	2-EXNW78-09 (94)	Z3PDI-SO-002-0002
SB25-2.0	EXSW03-07 (94)	SB13-2.0-D	2-EXSW78-09 (94)	Z3PDI-SO-003-0002
SB26-2.0	EXWW01-07 (94)	SB14-2.0	2-EXWW-ALBACORE-06 (94)	Z3PDI-SO-005-0002
SB27-2.0	SB06-2.0	SB15-2.0	4-EXEW03-07 (94)	
SB30-2.0	SB07-2.0	SB19-2.0	EXBE-BULLHEAD-07 (94)	
SB32-2.0	SB09-2.0	SB20-2.0	EXEW-BULLHEAD-08 (94)	
SB33-2.0	SB10-2.0	SB21-2.0	EXNW03-07 (94)	

TABLE 4-20

RANGE AND FREQUENCY OF ALL ZONE 3 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
Volatile Organics (µg/kg)						
71-55-6	1,1,1-Trichloroethane	1/3	6 J	6 J	SB22-6.0	6 - 6
67-64-1	Acetone	1/3	84	84	SB22-6.0	13 - 13
75-09-2	Methylene Chloride	1/3	3 J	3 J	SB22-6.0	6 - 6
127-18-4	Tetrachloroethene	1/3	1 J	1 J	SB22-6.0	6 - 6
108-88-3	Toluene	1/3	0.8 J	0.8 J	SB22-6.0	6 - 6
1330-20-7	Total Xylenes	1/3	1 J	1 J	SB22-6.0	6 - 6
Semivolatile Organics (µg/kg)						
91-57-6	2-Methylnaphthalene	4/11	25 J	300 J	LS3SB0050201	330 - 430
83-32-9	Acenaphthene	5/11	17 J	200 J	LS3SB0050201	330 - 430
208-96-8	Acenaphthylene	3/11	26 J	340 J	LS3SB0040101-D	330 - 430
120-12-7	Anthracene	7/11	23 J	350	LS3SB0040201	330 - 430
56-55-3	Benzo(a)anthracene	9/11	21 J	2,100	LS3SB0040201	330 - 430
50-32-8	Benzo(a)pyrene	9/11	23 J	1,000 J	LS3SB0040101-D	330 - 380
205-99-2	Benzo(b)fluoranthene	9/11	25 J	1,500	LS3SB0040201	330 - 380
191-24-2	Benzo(g,h,i)perylene	9/11	27 J	850 J	LS3SB0040101-D	330 - 380
207-08-9	Benzo(k)fluoranthene	7/11	81 J	870	LS3SB0040201	330 - 430
117-81-7	bis(2-Ethylhexyl) phthalate	2/11	260 J	360 J	LS3SB0040101-D	330 - 430
86-74-8	Carbazole	4/11	22 J	270 J	LS3SB0040201	330 - 430
218-01-9	Chrysene	10/11	24 J	1,500 J	LS3SB0040201, LS3SB0050201	330 - 330
84-74-2	di-n-Butyl Phthalate	1/11	20 J	20 J	SB22-6.0	330 - 430
53-70-3	Dibenzo(a,h)anthracene	6/11	51 J	400 J	LS3SB0040101-D	330 - 430
132-64-9	Dibenzofuran	3/11	35 J	81 J	LS3SB0050201	330 - 430
84-66-2	Diethyl Phthalate	1/11	20 J	20 J	LS3SB0040101-D	330 - 430
206-44-0	Fluoranthene	10/11	33 J	4,200	LS3SB0040201	330 - 330
86-73-7	Fluorene	5/11	25 J	370	LS3SB0050201	330 - 430
193-39-5	Indeno(1,2,3-cd)pyrene	9/11	23 J	870 J	LS3SB0040101-D	330 - 380
91-20-3	Naphthalene	4/11	18 J	42 J	LS3SB0050201	330 - 430
85-01-8	Phenanthrene	8/11	36 J	1,700	LS3SB0040201	330 - 430
129-00-0	Pyrene	11/11	20 J	4,400	LS3SB0040201	-

TABLE 4-20

RANGE AND FREQUENCY OF ALL ZONE 3 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Frequency of Detection	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-Detects[2]
Inorganics (mg/kg)						
7429-90-5	Aluminum	9/9	3,510	8,120	110890-13MW12(8-10)	-
7440-36-0	Antimony	2/9	0.64 J	1.1 J	LS3SB0010201	0.42 - 6.2
7440-38-2	Arsenic	9/9	0.93 J	4.9	LS3SB0010301	-
7440-39-3	Barium	9/9	22.5	41.7	LS3SB0050201	-
7440-41-7	Beryllium	5/9	0.21 J	0.33	110890-13MW12(8-10)	0.15 - 0.22
7440-43-9	Cadmium	2/9	0.83 J	0.83 J	110890-13MW12(8-10)	0.04 - 0.67
7440-70-2	Calcium	9/9	602 J	13,800	SB22-6.0	-
15723-28-1	Chromium	9/9	6.1	19.3	LS3SB0050201	-
7440-48-4	Cobalt	9/9	2.4	5.1	LS3SB0050201	-
7440-50-8	Copper	8/9	6.4 J	73.6	LS3SB0050201	25.4 - 28.4
7439-89-6	Iron	9/9	5,100	9,230	LS3SB0050201	-
7439-92-1	Lead	81/82	2.6 J	4,173	EXSW-ALBACORE-06 (94)	4.8 - 19.3
7439-95-4	Magnesium	9/9	1,560	2,810	LS3SB0020201-D	-
7439-96-5	Manganese	9/9	88.1	290	LS3SB0010301	-
7439-97-6	Mercury	4/9	0.02 J	0.23 J	LS3SB0010201	0.005 - 0.12
7440-02-0	Nickel	9/9	5.2	13.2	LS3SB0050201	-
7440-09-7	Potassium	9/9	910 J	1,660	LS3SB0020201-D	-
7782-49-2	Selenium	2/9	0.42 J	0.6 J	LS3SB0010301	0.22 - 0.63
7440-22-4	Silver	2/9	0.35 J	1.7	SB22-6.0	0.19 - 1.8
7440-23-5	Sodium	9/9	92.7 J	530	SB22-6.0	-
7440-62-2	Vanadium	9/9	9.7	24.8	LS3SB0020201-D	-
7440-66-6	Zinc	9/9	17	74.1	LS3SB0010301	-
Petroleum Hydrocarbons (mg/kg)						
--	TPH[3]	15/17	18.6 J	3,400 J	13MW12(8-10)	11.1 - 11.1

TABLE 4-20

RANGE AND FREQUENCY OF ALL ZONE 3 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
TCLP Inorganics (µg/L)						
7440-39-3	Barium	7/7	63.2	264	13TB18-0103	-
7440-43-9	Cadmium	1/7	2.4	2.4	110890-13MW11(2-4)	2-3
15723-28-1	Chromium	5/7	4.7 J	71 J	110890-13MW11(2-4)	6.2 - 6.2
7439-92-1	Lead	11/16	54.6 J	8,600	SB17-6.0	26 - 100
SPLP Inorganics (µg/L)						
--	Lead	6/7	13.4	598	Z3PDI-SO-003-0204	7.5 - 7.5

J = Estimated value

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - Method 418.1

Associated Samples

SB21-6.0	EXNW04-06 (94)	SB07-4.0	110890-13MW12(8-10)	LS3SB0040101	EXBE-ALBACORE-03 (94)
SB22-4.0	EXNW07-05 (94)	SB07-6.0	13TB12-0204-X	LS3SB0040101-D	Z3PDI-SO-001-0204
SB22-6.0	EXSW-ALBACORE-06 (94)	SB08-6.0	13TB12-0406	LS3SB0040201	Z3PDI-SO-002-0406
SB23-4.0	EXSW02-06 (94)	SB09-4.0	13TB12-0608-X	LS3SB0050101	Z3PDI-SO-003-0204
SB23-6.0	EXSW04-06 (94)	SB09-6.0	13TB18-0103	LS3SB0050201	Z2PDI-SO-002-0204
SB24-6.0	EXSW07-04 (94)	SB10-4.0	13TB5A-1.5-3.5	LS3SB0020201-D	13TB11-0406
SB25-4.0	EXSW08-07 (94)	SB10-6.0	13TB5A-1.5-3.5-X	LS3SB0020401	110890-13MW11(2-4)
SB25-4.0-D	EXWW-ALBACORE-06 (94)	SB10-6.0-D	13TB7-0103	SB06-4.0	
SB25-6.0	EXWW02-06 (94)	SB12-4.0	2-EXBE78-06 (94)	SB06-4.0-D	
SB26-4.0	EXWW06-07 (94)	SB12-6.0	2-EXWW06-06 (94)	SB06-6.0	
SB26-6.0	EXWW07-05 (94)	SB13-4.0	2-EXWW09-06 (94)	SB19-6.0	
SB27-4.0	EXWW08-07 (94)	SB13-6.0	3-EXSW09-06 (94)	SB20-4.0	
SB27-6.0	FPTB12L-08	SB14-4.0	EXEW07-05 (94)-D	SB20-4.0-D	
SB29-4.0	FPTB13L-07	SB14-6.0	EXBE01-04 (94)	EXBE06-07 (94)	
SB29-6.0	FPTB13L-07-D	SB15-4.0	EXBE02-04 (94)	EXBE07-03 (94)	
SB30-4.0	LS3SB0010201	SB15-6.0	EXBE03-04 (94)	EXEW02-06 (94)	
SB30-6.0	LS3SB0010301	SB16-6.0	EXNW02-06 (94)	LS3SB0030101	
SB20-6.0	LS3SB0020201	SB17-6.0	EXEW07-05 (94)	LS3SB0030201	
SB21-4.0		SB19-4.0			

TABLE 4-21

DETECTED CONCENTRATIONS IN PDI ZONE 4 SURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z4PDI-001		Z4PDI-002	Z4PDI-003	Z4PDI-004
	Z4PDI-SO-001-0002	Z4PDI-SO-001-0002-D	Z4PDI-SO-002-0002	Z4PDI-SO-003-0002	Z4PDI-SO-004-0002
	20100910	20100910	20100910	20100911	20100911
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENTS	NA	NA	NA	NA	36.917
BENZO(A)ANTHRACENE	NA	NA	NA	NA	17 J
BENZO(A)PYRENE	NA	NA	NA	NA	24
BENZO(B)FLUORANTHENE	NA	NA	NA	NA	34
BENZO(K)FLUORANTHENE	NA	NA	NA	NA	10 J
CARBAZOLE	NA	NA	NA	NA	10 U
CHRYSENE	NA	NA	NA	NA	17 J
DIBENZO(A,H)ANTHRACENE	NA	NA	NA	NA	5.8 J
INDENO(1,2,3-CD)PYRENE	NA	NA	NA	NA	19 J
PHENANTHRENE	NA	NA	NA	NA	6.5 J
PYRENE	NA	NA	NA	NA	30
METALS (MG/KG)					
CHROMIUM	NA	NA	NA	12.7	NA
CHROMIUM III	NA	NA	NA	12.7	NA
LEAD	367 J	726 J	NA	982	NA
PETROLEUM HYDROCARBONS (MG/KG)					
TPH (C09-C36)[1]	220	NA	5 J	NA	NA
SPLP METALS (UG/L)					
LEAD	54.5 J	133 J	NA	NA	NA
MISCELLANEOUS PARAMETERS (MV)					
OXIDATION REDUCTION POTENTIAL	NA	NA	NA	115	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	93	93	95	94	98

1 - ETPH analytical method.

TABLE 4-21

DETECTED CONCENTRATIONS IN PDI ZONE 4 SURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z4PDI-005 Z4PDI-SO-005-0002 20100911	Z4PDI-006 Z4PDI-SO-006-0002 20100910	Z4PDI-007 Z4PDI-SO-007-0002 20100910	Z4PDI-008 Z4PDI-SO-008-0002 20100911	Z4PDI-009 Z4PDI-SO-009-0002 20100911
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENTS	46.876	NA	NA	NA	322.12
BENZO(A)ANTHRACENE	22	NA	NA	NA	120
BENZO(A)PYRENE	27	NA	NA	NA	190
BENZO(B)FLUORANTHENE	48	NA	NA	NA	340
BENZO(K)FLUORANTHENE	15 J	NA	NA	NA	96
CARBAZOLE	2.8 J	NA	NA	NA	28
CHRYSENE	26 J	NA	NA	NA	160 J
DIBENZO(A,H)ANTHRACENE	9.2 J	NA	NA	NA	66
INDENO(1,2,3-CD)PYRENE	35	NA	NA	NA	190
PHENANTHRENE	20 J	NA	NA	NA	110
PYRENE	50	NA	NA	NA	210
METALS (MG/KG)					
CHROMIUM	NA	NA	NA	NA	NA
CHROMIUM III	NA	NA	NA	NA	NA
LEAD	NA	369 J	160 J	1370	NA
PETROLEUM HYDROCARBONS (MG/KG)					
TPH (C09-C36)[1]	NA	NA	NA	NA	NA
SPLP METALS (UG/L)					
LEAD	NA	182	5.2	2180	NA
MISCELLANEOUS PARAMETERS (MV)					
OXIDATION REDUCTION POTENTIAL	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	94	95	93	96	93

1 - ETPH analytical method.

TABLE 4-22

DETECTED CONCENTRATIONS IN PDI ZONE 4 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z4PDI-001	Z4PDI-002		Z4PDI-006	
	Z4PDI-SO-001-0405	Z4PDI-SO-002-0204	Z4PDI-SO-002-0405	Z4PDI-SO-006-0406	Z4PDI-SO-006-0406-D
	20100910	20100910	20100910	20100910	20100910
METALS (MG/KG)					
CHROMIUM	NA	NA	NA	6.5	7.1
CHROMIUM III	NA	NA	NA	6.5	7.1
LEAD	128 J	NA	NA	NA	NA
PETROLEUM HYDROCARBONS (MG/KG)					
TPH (C09-C36)[1]	60	4.2 U	4.8 U	NA	NA
SPLP METALS (UG/L)					
LEAD	41.6	NA	NA	5	5
MISCELLANEOUS PARAMETERS (MV)					
OXIDATION REDUCTION POTENTIAL	NA	NA	NA	200	184
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	89	94	83	NA	NA

1 - ETPH analytical method.

TABLE 4-22

DETECTED CONCENTRATIONS IN PDI ZONE 4 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z4PDI-007 Z4PDI-SO-007-0204 20100910	Z4PDI-008 Z4PDI-SO-008-0204 20100911
METALS (MG/KG)		
CHROMIUM	NA	9.8
CHROMIUM III	NA	9.8
LEAD	NA	NA
PETROLEUM HYDROCARBONS (MG/KG)		
TPH (C09-C36)[1]	NA	NA
SPLP METALS (UG/L)		
LEAD	3.4 J	546
MISCELLANEOUS PARAMETERS (MV)		
OXIDATION REDUCTION POTENTIAL	NA	128
MISCELLANEOUS PARAMETERS (%)		
TOTAL SOLIDS	NA	NA

1 - ETPH analytical method.

TABLE 4-23

SUMMARY OF ZONE 4 SURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Detected Chemical	Frequency of Detection(2)	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(3)
PAHs (µg/kg)						
NA	BAP Equivalents	3/3	36.917	322.12	Z4PDI-SO-009-0002	NA
56-55-3	Benzo(a)anthracene	3/3	17 J	120	Z4PDI-SO-009-0002	NA
50-32-8	Benzo(a)pyrene	3/3	24	190	Z4PDI-SO-009-0002	NA
205-99-2	Benzo(b)fluoranthene	3/3	34	340	Z4PDI-SO-009-0002	NA
207-08-9	Benzo(k)fluoranthene	3/3	10 J	96	Z4PDI-SO-009-0002	NA
86-74-8	Carbazole	2/3	2.8 J	28	Z4PDI-SO-009-0002	10
218-01-9	Chrysene	3/3	17 J	160 J	Z4PDI-SO-009-0002	NA
53-70-3	Dibenzo(a,h)anthracene	3/3	5.8 J	66	Z4PDI-SO-009-0002	NA
193-39-5	Indeno(1,2,3-cd)pyrene	3/3	19 J	190	Z4PDI-SO-009-0002	NA
85-01-8	Phenanthrene	3/3	6.5 J	110	Z4PDI-SO-009-0002	NA
129-00-0	Pyrene	3/3	30	210	Z4PDI-SO-009-0002	NA
Inorganics (mg/kg)						
15723-28-1	Chromium	1/1	12.7	12.7	Z4PDI-SO-003-0002	NA
16065-83-1	Chromium III	1/1	12.7	12.7	Z4PDI-SO-003-0002	NA
7439-92-1	Lead	5/5	160 J	1370	Z4PDI-SO-008-0002	NA
Petroleum Hydrocarbons (mg/kg)						
NA	TPH (C09 - C36)[4]	2/2	5 J	220	Z4PDI-SO-001-0002	NA
SPLP Inorganics (µg/L)						
7439-92-1	Lead	4/4	5.2	2180	Z4PDI-SO-008-0002	NA
Miscellaneous Parameters						
NA	Oxidation/Reduction Potential (mV)	1/1	115	115	Z4PDI-SO-003-0002	NA
NA	Total Solids (%)	9/9	93	98	Z4PDI-SO-004-0002	NA

NA - Not applicable.

Note: Hexavalent chromium was analyzed for but not detected at one sample (0.11 U mg/kg).

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations
2 - Detected duplicates are considered one detection
3 - Values presented are sample-specific quantitation limits
4 - ETPH analytical method

TABLE 4-23

SUMMARY OF ZONE 4 SURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Associated Samples:

Z4PDI-SO-001-0002	Z4PDI-SO-003-0002	Z4PDI-SO-006-0002	Z4PDI-SO-009-0002
Z4PDI-SO-001-0002-D	Z4PDI-SO-004-0002	Z4PDI-SO-007-0002	
Z4PDI-SO-002-0002	Z4PDI-SO-005-0002	Z4PDI-SO-008-0002	

TABLE 4-24

SUMMARY OF ZONE 4 SUBSURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Detected Chemical	Frequency of Detection(2)	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(3)
Inorganics (mg/kg)						
15723-28-1	Chromium	2/2	6.5	9.8	Z4PDI-SO-008-0204	NA
16065-83-1	Chromium III	2/2	6.5	9.8	Z4PDI-SO-008-0204	NA
7439-92-1	Lead	1/1	128 J	128 J	Z4PDI-SO-001-0405	NA
Petroleum Hydrocarbons (mg/kg)						
NA	TPH (C09 - C36)[4]	1/3	60	60	Z4PDI-SO-001-0405	4.2 - 4.8
SPLP Inorganics (µg/L)						
7439-92-1	Lead	4/4	3.4 J	546	Z4PDI-SO-008-0204	NA
Miscellaneous Parameters						
NA	Oxidation/Reduction Potential (mV)	2/2	128	200	Z4PDI-SO-006-0406	NA
NA	Total Solids (%)	3/3	83	94	Z4PDI-SO-002-0204	NA

NA - Not applicable.

Note: Hexavalent chromium was analyzed for but not detected at two samples (0.11 U/0.11 U mg/kg).

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations
2 - Detected duplicates are considered one detection
3 - Values presented are sample-specific quantitation limits
4 - ETPH analytical method

Associated Samples:

Z4PDI-SO-001-0405
Z4PDI-SO-002-0204
Z4PDI-SO-002-0405
Z4PDI-SO-006-0406
Z4PDI-SO-006-0406-D
Z4PDI-SO-007-0204
Z4PDI-SO-008-0204

TABLE 4-25

RANGE AND FREQUENCY OF ALL ZONE 4 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-Detects[2]
Semivolatile Organic Compounds (µg/kg)						
91-57-6	2-Methylnaphthalene	1/1	2,000	2,000	LS4SB0010101	-
83-32-9	Acenaphthene	1/1	900	900	LS4SB0010101	-
208-96-8	Acenaphthylene	1/1	1,200	1,200	LS4SB0010101	-
120-12-7	Anthracene	1/1	2,700	2,700	LS4SB0010101	-
56-55-3	Benzo(a)anthracene	4/4	17 J	5,300	LS4SB0010101	-
50-32-8	Benzo(a)pyrene	4/4	24	4,300	LS4SB0010101	-
205-99-2	Benzo(b)fluoranthene	4/4	34	4,300	LS4SB0010101	-
191-24-2	Benzo(g,h,i)perylene	1/1	3,100 J	3,100 J	LS4SB0010101	-
207-08-9	Benzo(k)fluoranthene	4/4	10 J	1,400	LS4SB0010101	-
86-74-8	Carbazole	3/4	2.8 J	1,100	LS4SB0010101	10 - 10
218-01-9	Chrysene	4/4	17 J	5,500	LS4SB0010101	-
53-70-3	Dibenzo(a,h)anthracene	4/4	5.8 J	1,500	LS4SB0010101	-
132-64-9	Dibenzofuran	1/1	1,300	1,300	LS4SB0010101	-
206-44-0	Fluoranthene	1/1	11,000	11,000	LS4SB0010101	-
86-73-7	Fluorene	1/1	2,900	2,900	LS4SB0010101	-
193-39-5	Indeno(1,2,3-cd)pyrene	4/4	19 J	3,400	LS4SB0010101	-
91-20-3	Naphthalene	1/1	1,700	1,700	LS4SB0010101	-
85-01-8	Phenanthrene	4/4	6.5 J	14,000	LS4SB0010101	-
129-00-0	Pyrene	4/4	30	15,000	LS4SB0010101	-
Inorganics (mg/kg)						
7429-90-5	Aluminum	1/1	4,690	4,690	LS4SB0010101	-
7440-36-0	Antimony	1/1	3.3	3.3	LS4SB0010101	-
7440-38-2	Arsenic	1/1	4.2	4.2	LS4SB0010101	-
7440-39-3	Barium	1/1	46.8	46.8	LS4SB0010101	-
7440-41-7	Beryllium	1/1	0.28	0.28	LS4SB0010101	-
7440-43-9	Cadmium	1/1	0.53	0.53	LS4SB0010101	-
7440-70-2	Calcium	1/1	1,250	1,250	LS4SB0010101	-
15723-28-1	Total Chromium	2/2	10.5	12.7	Z4PDI-SO-003-0002	-
16065-83-1	Chromium III	1/1	12.7	12.7	Z4PDI-SO-003-0002	-
7440-48-4	Cobalt	1/1	2.8	2.8	LS4SB0010101	-
7440-50-8	Copper	1/1	147	147	LS4SB0010101	-

TABLE 4-25

RANGE AND FREQUENCY OF ALL ZONE 4 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
7439-89-6	Iron	1/1	7,860	7,860	LS4SB0010101	-
7439-92-1	Lead	9/9	160 J	10,600 J	13WE4A-0002	-
7439-95-4	Magnesium	1/1	1,640	1,640	LS4SB0010101	-
7439-96-5	Manganese	1/1	130	130	LS4SB0010101	-
7439-97-6	Mercury	1/1	0.31 J	0.31 J	LS4SB0010101	-
7440-02-0	Nickel	1/1	8.7	8.7	LS4SB0010101	-
7440-09-7	Potassium	1/1	878	878	LS4SB0010101	-
7440-23-5	Sodium	1/1	141	141	LS4SB0010101	-
7440-62-2	Vanadium	1/1	14.1	14.1	LS4SB0010101	-
7440-66-6	Zinc	1/1	128	128	LS4SB0010101	-
Petroleum Hydrocarbons (mg/kg)						
--	TPH (C09 - C36)[3]	2/2	5 J	220	Z4PDI-SO-001-0002	-
--	TPH[4]	3/3	500 J	3,440	13TB4A-0002	
TCLP Inorganics (µg/L)						
7440-38-2	Arsenic	1/2	30.9 J	30.9 J	13WE4A-0002	26 - 26
7440-39-3	Barium	2/2	166	291	13TB4A-0002	-
7440-43-9	Cadmium	2/2	2.4 J	10.6	13WE4A-0002	-
15723-28-1	Total Chromium	2/2	8.6	8.7	13TB4A-0002	-
7439-92-1	Lead	2/2	909 J	143,000 J	13WE4A-0002	-
SPLP Inorganics (µg/L)						
7439-92-1	Lead	5/5	5.2 J	2,180	Z4PDI-SO-008-0002	-

J = Estimated value

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - ETPH analytical method
4 - Method 418.1

TABLE 4-25

RANGE AND FREQUENCY OF ALL ZONE 4 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

Associated Samples

Z4PDI-SO-001-0002	Z4PDI-SO-004-0002	Z4PDI-SO-009-0002
Z4PDI-SO-001-0002-D	Z4PDI-SO-005-0002	13TB4A-0002
Z4PDI-SO-002-0002	Z4PDI-SO-006-0002	13TB4A-0002-X
Z4PDI-SO-003-0002	Z4PDI-SO-007-0002	13WE4A-0002
	Z4PDI-SO-008-0002	LS4SB0010101

TABLE 4-26

RANGE AND FREQUENCY OF ALL ZONE 4 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-Detects[2]
Volatile Organics (µg/kg)						
71-43-2	Benzene	1/9	1.4	1.4	QW-3 (94)	1.15 - 13
75-15-0	Carbon Disulfide	1/5	5 J	5 J	111290-13MW16(10-12)	6 - 13
100-41-4	Ethylbenzene	3/9	0.7 J	18 J	QW-2 (94)	1.17 - 13
75-09-2	Methylene Chloride	4/5	1 J	12	111390-13MW13(8-10)	13 - 13
127-18-4	Tetrachloroethene	4/5	3 J	8 J	111390-13MW13(8-10)-D	6 - 13
108-88-3	Toluene	2/9	3 J	3.2	QW-3 (94)	1.15 - 8
1330-20-7	Total Xylenes	4/9	0.616 J	20.3 J	QW-2 (94)	1.17 - 13
79-01-6	Trichloroethene	4/5	2 J	5 J	111390-13MW13(8-10), 111390-13MW13(8-10)-D	13 - 13
Semivolatile Organics (µg/kg)						
91-57-6	2-Methylnaphthalene	2/10	23 J	24 J	LS4SB0030101	360 - 430
208-96-8	Acenaphthylene	2/10	19 J	72 J	LS4SB0030101	360 - 430
120-12-7	Anthracene	4/10	28 J	74 J	LS4SB0010301	360 - 430
56-55-3	Benzo(a)anthracene	8/10	44 J	620	LS4SB0030101	360 - 430
50-32-8	Benzo(a)pyrene	9/10	41 J	680	LS4SB0030101	360 - 360
205-99-2	Benzo(b)fluoranthene	9/10	22 J	680	LS4SB0030101	360 - 360
191-24-2	Benzo(g,h,i)perylene	9/10	54 J	650	LS4SB0030101	360 - 360
207-08-9	Benzo(k)fluoranthene	7/10	56 J	580	LS4SB0030101	360 - 430
85-68-7	Butyl Benzyl Phthalate	1/10	23 J	23 J	LS4SB0020201	360 - 430
86-74-8	Carbazole	1/10	25 J	25 J	LS4SB0030101	360 - 430
218-01-9	Chrysene	8/10	55 J	660	LS4SB0030101	360 - 430
53-70-3	Dibenzo(a,h)anthracene	4/10	34 J	80 J	LS4SB0020201	360 - 420
206-44-0	Fluoranthene	8/10	45 J	770	LS4SB0030101	360 - 430
86-73-7	Fluorene	1/10	28 J	28 J	LS4SB0010301	360 - 430
193-39-5	Indeno(1,2,3-cd)pyrene	9/10	46 J	560	LS4SB0030101	360 - 360
91-20-3	Naphthalene	2/10	34 J	39 J	QW-1 (94)	360 - 430
85-01-8	Phenanthrene	8/10	24 J	210 J	LS4SB0030101	360 - 430
108-95-2	Phenol	1/8	24 J	24 J	LS4SB0050101	360 - 420
129-00-0	Pyrene	9/10	19 J	830	QW-1 (94), LS4SB0030101	430 - 430
Pesticides/PCBs (µg/kg)						
72-20-8	Endrin	1/1	6.7	6.7	QW-1 (94)	-

TABLE 4-26

RANGE AND FREQUENCY OF ALL ZONE 4 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
Inorganics (mg/kg)						
7429-90-5	Aluminum	10/10	2,670	10,600	111290-13MW16(10-12)	-
7440-36-0	Antimony	2/10	0.49 J	1.3	QW-1 (94)	0.44 - 3.4
7440-38-2	Arsenic	9/10	0.77	4.5 J	LS4SB0030101	0.71 - 0.72
7440-39-3	Barium	8/10	17.8 J	48.3 J	111390-13MW13(8-10)	34.5 - 38.6
7440-41-7	Beryllium	3/10	0.15 J	0.34 J	111290-13MW16(10-12)	0.11 - 0.24
7440-43-9	Cadmium	6/10	0.07 J	2.5 J	111290-13MW16(10-12)	0.04 - 0.15
7440-70-2	Calcium	10/10	603 J	2,710	111290-13MW16(10-12)	-
15723-28-1	Total Chromium	12/12	5.6 J	27.8	111290-13MW16(10-12)	-
16065-83-1	Chromium III	2/2	6.5	9.8	Z4PDI-SO-008-0204	-
7440-48-4	Cobalt	10/10	1.8 J	6.7 J	111290-13MW16(10-12)	-
7440-50-8	Copper	10/10	4.5 J	32.5	111390-13MW14(12-14)	-
7439-89-6	Iron	10/10	4,720 J	16,900	111290-13MW16(10-12)	-
7439-92-1	Lead	14/16	25.2 J	8,240 J	13TB3A-2.5-4.5	2.2 - 2.7
7439-95-4	Magnesium	10/10	1,070 J	5,510	111290-13MW16(10-12)	-
7439-96-5	Manganese	10/10	75.1 J	191 J	111290-13MW16(10-12)	-
7439-97-6	Mercury	1/10	0.5	0.5	LS4SB0030101	0.01 - 0.16
7440-02-0	Nickel	10/10	4.6	16.3	111290-13MW16(10-12)	-
7440-09-7	Potassium	10/10	567	2,780	111290-13MW16(10-12)	-
7782-49-2	Selenium	2/10	0.28 J	1 J	111290-13MW16(10-12)	0.23 - 0.63
7440-23-5	Sodium	10/10	78.4	5,890	111290-13MW16(10-12)	-
7440-62-2	Vanadium	10/10	7.3	35.9	111290-13MW16(10-12)	-
7440-66-6	Zinc	10/10	12.3 J	63.6 J	LS4SB0030201	-
Petroleum Hydrocarbons (mg/kg)						
--	TPH (C09 - C36)[3]	1/3	60	60	Z4PDI-SO-001-0405	4.2 - 4.8
--	TPH[4]	19/21	15.3 J	11,800	13TB2A-0608	10.4 - 13.1
TCLP Inorganics (µg/L)						
7440-38-2	Arsenic	3/9	35.4 J	360	111290-13MW16(10-12)	3 - 300
7440-39-3	Barium	9/9	24.6	408	13TB3A-2.5-4.5	-

TABLE 4-26

RANGE AND FREQUENCY OF ALL ZONE 4 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
TCLP Inorganics, continued (µg/L)						
7440-43-9	Cadmium	2/9	2.2 J	2.2 J	13TB3A-0608, QW-1 (94)	2 - 5
15723-28-1	Total Chromium	2/9	8.1	11.2	13TB2A-0406	3 - 50
7439-92-1	Lead	6/9	430 J	150,000 J	13TB3A-2.5-4.5	14 - 300
7782-49-2	Selenium	1/9	45.3 J	45.3 J	13TB3A-0608	14.6 - 300
SPLP Inorganics (µg/L)						
7439-92-1	Lead	6/9	3.4 J	546	Z4PDI-SO-008-0204	1.3 - 13.2

J = Estimated value

Footnotes:

1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - ETPH analytical method
4 - Method 418.1

Associated Samples

111390-13MW13(8-10)
111390-13MW13(8-10)-D
111390-13MW14(12-14)
111390-13MW14(12-14)-D
111290-13MW15(12-14)
111290-13MW16(10-12)
13TB2A-0406
13TB2A-0406-X
13TB2A-0608
13TB3A-2.5-4.5
13TB3A-2.5-4.5-D
13TB3A-0608-X
13TB6-0507
FPTB10L-03
FPTB11L-07
FPTB06L-07
FPTB07L-08
FPTB08L-07
LS4SB0010301
LS4SB0050101
LS4SB0050301
QW-1 (94)
QW-2 (94)
QW-3 (94)
QW-4 (94)
QW-5 (94)
LS4SB0020101
LS4SB0020201
LS4SB0030101
LS4SB0030201
LS4SB0040101
LS4SB0040201
Z4PDI-SO-001-0405
Z4PDI-SO-002-0204
Z4PDI-SO-002-0405
Z4PDI-SO-006-0406
FPTB09L-08
FPTB09L-08-D
Z4PDI-SO-006-0406-D
Z4PDI-SO-007-0204
Z4PDI-SO-008-0204

TABLE 4-27

DETECTED CONCENTRATIONS IN PDI ZONE 5 SURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z5PDI-001	Z5PDI-002		Z5PDI-003	Z5PDI-004	Z5PDI-005
	Z5PDI-SO-001-0002	Z5PDI-SO-002-0002	Z5PDI-SO-002-0002-D	Z5PDI-SO-003-0002	Z5PDI-SO-004-0002	Z5PDI-SO-005-0002
	20100909	20100909	20100909	20100909	20100909	20100909
PETROLEUM HYDROCARBONS (MG/KG)						
TPH (C09-C36)[1]	57	83	86	180	35 J	110
MISCELLANEOUS PARAMETERS (%)						
TOTAL SOLIDS	94	96	96	95	96	95

1 - ETPH analytical method.

TABLE 4-28

DETECTED CONCENTRATIONS IN PDI ZONE 5 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z5PDI-001		Z5PDI-002	Z5PDI-003
	Z5PDI-SO-001-0204	Z5PDI-SO-001-0204-D	Z5PDI-SO-002-0204	Z5PDI-SO-003-0204
	20100909	20100909	20100909	20100909
PETROLEUM HYDROCARBONS (MG/KG)				
TPH (C09-C36)[1]	2.9 J	4.1 U	8.2	2.9 J
MISCELLANEOUS PARAMETERS (%)				
TOTAL SOLIDS	92	93	96	96

1 - ETPH analytical method.

TABLE 4-28

DETECTED CONCENTRATIONS IN PDI ZONE 5 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z5PDI-004		Z5PDI-005
	Z5PDI-SO-004-0204	Z5PDI-SO-004-0204-D	Z5PDI-SO-005-0204
	20100909	20100909	20100909
PETROLEUM HYDROCARBONS (MG/KG)			
TPH (C09-C36)[1]	2100	1400	150
MISCELLANEOUS PARAMETERS (%)			
TOTAL SOLIDS	94	92	95

1 - ETPH analytical method.

TABLE 4-29

SUMMARY OF ZONE 5 SURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Detected Chemical	Frequency of Detection(2)	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(3)
Petroleum Hydrocarbons (mg/kg)						
--	TPH (C09 - C36)[4]	5/5	35 J	180	Z5PDI-SO-003-0002	NA
Miscellaneous Parameters (%)						
--	Total Solids	5/5	94	96	Z5PDI-SO-002-0002, Z5PDI-SO-002-0002-D, Z5PDI-SO-004-0002	NA

NA - Not applicable.

Note: All analyzed chemicals were detected.

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations
2 - Detected duplicates are considered one detection
3 - Values presented are sample-specific quantitation limits
4 - ETPH analytical method

Associated Samples:

Z5PDI-SO-001-0002
Z5PDI-SO-002-0002
Z5PDI-SO-002-0002,D
Z5PDI-SO-003-0002
Z5PDI-SO-004-0002
Z5PDI-SO-005-0002

TABLE 4-30

SUMMARY OF ZONE 5 SUBSURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Detected Chemical	Frequency of Detection(2)	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(3)
Petroleum Hydrocarbons (mg/kg)						
--	TPH (C09 - C36)[4]	5/5	2.9 J	2100	Z5PDI-SO-004-0204	4.1
Miscellaneous Parameters (%)						
--	Total Solids	5/5	92	96	Z5PDI-SO-002-0204, Z5PDI-SO-003-0204	NA

NA - Not applicable.

Note: All analyzed chemicals were detected.

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations
2 - Detected duplicates are considered one detection
3 - Values presented are sample-specific quantitation limits
4 - ETPH analytical method

Associated Samples:

Z5PDI-SO-001-0204
Z5PDI-SO-001-0204,D
Z5PDI-SO-002-0204
Z5PDI-SO-003-0204
Z5PDI-SO-004-0204
Z5PDI-SO-004-0204,D
Z5PDI-SO-005-0204

TABLE 4-31

SUMMARY OF ALL ZONE 5 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-Detects[2]
Volatile Organics (µg/kg)						
67-64-1	Acetone	6/6	8 J	140	19MW4-0002 (93), 19SS1 (93)	-
100-41-4	Ethylbenzene	1/6	38 J	38 J	19MW4-0002 (93)	10 - 11
75-09-2	Methylene Chloride	6/6	4	20	19MW4-0002 (93)	-
108-88-3	Toluene	1/6	10 J	10 J	19MW4-0002 (93)	10 - 11
1330-20-7	Total Xylenes	1/6	150	150	19MW4-0002 (93)	10 - 11
Semivolatile Organics (µg/kg)						
56-55-3	Benzo(a)anthracene	1/4	230 J	230 J	19MW3-0002 (93)	340 - 20000
205-99-2	Benzo(b)fluoranthene	1/4	200 J	200 J	19MW3-0002 (93)	340 - 20000
206-44-0	Fluoranthene	1/4	480	480	19MW3-0002 (93)	340 - 20000
129-00-0	Pyrene	1/4	420	420	19MW3-0002 (93)	340 - 20000
Pesticides/PCBs (µg/kg)						
72-55-9	4,4'-DDE	1/4	56	56	19SS1 (93)	3.4 - 3.6
11096-82-5	Aroclor-1260	2/4	55	56	19MW3-0002 (93)	34 - 360
Inorganics (mg/kg)						
7429-90-5	Aluminum	4/4	1,940	4,980	19MW3-0002 (93)	-
7440-38-2	Arsenic	4/4	0.52 J	1.5	19SS1 (93)	-
7440-39-3	Barium	4/4	24.9 J	35.4 J	19MW3-0002 (93)	-
7440-41-7	Beryllium	3/4	0.09 J	0.27 J	19SS1 (93)	0.29 - 0.29
7440-42-8	Boron	1/4	19.7 J	19.7 J	19MW3-0002 (93)	1.8 - 3.4
7440-70-2	Calcium	4/4	753 J	881 J	19TB2-0002 (93)	-
15723-28-1	Chromium	4/4	5	12.4	19MW3-0002 (93)	-
7440-48-4	Cobalt	4/4	1.9 J	4.7 J	19MW3-0002 (93)	-
7440-50-8	Copper	4/4	5.5	19.7	19SS1 (93)	-
7439-89-6	Iron	4/4	4,290	10,400	19MW3-0002 (93)	-
7439-92-1	Lead	3/4	6.1	48.4	19SS1 (93)	10.4 - 10.4
7439-95-4	Magnesium	4/4	882 J	2,860	19MW3-0002 (93)	-
7439-96-5	Manganese	4/4	84.9	150	19TB4-0002 (93)	-
7440-02-0	Nickel	3/4	5.7 J	9.4	19MW3-0002 (93)	2 - 2
7440-09-7	Potassium	4/4	655 J	1,240	19MW3-0002 (93)	-
7440-23-5	Sodium	3/4	60.9 J	296 J	19MW3-0002 (93)	277 - 277

TABLE 4-31

SUMMARY OF ALL ZONE 5 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
7440-28-0	Thallium	1/4	0.18	0.18	19SS1 (93)	0.11 - 0.11
7440-62-2	Vanadium	4/4	5.9 J	15.6	19MW3-0002 (93)	-
7440-66-6	Zinc	4/4	14	38.7	19SS1 (93)	-
Petroleum Hydrocarbons (mg/kg)						
--	TPH (C09 - C36)[3]	5/5	35 J	180	Z5PDI-SO-003-0002	-
--	TPH[4]	1/1	6,800	6,800	19SS1 (93)	-
TCLP Inorganics (µg/L)						
7440-39-3	Barium	1/1	557	557	19SS1 (93)	-
7439-92-1	Lead	1/1	173	173	19SS1 (93)	-

J = Estimated value

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - ETPH analytical method
4 - Method 418.1

Associated Samples

19MW3-0002 (93)	19TB1-0002 (93)	Z5PDI-SO-001-0002	Z5PDI-SO-003-0002
19MW4-0002 (93)	19TB2-0002 (93)	Z5PDI-SO-002-0002	Z5PDI-SO-004-0002
19SS1 (93)	19TB4-0002 (93)	Z5PDI-SO-002-0002-D	Z5PDI-SO-005-0002

TABLE 4-32

SUMMARY OF ALL ZONE 5 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-Detects[2]
Volatile Organics (µg/kg)						
78-93-3	2-Butanone	1/10	5	5	19TB2-0608 (93)	11 - 2800
67-64-1	Acetone	9/10	7 J	180	19MW4-0608 (93)	12 - 2800
100-41-4	Ethylbenzene	1/10	33 J	33 J	19MW4-0608 (93)	11 - 2800
75-09-2	Methylene Chloride	10/10	5	1,900	19MW3-0406 (93)	-
108-88-3	Toluene	2/10	3 J	3 J	19MW2-0204 (93), 19TB2-0608 (93)	11 - 2800
1330-20-7	Total Xylenes	2/10	7 J	32 J	19MW4-0608 (93)	11 - 2800
Semivolatile Organics (µg/kg)						
91-57-6	2-Methylnaphthalene	7/23	27 J	23,000	19MW3-0406 (93)	330 - 22000
83-32-9	Acenaphthene	2/23	20 J	48 J	LS5SB0060201	330 - 22000
208-96-8	Acenaphthylene	3/23	20 J	49 J	LS5SB0060201	330 - 22000
120-12-7	Anthracene	8/23	1 J	640	LS5SB0030201	330 - 22000
56-55-3	Benzo(a)anthracene	12/23	24 J	700	LS5SB0040201	350 - 22000
50-32-8	Benzo(a)pyrene	12/24	29 J	1,100	LS5SB0040201	350 - 22000
205-99-2	Benzo(b)fluoranthene	13/24	32 J	1,200	LS5SB0040201	350 - 22000
191-24-2	Benzo(g,h,i)perylene	11/24	35 J	600	LS5SB0040201	330 - 22000
207-08-9	Benzo(k)fluoranthene	10/23	18 J	290 J	LS5SB0040101-D	330 - 22000
117-81-7	bis(2-Ethylhexyl) phthalate	1/24	20 J	32 J	19MW1-0.252.25 (93)-D	330 - 22000
85-68-7	Butyl Benzyl Phthalate	1/23	24 J	24 J	19MW1-0.252.25 (93)-D	330 - 22000
86-74-8	Carbazole	4/23	21 J	61 J	LS5SB0060201	330 - 22000
218-01-9	Chrysene	12/24	28 J	850	LS5SB0040201	350 - 22000
84-74-2	di-n-Butyl Phthalate	1/23	19 J	19 J	LS5SB0040101-D	330 - 22000
117-84-0	di-n-Octyl Phthalate	1/23	62 J	62 J	19MW1-0.252.25 (93)-D	330 - 22000
53-70-3	Dibenzo(a,h)anthracene	5/23	32 J	120 J	LS5SB0040101-D	330 - 22000
132-64-9	Dibenzofuran	1/23	57 J	57 J	LS5SB0060201	330 - 22000
206-44-0	Fluoranthene	14/24	39 J	1,900	LS5SB0040201	350 - 22000
86-73-7	Fluorene	4/23	18 J	4,100 J	LS5SB0010201	330 - 22000
193-39-5	Indeno(1,2,3-cd)pyrene	10/23	24 J	530	LS5SB0040201	330 - 22000
91-20-3	Naphthalene	3/23	22 J	4,500 J	LS5SB0010201	330 - 22000
85-01-8	Phenanthrene	12/23	31 J	7,000 J	19MW3-0406 (93)	350 - 22000

TABLE 4-32

SUMMARY OF ALL ZONE 5 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-Detects[2]
129-00-0	Pyrene	15/24	41 J	1,600	LS5SB0040201	350 - 22000
Pesticides/PCBs (µg/kg)						
72-54-8	4,4'-DDD	1/12	10	12	19MW1-0.252.25 (93)-D	3.5 - 4
72-55-9	4,4'-DDE	1/12	350	430	19MW1-0.252.25 (93)-D	3.5 - 4
50-29-3	4,4'-DDT	1/12	520	640	19MW1-0.252.25 (93)-D	3.5 - 4
5103-71-9	alpha-Chlordane	1/12	5	5.9	19MW1-0.252.25 (93)-D	1.8 - 2
11096-82-5	Aroclor-1260	4/12	42	140	19MW2-0204 (93)	35 - 81
Inorganics (mg/kg)						
7429-90-5	Aluminum	16/16	1,880	13,600	19MW1-0.252.25 (93)-D	-
7440-38-2	Arsenic	16/16	0.34 J	3.5	19MW1-0.252.25 (93)	-
7440-39-3	Barium	16/16	13.6 J	53.6 J	19TB3-0204 (93)	-
7440-41-7	Beryllium	10/16	0.12 J	0.91 J	19MW1-0.252.25 (93)	0.08 - 0.24
7440-70-2	Calcium	16/16	455 J	2,810 J	LS5SB0060101	-
15723-28-1	Chromium	16/16	2.5	23.4	19MW1-0.252.25 (93)	-
7440-48-4	Cobalt	16/16	0.98 J	4.9 J	19TB4-0406 (93)	-
7440-50-8	Copper	16/16	2.7 J	43.8	19MW3-0406 (93)	-
57-12-5	Cyanide	2/12	0.17 J	0.24 J	19MW2-0204 (93)	0.15 - 1.2
7439-89-6	Iron	16/16	3,450	13,100	19MW1-0.252.25 (93)-D	-
7439-92-1	Lead	16/17	1.3	91.2	LS5SB0010101	31.5 - 31.5
7439-95-4	Magnesium	16/16	796 J	3,160 J	19TB3-0204 (93)	-
7439-96-5	Manganese	16/16	43.1	300	19MW1-0.252.25 (93)	-
7439-97-6	Mercury	2/16	0.01 J	0.1	19MW1-0.252.25 (93)	0.01 - 0.11
7440-02-0	Nickel	15/16	3 J	8.1	19MW3-0406 (93)	2 - 2
7440-09-7	Potassium	16/16	239 J	3,100 J	19TB3-0204 (93)	-
7782-49-2	Selenium	1/16	0.67 J	1.1 J	19MW1-0.252.25 (93)	0.16 - 0.38
7440-23-5	Sodium	16/16	47 J	529 J	19TB3-1012 (93)	-
7440-62-2	Vanadium	16/16	4.3 J	22.9	19MW1-0.252.25 (93)-D	-
7440-66-6	Zinc	16/16	10.9	116	LS5SB0060201	-
Petroleum Hydrocarbons (mg/kg)						
--	TPH (C09 - C36)[3]	5/5	2.9 J	2,100	Z5PDI-SO-004-0204	4.1
--	TPH[4]	12/14	53	6,200	19TB2-0608 (93)	66 - 78

TABLE 4-32

SUMMARY OF ALL ZONE 5 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
TCLP Inorganics (µg/L)						
7440-39-3	Barium	8/8	217	417	19TB3-1012 (93)	-
7440-43-9	Cadmium	1/8	2.8 J	2.8 J	19MW1-0.252.25 (93)	2 - 2.5
15723-28-1	Chromium	5/8	5.4 J	32.4	19MW2-0406 (93)-D	3.9 - 4
7439-92-1	Lead	7/8	12.4	419	19MW2-0406 (93)	26 - 28
7440-22-4	Silver	3/8	9.8	19.4	19MW2-0406 (93)-D	2.5 - 4
SPLP Inorganics (µg/L)						
7439-92-1	Lead	4/4	1.4 J	10.1	LS5SB0010101	-

J = Estimated value

Footnotes:

1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - ETPH analytical method
4 - Method 418.1

Associated Samples

19MW1-0.252.25 (93)	19TB1-0608 (93)	LS5SB0020101	LS5SB0040201
19MW1-0.252.25 (93)-D	19TB2-0608 (93)	LS5SB0020201	LS5SB0050101
19MW2-0204 (93)	19TB3-0204 (93)	LS5SB0060101	LS5SB0050201
19MW2-0406 (93)	19TB3-1012 (93)	LS5SB0060201	Z5PDI-SO-001-0204
19MW2-0406 (93)-D	19TB4-0204 (93)	LS5SB0030101	Z5PDI-SO-001-0204-D
19MW3-0406 (93)	19TB4-0406 (93)	LS5SB0030101-D	Z5PDI-SO-002-0204
19MW4-0004 (93)	LS5SB0010101	LS5SB0030201	Z5PDI-SO-003-0204
19MW4-0608 (93)	LS5SB0010101-D	LS5SB0040101	Z5PDI-SO-004-0204
19TB1-0004 (93)	LS5SB0010201	LS5SB0040101-D	Z5PDI-SO-004-0204-D
			Z5PDI-SO-005-0204

TABLE 4-33

DETECTED CONCENTRATIONS IN PDI ZONE 6 SURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z6PDI-001 Z6PDI-SO-001-0002 20100909	Z6PDI-002 Z6PDI-SO-002-0002 20100909	Z6PDI-003 Z6PDI-SO-003-0002 20100914	Z6PDI-004 Z6PDI-SO-004-0002 20100909
PETROLEUM HYDROCARBONS (MG/KG)				
TPH (C09-C36)[1]	570	180	21	55
MISCELLANEOUS PARAMETERS (%)				
TOTAL SOLIDS	97	97	96	94

1 - ETPH analytical method.

TABLE 4-34

DETECTED CONCENTRATIONS IN PDI ZONE 6 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z6PDI-001		Z6PDI-002	Z6PDI-003	Z6PDI-004
	Z6PDI-SO-001-0405	Z6PDI-SO-001-0405-D	Z6PDI-SO-002-0405	Z6PDI-SO-003-0304	Z6PDI-SO-004-0204
	20100909	20100909	20100909	20100914	20100909
PETROLEUM HYDROCARBONS (MG/KG)					
TPH (C09-C36)[1]	5.1 J	8.5	3.8 U	4.8 J	46
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	94	94	95	92	95

1 - ETPH analytical method.

TABLE 4-35

SUMMARY OF ZONE 6 SURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Detected Chemical	Frequency of Detection(2)	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(3)
Petroleum Hydrocarbons (mg/kg)						
--	TPH (C09-C36)[4]	4/4	21	570	Z6PDI-SO-001-0002	NA
Miscellaneous Parameters (%)						
--	Total Solids	4/4	94	97	Z6PDI-SO-001-0002, Z6PDI-SO-002-0002	NA

NA - Not applicable.

Note: All analyzed chemicals were detected.

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations
2 - Detected duplicates are considered one detection
3 - Values presented are sample-specific quantitation limits
4 - ETPH analytical method

Associated Samples:

Z6PDI-SO-001-0002
Z6PDI-SO-002-0002
Z6PDI-SO-003-0002
Z6PDI-SO-004-0002

TABLE 4-36

SUMMARY OF ZONE 6 SUBSURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Detected Chemical	Frequency of Detection[2]	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-Detects[3]
Petroleum Hydrocarbons (mg/kg)						
--	TPH(C09-C36)[4]	3/4	4.8 J	46	Z6PDI-SO-004-0204	3.8
Miscellaneous Parameters (%)						
--	Total Solids	4/4	92	95	Z6PDI-SO-002-0405, Z6PDI-SO-004-0204	NA

NA - Not applicable.

Note: All analyzed chemicals were detected.

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations
2 - Detected duplicates are considered one detection
3 - Values presented are sample-specific quantitation limits
4 - ETPH analytical method

Associated Samples:

Z6PDI-SO-001-0405
Z6PDI-SO-001-0405,D
Z6PDI-SO-002-0405
Z6PDI-SO-003-0304
Z6PDI-SO-004-0204

TABLE 4-37

SUMMARY OF ALL ZONE 6 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
Semivolatile Organics (µg/kg)						
91-57-6	2-Methylnaphthalene	1/3	30 J	30 J	LS6SB0050101	330 - 360
83-32-9	Acenaphthene	2/3	22 J	42 J	LS6SB0040101	360
208-96-8	Acenaphthylene	1/3	29 J	29 J	LS6SB0050101	330 - 360
120-12-7	Anthracene	2/3	69 J	86 J	LS6SB0040101	360
56-55-3	Benzo(a)anthracene	3/3	40 J	330	LS6SB0040101	-
50-32-8	Benzo(a)pyrene	2/3	31 J	460 J	LS6SB0040101	330
205-99-2	Benzo(b)fluoranthene	2/3	37 J	240 J	LS6SB0040101	330
191-24-2	Benzo(g,h,i)perylene	2/3	26 J	88 J	LS6SB0040101	330
207-08-9	Benzo(k)fluoranthene	2/3	26 J	280 J	LS6SB0040101	330
85-68-7	Butyl Benzyl Phthalate	2/3	19 J	19 J	LS6SB0030201, LS6SB0040101	330
86-74-8	Carbazole	1/3	28 J	28 J	LS6SB0040101	330 - 360
218-01-9	Chrysene	3/3	45 J	360	LS6SB0040101	-
117-84-0	di-n-Octyl Phthalate	1/3	32 J	32 J	LS6SB0030201	330 - 330
132-64-9	Dibenzofuran	1/3	30 J	30 J	LS6SB0050101	330 - 360
206-44-0	Fluoranthene	3/3	40 J	500	LS6SB0040101	-
86-73-7	Fluorene	1/3	34 J	34 J	LS6SB0040101	330 - 360
193-39-5	Indeno(1,2,3-cd)pyrene	2/3	26 J	130 J	LS6SB0040101	330
85-01-8	Phenanthrene	3/3	25 J	340	LS6SB0040101	-
129-00-0	Pyrene	3/3	56 J	1,000	LS6SB0040101	-
Inorganics (mg/kg)						
7429-90-5	Aluminum	3/3	4,660	6,150	LS6SB0030201	-
7440-38-2	Arsenic	3/3	1.6	2.1	LS6SB0040101	-
7440-39-3	Barium	3/3	31.7	45	LS6SB0030201	-
7440-41-7	Beryllium	2/3	0.18	0.22	LS6SB0030201	0.14
7440-70-2	Calcium	3/3	722 J	1,680	LS6SB0030201	-
15723-28-1	Chromium	3/3	10.2	13.9	LS6SB0030201	-
7440-48-4	Cobalt	3/3	3.5	5.1	LS6SB0030201	-
7440-50-8	Copper	3/3	8.7	24.5	LS6SB0030201	-
7439-89-6	Iron	3/3	6,720	10,400	LS6SB0030201	-
7439-92-1	Lead	3/3	3.1 J	12.4 J	LS6SB0030201	-

TABLE 4-37

SUMMARY OF ALL ZONE 6 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
7439-95-4	Magnesium	3/3	1,990 J	3,810	LS6SB0030201	-
7439-96-5	Manganese	3/3	131	182	LS6SB0030201	-
7439-97-6	Mercury	1/3	0.04 J	0.04 J	LS6SB0030201	0.01
7440-02-0	Nickel	3/3	8.5 J	10.4	LS6SB0030201	-
7440-09-7	Potassium	3/3	1,280	1,840	LS6SB0030201	-
7440-23-5	Sodium	3/3	122	172	LS6SB0030201	-
7440-62-2	Vanadium	3/3	14.3	23.1	LS6SB0050101	-
7440-66-6	Zinc	3/3	15.8	50.1	LS6SB0030201	-
Petroleum Hydrocarbons (mg/kg)						
--	TPH (C09 - C36)[3]	4/4	21	570	Z6PDI-SO-001-0002	-
--	TPH[4]	3/3	120 J	4,000	LS6SB0050101	-
SPLP Inorganics (µg/L)						
7440-39-3	Barium	1/2	236	236	LS6SB0040101	18.4
7440-70-2	Calcium	2/2	728	7,920	LS6SB0030201	-
15723-28-1	Chromium	1/2	0.93 J	0.93 J	LS6SB0040101	1.2
7440-50-8	Copper	1/2	0.96 J	0.96 J	LS6SB0040101	0.74
7439-89-6	Iron	1/2	363	363	LS6SB0040101	55.4
7439-92-1	Lead	1/2	2.9 J	2.9 J	LS6SB0040101	1.9
7439-96-5	Manganese	1/2	24.2	24.2	LS6SB0040101	0.38
7440-02-0	Nickel	1/2	1.2 J	1.2 J	LS6SB0040101	0.75
7440-09-7	Potassium	2/2	799	1,050	LS6SB0040101	-
7440-23-5	Sodium	2/2	3,520	4,060	LS6SB0040101	-
7440-62-2	Vanadium	1/2	0.83 J	0.83 J	LS6SB0040101	2

J = Estimated value

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - ETPH analytical method
4 - Method 418.1

TABLE 4-37

SUMMARY OF ALL ZONE 6 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

Associated Samples

LS6SB0030201	Z6PDI-SO-001-0002	Z6PDI-SO-004-0002
LS6SB0040101	Z6PDI-SO-002-0002	
LS6SB0050101	Z6PDI-SO-003-0002	

TABLE 4-38

SUMMARY OF ALL ZONE 6 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Frequency of Detection	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-Detects[2]
Volatile Organics (µg/kg)						
67-64-1	Acetone	1/7	90	90	LS6SB0010401	10 - 140
Semivolatile Organics (µg/kg)						
120-12-7	Anthracene	2/7	19 J	35 J	LS6SB0020201	330 - 360
56-55-3	Benzo(a)anthracene	3/7	42 J	160 J	LS6SB0020201	330 - 360
50-32-8	Benzo(a)pyrene	2/7	160 J	180 J	LS6SB0020301	330 - 360
205-99-2	Benzo(b)fluoranthene	3/7	31 J	160 J	LS6SB0020201	330 - 360
191-24-2	Benzo(g,h,i)perylene	2/7	90 J	110 J	LS6SB0020201	330 - 360
207-08-9	Benzo(k)fluoranthene	3/7	26 J	150 J	LS6SB0020301	330 - 360
85-68-7	Butyl Benzyl Phthalate	2/7	22 J	43 J	LS6SB0020301	330 - 360
218-01-9	Chrysene	4/7	28 J	150 J	LS6SB0020201, LS6SB0020301	330 - 360
53-70-3	Dibenzo(a,h)anthracene	1/7	50 J	50 J	LS6SB0020201	330 - 360
206-44-0	Fluoranthene	4/7	21 J	260 J	LS6SB0020201	330 - 360
193-39-5	Indeno(1,2,3-cd)pyrene	2/7	80 J	98 J	LS6SB0020201	330 - 360
85-01-8	Phenanthrene	3/7	37 J	130 J	LS6SB0020201	330 - 360
129-00-0	Pyrene	4/7	33 J	320 J	LS6SB0020201	330 - 360
Inorganics (mg/kg)						
7429-90-5	Aluminum	7/7	2,410	8,250	LS6SB0010201	-
7440-38-2	Arsenic	7/7	0.87 J	2.2	LS6SB0020201	-
7440-39-3	Barium	7/7	16.8	38.6	LS6SB0010201	-
7440-70-2	Calcium	7/7	588	982 J	LS6SB0020201	-
15723-28-1	Chromium	7/7	5.8	15.2	LS6SB0010201, LS6SB0010401	-
7440-48-4	Cobalt	7/7	2.1	6.4	LS6SB0010201	-
7440-50-8	Copper	7/7	6.8	12.7	LS6SB0020201	-
7439-89-6	Iron	7/7	4,010	10,200	LS6SB0010201	-
7439-92-1	Lead	6/7	2	18	LS6SB0010201	4.4
7439-95-4	Magnesium	7/7	1,200 J	3,170	LS6SB0010401	-
7439-96-5	Manganese	7/7	75.2	160	LS6SB0050301	-
7440-02-0	Nickel	7/7	4.8 J	12.5	LS6SB0010201	-
7440-09-7	Potassium	7/7	711	1,710	LS6SB0010401	-

TABLE 4-38

SUMMARY OF ALL ZONE 6 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
7440-22-4	Silver	1/7	0.46	0.46	LS6SB0010201	0.18 - 0.46
7440-23-5	Sodium	7/7	56.9	140	LS6SB0030301	-
7440-62-2	Vanadium	7/7	8.5	19.6	LS6SB0010201	-
7440-66-6	Zinc	7/7	10.7	27.8	LS6SB0020201	-
Petroleum Hydrocarbons (mg/kg)						
--	TPH (C09 - C36)[3]	3/4	4.8 J	46	Z6PDI-SO-004-0204	3.8
--	TPH[4]	7/7	4.8	1,200	LS6SB0020301	3.8 - 25
SPLP Inorganics (µg/L)						
7429-90-5	Aluminum	2/4	480	861	LS6SB0010201	42.4 - 89.4
7440-39-3	Barium	2/4	238	300	LS6SB0010201	17.4 - 49.1
7440-70-2	Calcium	4/4	736	1,600	LS6SB0010201	-
7440-50-8	Copper	1/4	3.5	3.5	LS6SB0010201	0.74 - 1.5
7439-89-6	Iron	1/4	661	661	LS6SB0010201	13.4 - 343
7439-95-4	Magnesium	2/4	429	522	LS6SB0010201	145 - 160
7439-96-5	Manganese	4/4	1.6	73.3	LS6SB0010401	-
7440-09-7	Potassium	3/4	670	1,550	LS6SB0010201	1420
7440-23-5	Sodium	4/4	1,190	2,500	LS6SB0030301	-
7440-66-6	Zinc	1/4	109	109	LS6SB0010201	20.3 - 80.1

J = Estimated value

Footnotes:

1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - ETPH analytical method
4 - Method 418.1

Associated Samples

LS6SB0010201	LS6SB0030301	Z6PDI-SO-001-0405	Z6PDI-SO-004-0204
LS6SB0010401	LS6SB0040301	Z6PDI-SO-001-0405-D	
LS6SB0020201	LS6SB0050301	Z6PDI-SO-002-0405	
LS6SB0020301		Z6PDI-SO-003-0304	

TABLE 4-39

DETECTED CONCENTRATIONS IN PDI ZONE 7 SURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z7PDI-001	Z7PDI-002	Z7PDI-003		Z7PDI-004
	Z7PDI-SO-001-0002	Z7PDI-SO-002-0002	Z7PDI-SO-003-0002	Z7PDI-SO-003-0002-D	Z7PDI-SO-004-0002
	20100911	20100911	20100910	20100910	20100911
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENT	1353.84	7784.9	14660.7	NA	9037.2
BENZO(A)ANTHRACENE	830	5000	7800	NA	5500
BENZO(A)PYRENE	930	5100	8400	NA	5800
BENZO(B)FLUORANTHENE	1400	6900	15000	NA	8600
BENZO(K)FLUORANTHENE	400	3000	6300	NA	3200
CARBAZOLE	27	180	46	NA	370 J
CHRYSENE	840	4900	7700 J	NA	5200
DIBENZO(A,H)ANTHRACENE	130	1100	3100	NA	1400 J
INDENO(1,2,3-CD)PYRENE	660	3600	8100	NA	3900
PHENANTHRENE	240	2000	550 J	NA	2100
PYRENE	1700	9100	8500	NA	9600
METALS (MG/KG)					
ANTIMONY	0.34 U	2.1 J	NA	NA	2.6 J
CHROMIUM	10.3	NA	NA	NA	NA
CHROMIUM III	10.3	NA	NA	NA	NA
HEXAVALENT CHROMIUM	0.1 U	NA	NA	NA	NA
LEAD	24.1	1220	2120	1780	308
SPLP METALS (UG/L)					
ANTIMONY	2.7 J	14.6	NA	NA	9.4
LEAD	8.5	456	NA	NA	102
MISCELLANEOUS PARAMETERS (MV)					
OXIDATION/REDUCTION POTENTIAL	153	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	97	94	90	92	98

TABLE 4-39

DETECTED CONCENTRATIONS IN PDI ZONE 7 SURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z7PDI-005 Z7PDI-SO-005-0002 20100911	Z7PDI-006 Z7PDI-SO-006-0002 20100911	Z7PDI-007 Z7PDI-SO-007-0002 20100910	Z7PDI-008 Z7PDI-SO-008-0002 20100910	Z7PDI-009 Z7PDI-SO-009-0002 20100911
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENT	3221.8	NA	127.434	2530.5	3393.2
BENZO(A)ANTHRACENE	2000	NA	69	1500	2100
BENZO(A)PYRENE	2100	NA	81 J	1600	2200
BENZO(B)FLUORANTHENE	3100	NA	120 J	2300	3300
BENZO(K)FLUORANTHENE	1000	NA	36 J	920	1100
CARBAZOLE	220 J	NA	2.1 J	35	380 J
CHRYSENE	1800	NA	74 J	1300 J	2200
DIBENZO(A,H)ANTHRACENE	470 J	NA	21 J	420	520 J
INDENO(1,2,3-CD)PYRENE	1300	NA	61 J	1200	1200
PHENANTHRENE	2000 J	NA	24	150	2400 J
PYRENE	3600	NA	130	1700	3000
METALS (MG/KG)					
ANTIMONY	NA	NA	50.6 J	NA	0.63 J
CHROMIUM	18.1	NA	NA	NA	NA
CHROMIUM III	17.4	NA	NA	NA	NA
HEXAVALENT CHROMIUM	0.78	NA	NA	NA	NA
LEAD	204	8.2	31400	16	257
SPLP METALS (UG/L)					
ANTIMONY	NA	NA	120	NA	11.6
LEAD	NA	NA	1040	NA	NA
MISCELLANEOUS PARAMETERS (MV)					
OXIDATION/REDUCTION POTENTIAL	157	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	91	95	95	95	93

TABLE 4-39

DETECTED CONCENTRATIONS IN PDI ZONE 7 SURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z7PDI-009	Z7PDI-010		Z7PDI-011	Z7PDI-012
	Z7PDI-SO-009-0002-D	Z7PDI-SO-010-0002	Z7PDI-SO-010-0002-D	Z7PDI-SO-011-0002	Z7PDI-SO-012-0002
	20100911	20100913	20100913	20100913	20100913
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENT	NA	2057.92	NA	227.79	320.29
BENZO(A)ANTHRACENE	NA	1000	NA	130	200 J
BENZO(A)PYRENE	NA	1300	NA	140	200 J
BENZO(B)FLUORANTHENE	NA	1800	NA	220	310 J
BENZO(K)FLUORANTHENE	NA	700	NA	65	110 J
CARBAZOLE	NA	46	NA	12 J	11 J
CHRYSENE	NA	920 J	NA	140 J	190 J
DIBENZO(A,H)ANTHRACENE	NA	350	NA	39 J	53 J
INDENO(1,2,3-CD)PYRENE	NA	1200	NA	130	150 J
PHENANTHRENE	NA	140	NA	89	94 J
PYRENE	NA	1600	NA	290	370 J
METALS (MG/KG)					
ANTIMONY	0.55 J	8.5 J	12.4 J	NA	NA
CHROMIUM	NA	NA	NA	NA	NA
CHROMIUM III	NA	NA	NA	NA	NA
HEXAVALENT CHROMIUM	NA	NA	NA	NA	NA
LEAD	266	1810	1870	262	NA
SPLP METALS (UG/L)					
ANTIMONY	NA	377	NA	NA	NA
LEAD	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MV)					
OXIDATION/REDUCTION POTENTIAL	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	92	95	94	97	96

TABLE 4-39

DETECTED CONCENTRATIONS IN PDI ZONE 7 SURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z7PDI-012	Z7PDI-013		Z7PDI-014	Z7PDI-015
	Z7PDI-SO-012-0002-D	Z7PDI-SO-013-0002	Z7PDI-SO-013-0002-D	Z7PDI-SO-014-0002	Z7PDI-SO-015-0002
	20100913	20100913	20100913	20100908	20100908
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENT	138.863	265.97	980.66	127.336	484.95
BENZO(A)ANTHRACENE	71 J	140 J	530 J	63	320
BENZO(A)PYRENE	87 J	170 J	660 J	83	310
BENZO(B)FLUORANTHENE	120 J	260 J	1000 J	100	410
BENZO(K)FLUORANTHENE	39 J	82 J	310 J	46	170 J
CARBAZOLE	10 U	12 J	56 J	6.1 J	6.9 J
CHRYSENE	73 J	150 J	560 J	76 J	250 J
DIBENZO(A,H)ANTHRACENE	26 J	40 J	110 J	21 J	77 J
INDENO(1,2,3-CD)PYRENE	63 J	150 J	540 J	65	230 J
PHENANTHRENE	25 J	84 J	510 J	36	120
PYRENE	120 J	260 J	1100 J	160	500
METALS (MG/KG)					
ANTIMONY	NA	NA	NA	NA	NA
CHROMIUM	NA	NA	NA	NA	NA
CHROMIUM III	NA	NA	NA	NA	NA
HEXAVALENT CHROMIUM	NA	NA	NA	NA	NA
LEAD	NA	NA	NA	NA	NA
SPLP METALS (UG/L)					
ANTIMONY	NA	NA	NA	NA	NA
LEAD	NA	NA	NA	NA	20.7
MISCELLANEOUS PARAMETERS (MV)					
OXIDATION/REDUCTION POTENTIAL	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	95	94	93	93	93

TABLE 4-39

DETECTED CONCENTRATIONS IN PDI ZONE 7 SURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z7PDI-015	Z7PDI-016	Z7PDI-017	Z7PDI-018	
	Z7PDI-SO-015-0002-D	Z7PDI-SO-016-0002	Z7PDI-SO-017-0002	Z7PDI-SO-018-0002	Z7PDI-SO-018-0002-D
	20100908	20100908	20100911	20100908	20100908
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENT	673.5	964.85	NA	2619.2	933.25
BENZO(A)ANTHRACENE	390	670	NA	1900 J	630 J
BENZO(A)PYRENE	440	610	NA	1700 J	610 J
BENZO(B)FLUORANTHENE	580	920	NA	2500 J	880 J
BENZO(K)FLUORANTHENE	220 J	230	NA	770 J	270 J
CARBAZOLE	15 J	11 J	NA	320 J	51 J
CHRYSENE	300 J	550 J	NA	1500 J	550 J
DIBENZO(A,H)ANTHRACENE	100 J	150 J	NA	350 J	130 J
INDENO(1,2,3-CD)PYRENE	340 J	430 J	NA	1200 J	390 J
PHENANTHRENE	120	110	NA	1800 J	740 J
PYRENE	550	770	NA	2700 J	1200 J
METALS (MG/KG)					
ANTIMONY	NA	NA	0.22 J	NA	NA
CHROMIUM	NA	NA	NA	NA	NA
CHROMIUM III	NA	NA	NA	NA	NA
HEXAVALENT CHROMIUM	NA	NA	NA	NA	NA
LEAD	NA	NA	NA	NA	NA
SPLP METALS (UG/L)					
ANTIMONY	NA	NA	8 U	NA	NA
LEAD	15.7	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MV)					
OXIDATION/REDUCTION POTENTIAL	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	94	96	94	94	96

TABLE 4-39

DETECTED CONCENTRATIONS IN PDI ZONE 7 SURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z7PDI-019	Z7PDI-020	
	Z7PDI-SO-019-0002	Z7PDI-SO-020-0002	Z7PDI-SO-020-0002-D
	20100908	20100910	20100910
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)			
BAP EQUIVALENT	3649.6	45.888	38.853
BENZO(A)ANTHRACENE	3800	21	18 J
BENZO(A)PYRENE	2400	28	24
BENZO(B)FLUORANTHENE	3300	46	38
BENZO(K)FLUORANTHENE	1700	16 J	13 J
CARBAZOLE	570 J	10 UJ	10 UJ
CHRYSENE	2600 J	28	23
DIBENZO(A,H)ANTHRACENE	410 J	8.1 J	6.6 J
INDENO(1,2,3-CD)PYRENE	1100	29	25
PHENANTHRENE	5300	16 J	10 J
PYRENE	6000	42	35
METALS (MG/KG)			
ANTIMONY	NA	NA	NA
CHROMIUM	NA	NA	NA
CHROMIUM III	NA	NA	NA
HEXAVALENT CHROMIUM	NA	NA	NA
LEAD	NA	NA	NA
SPLP METALS (UG/L)			
ANTIMONY	NA	NA	NA
LEAD	NA	NA	NA
MISCELLANEOUS PARAMETERS (MV)			
OXIDATION/REDUCTION POTENTIAL	NA	NA	NA
MISCELLANEOUS PARAMETERS (%)			
TOTAL SOLIDS	96	95	94

TABLE 4-40

DETECTED CONCENTRATIONS IN PDI ZONE 7 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z7PDI-001		Z7PDI-002		Z7PDI-003
	Z7PDI-SO-001-0204 20100911	Z7PDI-SO-001-0607 20100911	Z7PDI-SO-002-0607 20100911	Z7PDI-SO-002-0607-D 20100911	Z7PDI-SO-003-0204 20100910
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENT	NA	NA	728.68	NA	NA
BENZO(A)ANTHRACENE	NA	NA	430	NA	NA
BENZO(A)PYRENE	NA	NA	480	NA	NA
BENZO(B)FLUORANTHENE	NA	NA	690	NA	NA
BENZO(K)FLUORANTHENE	NA	NA	220	NA	NA
CARBAZOLE	NA	NA	38	NA	NA
CHRYSENE	NA	NA	480	NA	NA
DIBENZO(A,H)ANTHRACENE	NA	NA	100	NA	NA
INDENO(1,2,3-CD)PYRENE	NA	NA	340	NA	NA
PHENANTHRENE	NA	NA	310	NA	NA
PYRENE	NA	NA	900	NA	NA
METALS (MG/KG)					
ANTIMONY	0.35 UJ	0.37 J	4.6 J	NA	NA
CHROMIUM	NA	NA	NA	NA	10.7
CHROMIUM III	NA	NA	NA	NA	10.2
HEXAVALENT CHROMIUM	NA	NA	NA	NA	0.53
LEAD	11.1	608	2690	NA	NA
SPLP METALS (UG/L)					
ANTIMONY	3.4 J	2.7 J	18.9	19	19.1
LEAD	2.5 U	29.1	218	132	NA
MISCELLANEOUS PARAMETERS (MV)					
OXIDATION/REDUCTION POTENTIAL	NA	NA	NA	NA	196
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	97	94	94	NA	NA

TABLE 4-40

DETECTED CONCENTRATIONS IN PDI ZONE 7 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z7PDI-003		Z7PDI-004		Z7PDI-005
	Z7PDI-SO-003-0204-D 20100910	Z7PDI-SO-003-0506 20100910	Z7PDI-SO-004-0304 20100911	Z7PDI-SO-004-0406 20100911	Z7PDI-SO-005-0204 20100911
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENT	NA	NA	NA	167.99	4568
BENZO(A)ANTHRACENE	NA	NA	NA	110	3400
BENZO(A)PYRENE	NA	NA	NA	110	2900
BENZO(B)FLUORANTHENE	NA	NA	NA	150	4600
BENZO(K)FLUORANTHENE	NA	NA	NA	69	1500
CARBAZOLE	NA	NA	NA	16 J	420 J
CHRYSENE	NA	NA	NA	100	3000
DIBENZO(A,H)ANTHRACENE	NA	NA	NA	23	670 J
INDENO(1,2,3-CD)PYRENE	NA	NA	NA	82	1800
PHENANTHRENE	NA	NA	NA	100	6200 J
PYRENE	NA	NA	NA	220	6100
METALS (MG/KG)					
ANTIMONY	NA	NA	5.2 J	5.3 J	NA
CHROMIUM	NA	NA	NA	NA	10.7
CHROMIUM III	NA	NA	NA	NA	10.7
HEXAVALENT CHROMIUM	NA	NA	NA	NA	0.11 U
LEAD	NA	NA	NA	NA	103
SPLP METALS (UG/L)					
ANTIMONY	14.1	48.7	15.8	28.4	NA
LEAD	NA	NA	30	262	NA
MISCELLANEOUS PARAMETERS (MV)					
OXIDATION/REDUCTION POTENTIAL	NA	NA	NA	NA	168
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	NA	NA	96	92	94

TABLE 4-40

DETECTED CONCENTRATIONS IN PDI ZONE 7 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z7PDI-007		Z7PDI-008	Z7PDI-009	
	Z7PDI-SO-007-0506 20100910	Z7PDI-SO-007-0506-D 20100910	Z7PDI-SO-008-0507 20100910	Z7PDI-SO-009-0607 20100911	Z7PDI-SO-009-0607-D 20100911
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENT	NA	NA	NA	NA	NA
BENZO(A)ANTHRACENE	NA	NA	NA	NA	NA
BENZO(A)PYRENE	NA	NA	NA	NA	NA
BENZO(B)FLUORANTHENE	NA	NA	NA	NA	NA
BENZO(K)FLUORANTHENE	NA	NA	NA	NA	NA
CARBAZOLE	NA	NA	NA	NA	NA
CHRYSENE	NA	NA	NA	NA	NA
DIBENZO(A,H)ANTHRACENE	NA	NA	NA	NA	NA
INDENO(1,2,3-CD)PYRENE	NA	NA	NA	NA	NA
PHENANTHRENE	NA	NA	NA	NA	NA
PYRENE	NA	NA	NA	NA	NA
METALS (MG/KG)					
ANTIMONY	118 J	NA	NA	10.7 J	6.2 J
CHROMIUM	NA	NA	NA	8.8	NA
CHROMIUM III	NA	NA	NA	8.6	NA
HEXAVALENT CHROMIUM	NA	NA	NA	0.13	NA
LEAD	23800	NA	4.3	3320	NA
SPLP METALS (UG/L)					
ANTIMONY	26.4	21.3	NA	53.9	NA
LEAD	18.2	11.8	1.9 J	1270	NA
MISCELLANEOUS PARAMETERS (MV)					
OXIDATION/REDUCTION POTENTIAL	NA	NA	NA	169	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	85	NA	98	94	96

TABLE 4-40

DETECTED CONCENTRATIONS IN PDI ZONE 7 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z7PDI-010		Z7PDI-011	Z7PDI-013	Z7PDI-014
	Z7PDI-SO-010-0204	Z7PDI-SO-010-0204-D	Z7PDI-SO-011-0204	Z7PDI-SO-013-0406	Z7PDI-SO-014-0204
	20100913	20100913	20100913	20100913	20100908
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)					
BAP EQUIVALENT	NA	NA	20.781	365.42	91.258
BENZO(A)ANTHRACENE	NA	NA	12 J	260	45
BENZO(A)PYRENE	NA	NA	13 J	230	57
BENZO(B)FLUORANTHENE	NA	NA	22	360	79
BENZO(K)FLUORANTHENE	NA	NA	6.8 J	120	21
CARBAZOLE	NA	NA	10 UJ	50 J	4.2 J
CHRYSENE	NA	NA	13 J	220	48 J
DIBENZO(A,H)ANTHRACENE	NA	NA	3.2 J	52	17 J
INDENO(1,2,3-CD)PYRENE	NA	NA	11 J	200	46 J
PHENANTHRENE	NA	NA	7.9 J	310	24
PYRENE	NA	NA	18 J	540	95
METALS (MG/KG)					
ANTIMONY	110 J	NA	NA	NA	NA
CHROMIUM	NA	NA	NA	NA	NA
CHROMIUM III	NA	NA	NA	NA	NA
HEXAVALENT CHROMIUM	NA	NA	NA	NA	NA
LEAD	NA	NA	NA	NA	NA
SPLP METALS (UG/L)					
ANTIMONY	627 J	344 J	NA	NA	NA
LEAD	1820	1410	122	NA	NA
MISCELLANEOUS PARAMETERS (MV)					
OXIDATION/REDUCTION POTENTIAL	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (%)					
TOTAL SOLIDS	84	NA	91	93	94

TABLE 4-40

DETECTED CONCENTRATIONS IN PDI ZONE 7 SUBSURFACE SOIL SAMPLES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	Z7PDI-015 Z7PDI-SO-015-0204 20100908	Z7PDI-016 Z7PDI-SO-016-0204 20100908	Z7PDI-017 Z7PDI-SO-017-0406 20100911	Z7PDI-020 Z7PDI-SO-020-0406 20100910
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)				
BAP EQUIVALENT	860.31	735.28	NA	10 U
BENZO(A)ANTHRACENE	490	480	NA	10 U
BENZO(A)PYRENE	560	480	NA	10 U
BENZO(B)FLUORANTHENE	700	650	NA	10 U
BENZO(K)FLUORANTHENE	290	190	NA	10 U
CARBAZOLE	29	23	NA	10 UJ
CHRYSENE	410 J	380 J	NA	10 U
DIBENZO(A,H)ANTHRACENE	140	110 J	NA	10 U
INDENO(1,2,3-CD)PYRENE	380 J	300	NA	10 U
PHENANTHRENE	180	220	NA	10 U
PYRENE	600	660	NA	10 U
METALS (MG/KG)				
ANTIMONY	NA	NA	0.68 J	NA
CHROMIUM	NA	NA	12.3	8.1
CHROMIUM III	NA	NA	12.3	8.1
HEXAVALENT CHROMIUM	NA	NA	0.11 U	0.11 U
LEAD	NA	NA	168	NA
SPLP METALS (UG/L)				
ANTIMONY	NA	NA	7.4 U	NA
LEAD	8.9	NA	40.5	NA
MISCELLANEOUS PARAMETERS (MV)				
OXIDATION/REDUCTION POTENTIAL	NA	NA	173	177
MISCELLANEOUS PARAMETERS (%)				
TOTAL SOLIDS	95	92	93	94

TABLE 4-41

SUMMARY OF ZONE 7 SURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Detected Chemical	Frequency of Detection[2]	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-Detects[3]
PAHs (µg/kg)						
NA	Bap Equivalents	18/18	38.853	14660.7	Z7PDI-SO-003-0002	NA
56-55-3	Benzo(a)anthracene	18/18	18 J	7800	Z7PDI-SO-003-0002	NA
50-32-8	Benzo(a)pyrene	18/18	24	8400	Z7PDI-SO-003-0002	NA
205-99-2	Benzo(b)fluoranthene	18/18	38	15000	Z7PDI-SO-003-0002	NA
207-08-9	Benzo(k)fluoranthene	18/18	13 J	6300	Z7PDI-SO-003-0002	NA
86-74-8	Carbazole	17/18	2.1 J	570 J	Z7PDI-SO-019-0002	10
218-01-9	Chrysene	18/18	23	7700 J	Z7PDI-SO-003-0002	NA
53-70-3	Dibenzo(a,h)anthracene	18/18	6.6 J	3100	Z7PDI-SO-003-0002	NA
193-39-5	Indeno(1,2,3-cd)pyrene	18/18	25	8100	Z7PDI-SO-003-0002	NA
85-01-8	Phenanthrene	18/18	10 J	5300	Z7PDI-SO-019-0002	NA
129-00-0	Pyrene	18/18	35	9600	Z7PDI-SO-004-0002	NA
Inorganics (mg/kg)						
7440-36-0	Antimony	6/7	0.22 J	50.6 J	Z7PDI-SO-007-0002	0.34
15723-28-1	Chromium	2/2	10.3	18.1	Z7PDI-SO-005-0002	NA
16065-83-1	Chromium III	2/2	10.3	17.4	Z7PDI-SO-005-0002	NA
18540-29-9	Hexavalent Chromium	1/2	0.78	0.78	Z7PDI-SO-005-0002	0.1
7439-92-1	Lead	11/11	8.2	31400	Z7PDI-SO-007-0002	NA
SPLP Inorganics (µg/L)						
7440-36-0	Antimony	6/7	2.7 J	377	Z7PDI-SO-010-0002	8
7439-92-1	Lead	5/5	8.5	1040	Z7PDI-SO-007-0002	NA
Miscellaneous Parameters						
NA	Oxidation/Reduction Potential (mV)	2/2	153	157	Z7PDI-SO-005-0002	NA
NA	Total Solids (%)	20/20	90	98	Z7PDI-SO-004-0002	NA

NA - Not applicable.

Note: All analyzed chemicals were detected.

TABLE 4-41

SUMMARY OF ZONE 7 SURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations
2 - Detected duplicates are considered one detection
3 - Values presented are sample-specific quantitation limits

Associated Samples:

Z7PDI-SO-001-0002
Z7PDI-SO-002-0002
Z7PDI-SO-003-0002
Z7PDI-SO-003-0002-D
Z7PDI-SO-004-0002
Z7PDI-SO-005-0002
Z7PDI-SO-006-0002
Z7PDI-SO-007-0002
Z7PDI-SO-008-0002
Z7PDI-SO-009-0002
Z7PDI-SO-009-0002-D
Z7PDI-SO-010-0002
Z7PDI-SO-010-0002-D
Z7PDI-SO-011-0002
Z7PDI-SO-012-0002
Z7PDI-SO-012-0002-D
Z7PDI-SO-013-0002
Z7PDI-SO-013-0002-D
Z7PDI-SO-014-0002
Z7PDI-SO-015-0002
Z7PDI-SO-015-0002-D
Z7PDI-SO-016-0002
Z7PDI-SO-017-0002
Z7PDI-SO-018-0002
Z7PDI-SO-018-0002-D
Z7PDI-SO-019-0002
Z7PDI-SO-020-0002
Z7PDI-SO-020-0002-D

TABLE 4-42

SUMMARY OF ZONE 7 SUBSURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Detected Chemical	Frequency of Detection[2]	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-Detects[3]
PAHs (µg/kg)						
NA	BaP Equivalents	8/9	20.781	4568	Z7PDI-SO-005-0204	10
56-55-3	Benzo(a)anthracene	8/9	12 J	3400	Z7PDI-SO-005-0204	10
50-32-8	Benzo(a)pyrene	8/9	13 J	2900	Z7PDI-SO-005-0204	10
205-99-2	Benzo(b)fluoranthene	8/9	22	4600	Z7PDI-SO-005-0204	10
207-08-9	Benzo(k)fluoranthene	8/9	6.8 J	1500	Z7PDI-SO-005-0204	10
86-74-8	Carbazole	7/9	4.2 J	420 J	Z7PDI-SO-005-0204	10
218-01-9	Chrysene	8/9	13 J	3000	Z7PDI-SO-005-0204	10
53-70-3	Dibenzo(a,h)anthracene	8/9	3.2 J	670 J	Z7PDI-SO-005-0204	10
193-39-5	Indeno(1,2,3-cd)pyrene	8/9	11 J	1800	Z7PDI-SO-005-0204	10
85-01-8	Phenanthrene	8/9	7.9 J	6200 J	Z7PDI-SO-005-0204	10
129-00-0	Pyrene	8/9	18 J	6100	Z7PDI-SO-005-0204	10
Inorganics (mg/kg)						
7440-36-0	Antimony	8/9	0.37 J	118 J	Z7PDI-SO-007-0506	0.35
15723-28-1	Chromium	5/5	8.1	12.3	Z7PDI-SO-017-0406	NA
16065-83-1	Chromium III	5/5	8.1	12.3	Z7PDI-SO-017-0406	NA
18540-29-9	Hexavalent Chromium	2/5	0.13	0.53	Z7PDI-SO-003-0204	0.11
7439-92-1	Lead	8/8	4.3	23800	Z7PDI-SO-007-0506	NA
SPLP Inorganics (µg/L)						
7440-36-0	Antimony	10/11	2.7 J	627 J	Z7PDI-SO-010-0204	7.4
7439-92-1	Lead	11/12	1.9 J	1820	Z7PDI-SO-010-0204	2.5
Miscellaneous Parameters						
NA	Oxidation/Reduction Potential (mV)	5/5	168	196	Z7PDI-SO-003-0204	NA
NA	Total Solids (%)	17/17	84	98	Z7PDI-SO-008-0507	NA

NA - Not applicable.

Note: All analyzed chemicals were detected.

TABLE 4-42

SUMMARY OF ZONE 7 SUBSURFACE SOIL PDI RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations
2 - Detected duplicates are considered one detection
3 - Values presented are sample-specific quantitation limits

Associated Samples:

Z7PDI-SO-001-0204
Z7PDI-SO-001-0607
Z7PDI-SO-002-0607
Z7PDI-SO-002-0607-D
Z7PDI-SO-003-0204
Z7PDI-SO-003-0204-D
Z7PDI-SO-003-0506
Z7PDI-SO-004-0304
Z7PDI-SO-004-0406
Z7PDI-SO-005-0204
Z7PDI-SO-007-0506
Z7PDI-SO-007-0506-D
Z7PDI-SO-008-0507
Z7PDI-SO-009-0607
Z7PDI-SO-009-0607-D
Z7PDI-SO-010-0204
Z7PDI-SO-010-0204-D
Z7PDI-SO-011-0204
Z7PDI-SO-013-0406
Z7PDI-SO-014-0204
Z7PDI-SO-015-0204
Z7PDI-SO-016-0204
Z7PDI-SO-017-0406
Z7PDI-SO-020-0406

TABLE 4-43

SUMMARY OF ALL ZONE 7 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
Volatile Organic Compounds (µg/kg)						
67-64-1	Acetone	3/5	9 J	23	20TB5-0002 (93)	14 - 32
75-09-2	Methylene Chloride	3/5	5	6	20TB6-0002 (93)	11
Semivolatile Organic Compounds (µg/kg)						
91-57-6	2-Methylnaphthalene	1/6	24 J	25 J	LS7SB0070101-D	340 - 390
208-96-8	Acenaphthylene	1/6	34 J	43 J	LS7SB0070101-D	340 - 390
120-12-7	Anthracene	2/6	54 J	260 J	20TB5-0002 (93)	340 - 390
56-55-3	Benzo(a)anthracene	23/24	18 J	7,800	Z7PDI-SO-003-0002	390
50-32-8	Benzo(a)pyrene	23/24	24 J	8,400	Z7PDI-SO-003-0002	390
205-99-2	Benzo(b)fluoranthene	23/24	38 J	15,000	Z7PDI-SO-003-0002	390
191-24-2	Benzo(g,h,i)perylene	3/6	260 J	560	20MW5-0002 (93)	340 - 390
207-08-9	Benzo(k)fluoranthene	21/24	13 J	6,300	Z7PDI-SO-003-0002	340 - 390
86-74-8	Carbazole	18/24	2.1 J	570 J	Z7PDI-SO-019-0002	10 - 390
218-01-9	Chrysene	23/24	23 J	7,700 J	Z7PDI-SO-003-0002	390
84-74-2	di-n-Butyl Phthalate	1/6	30 J	30 J	LS7SB0070101-D	330 - 390
53-70-3	Dibenzo(a,h)anthracene	19/23	6.6 J	3,100	Z7PDI-SO-003-0002	340 - 390
206-44-0	Fluoranthene	5/6	430	1,100	20TB5-0002 (93)	390 - 390
193-39-5	Indeno(1,2,3-cd)pyrene	21/24	25 J	8,100	Z7PDI-SO-003-0002	340 - 390
85-01-8	Phenanthrene	22/24	10 J	5,300	Z7PDI-SO-019-0002	340 - 390
129-00-0	Pyrene	23/24	35 J	9,600	Z7PDI-SO-004-0002	390
Pesticides/PCBs (µg/kg)						
72-54-8	4,4'-DDD	1/5	3.5	3.5	20TB6-0002 (93)	3.4 - 3.9
50-29-3	4,4'-DDT	1/5	17	17	20TB6-0002 (93)	3.5 - 14
Inorganics (mg/kg)						
7429-90-5	Aluminum	5/5	3,860 J	5,040 J	20TB5-0002 (93)	-
7440-36-0	Antimony	7/12	0.22 J	50.6 J	Z7PDI-SO-007-0002	0.34 - 5.3
7440-38-2	Arsenic	5/5	0.89 J	1.8	20TB6-0002 (93)	-
7440-39-3	Barium	5/5	25.2 J	364	20TB4-0002 (93)	-
7440-41-7	Beryllium	2/5	0.15 J	0.22 J	20TB4-0002 (93)	0.17 - 0.26
7440-42-8	Boron	1/5	2.9 J	2.9 J	20TB4-0002 (93)	1.2 - 3.1
7440-70-2	Calcium	5/5	670 J	5,480	20TB4-0002 (93)	-
15723-28-1	Total Chromium	7/7	6.4 J	18.1	Z7PDI-SO-005-0002	-
16065-83-1	Chromium III	2/2	10.3	17.4	Z7PDI-SO-005-0002	-

TABLE 4-43

SUMMARY OF ALL ZONE 7 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
18540-29-9	Hexavalent Chromium	1/2	0.78	0.78	Z7PDI-SO-005-0002	0.1
7440-48-4	Cobalt	4/5	2.7 J	3.8 J	20TB5-0002 (93)	2.8
7440-50-8	Copper	5/5	10 J	122 J	20MW5-0002 (93)	-
7439-89-6	Iron	5/5	5,530 J	8,060 J	20TB5-0002 (93)	-
7439-92-1	Lead	16/16	8.2	31,400	Z7PDI-SO-007-0002	-
7439-95-4	Magnesium	5/5	1,400 J	2,080 J	20TB5-0002 (93)	-
7439-96-5	Manganese	5/5	100 J	162	20TB4-0002 (93)	-
7439-97-6	Mercury	3/5	0.1 J	0.12 J	20MW5-0002 (93)	0.06 - 0.06
7440-02-0	Nickel	5/5	4.8 J	17.7	20TB6-0002 (93)	-
7440-09-7	Potassium	5/5	928 J	1,520 J	20TB5-0002 (93)	-
7440-23-5	Sodium	4/5	56.3 J	162 J	20TB4-0002 (93)	49.5
7440-62-2	Vanadium	5/5	10 J	16.8	20TB6-0002 (93)	-
7440-66-6	Zinc	5/5	23.1 J	188	20TB4-0002 (93)	-
Petroleum Hydrocarbons (mg/kg)						
--	TPH[3]	1/1	1,300 J	1,500 J	LS7SB0070101	-
SPLP Inorganics (µg/L)						
7440-36-0	Antimony	6/7	2.7 J	377	Z7PDI-SO-010-0002	8
7439-92-1	Lead	5/5	8.5	1,040	Z7PDI-SO-007-0002	-

J = Estimated value

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - Method 418.1

Associated Samples

Z7PDI-SO-001-0002	Z7PDI-SO-009-0002	Z7PDI-SO-014-0002	Z7PDI-SO-020-0002-D
Z7PDI-SO-002-0002	Z7PDI-SO-009-0002-D	Z7PDI-SO-015-0002	20TB5-0002 (93)
Z7PDI-SO-003-0002	Z7PDI-SO-010-0002	Z7PDI-SO-015-0002-D	20TB6-0002 (93)
Z7PDI-SO-003-0002-D	Z7PDI-SO-010-0002-D	Z7PDI-SO-016-0002	LS7SB0070101
Z7PDI-SO-004-0002	Z7PDI-SO-011-0002	Z7PDI-SO-017-0002	LS7SB0070101-D
Z7PDI-SO-005-0002	Z7PDI-SO-012-0002	Z7PDI-SO-018-0002	20MW2-0002 (93)

TABLE 4-43

SUMMARY OF ALL ZONE 7 SURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

Z7PDI-SO-006-0002	Z7PDI-SO-012-0002-D	Z7PDI-SO-018-0002-D	20MW5-0002 (93)
Z7PDI-SO-007-0002	Z7PDI-SO-013-0002	Z7PDI-SO-019-0002	20TB4-0002 (93)
Z7PDI-SO-008-0002	Z7PDI-SO-013-0002-D	Z7PDI-SO-020-0002	

TABLE 4-44

SUMMARY OF ALL ZONE 7 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration[1]	Maximum Concentration[1]	Sample with Maximum Concentration	Range of Non-Detects[2]
Volatile Organic Compounds (µg/kg)						
78-93-3	2-Butanone	1/22	20	20	20TB6-0810 (93)	10 - 14
67-64-1	Acetone	7/22	7	97 B	20TB6-0810 (93)	11 - 35
75-15-0	Carbon Disulfide	2/22	6 J	7 J	20MW5-0608 (93)	10 - 14
75-09-2	Methylene Chloride	8/22	5	12 B	20TB7-4852 (93)-D	10 - 13
108-88-3	Toluene	1/22	3 J	3 J	20TB7-4852 (93)-D	10 - 14
Semivolatile Organic Compounds (µg/kg)						
91-57-6	2-Methylnaphthalene	10/43	22 J	300 J	LS7SB0110101	330 - 11000
59-50-7	4-Chloro-3-Methylphenol	1/43	34 J	34 J	LS7SB0030201	330 - 11000
83-32-9	Acenaphthene	15/43	19 J	1,400	20TB7-4856 (93)-D	330 - 11000
208-96-8	Acenaphthylene	11/43	20 J	600	LS7SB0110101	330 - 11000
120-12-7	Anthracene	17/43	2 J	2,500	LS7SB0110101	330 - 11000
56-55-3	Benzo(a)anthracene	33/52	12 J	9,500 J	20MW6-0204 (93)	10 - 11000
50-32-8	Benzo(a)pyrene	30/51	13 J	14,000 J	20MW6-0204 (93)	10 - 11000
205-99-2	Benzo(b)fluoranthene	33/51	22	16,000 J	20MW6-0204 (93)	10 - 1800
191-24-2	Benzo(g,h,i)perylene	17/42	28 J	7,300 J	20MW6-0204 (93)	330 - 11000
207-08-9	Benzo(k)fluoranthene	22/51	6.8 J	9,700 J	20MW6-0204 (93)	10 - 11000
117-81-7	Bis(2-ethylhexyl)phthalate	1/43	32 J	93 J	20MW1-0.52.5 (93)	330 - 11000
86-74-8	Carbazole	22/52	4.2 J	950	LS7SB0110101	10 - 11000
218-01-9	Chrysene	33/52	13 J	11,000 J	20MW6-0204 (93)	10 - 11000
84-74-2	di-n-Butyl Phthalate	2/43	18 J	320 J	20TB7-3242 (93)	330 - 11000
117-84-0	di-n-Octyl Phthalate	1/42	41 J	41 J	20MW1-0.52.5 (93)	330 - 11000
53-70-3	Dibenzo(a,h)anthracene	21/51	3.2 J	3,100	LS7SB0110101	10 - 11000
132-64-9	Dibenzofuran	12/43	19 J	770	20TB7-4856 (93)-D	330 - 11000
206-44-0	Fluoranthene	33/43	18 J	19,000 J	20MW6-0204 (93)	360 - 400
86-73-7	Fluorene	15/43	19 J	1,600	20TB7-4856 (93)-D	330 - 11000
193-39-5	Indeno(1,2,3-cd)pyrene	25/51	11 J	7,000 J	20MW6-0204 (93)	10 - 11000
91-20-3	Naphthalene	9/43	36 J	510	LS7SB0110101	330 - 11000
85-01-8	Phenanthrene	32/52	7.9 J	13,000	20MW3-0204 (93)	10 - 1800
129-00-0	Pyrene	40/52	18 J	14,000 J	20MW6-0204 (93)	10 - 400
Pesticides/PCBs (µg/kg)						
72-54-8	4,4'-DDD	2/22	4.4	35	20TB7-3242 (93)	3.5 - 36
72-55-9	4,4'-DDE	1/22	15	17	20MW1-0.52.5 (93)	3.5 - 36
50-29-3	4,4'-DDT	4/22	4.4	71	20TB7-4856 (93)-D	3.5 - 4.8

TABLE 4-44

SUMMARY OF ALL ZONE 7 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
5103-71-9	alpha-Chlordane	1/22	12	12	20MW1-0.52.5 (93), 20MW1-0.52.5 (93)-D	1.8 - 19
5103-74-2	gamma-Chlordane	1/22	7.3	7.5	20MW1-0.52.5 (93)	1.8 - 19
1024-57-3	Heptachlor Epoxide	1/22	3.9	4	20MW1-0.52.5 (93)	1.8 - 19
Inorganics (mg/kg)						
7440-36-0	Antimony	17/39	0.37 J	1,820	20TB4-1416 (93)	0.35 - 7580
7440-38-2	Arsenic	29/30	0.32 J	50	20TB4-1416 (93)	0.55 - 0.55
7440-39-3	Barium	30/30	17.7 J	550	20TB4-1416 (93)	-
7440-41-7	Beryllium	21/30	0.14 J	1.2	20MW6-1214 (93)	0.05 - 0.29
7440-42-8	Boron	4/22	1.4 J	25.1 J	20TB4-1416 (93)	1.4 - 112
7440-43-9	Cadmium	8/30	0.16 J	4	20TB4-1416 (93)	0.04 - 6.8
7440-70-2	Calcium	30/30	367 J	35,000	20TB4-1416 (93)	-
15723-28-1	Total Chromium	33/35	4.1 J	44.4	20TB4-1416 (93)	4.1 - 4.1
16065-83-1	Chromium III	5/5	8.1	12.3	Z7PDI-SO-017-0406	-
18540-29-9	Hexavalent Chromium	2/5	0.13	0.53	Z7PDI-SO-003-0204	0.11 - 0.11
7440-48-4	Cobalt	27/30	1.1 J	12.3 J	20TB4-1416 (93)	2.2 - 2.8
7440-50-8	Copper	29/30	3 J	9,010	20TB4-1416 (93)	3.5
57-12-5	Cyanide	2/22	0.18 J	0.46 J	20TB4-1416 (93)	0.16 - 1
7439-89-6	Iron	30/30	4,510 J	186,000	20TB4-1416 (93)	-
7439-92-1	Lead	38/38	1.6 J	189,000 J	20MW6-0204 (93)	-
7439-95-4	Magnesium	30/30	47.9 J	7,610	20TB4-1416 (93)	-
7439-96-5	Manganese	30/30	32.7 J	956	20TB4-1416 (93)	-
7439-97-6	Mercury	11/30	0.01 J	1.9 J	LS7SB0100301	0.01 - 1.2
7440-02-0	Nickel	30/30	1.8 J	254	20MW6-1214 (93)	-
7440-09-7	Potassium	30/30	4.8 J	5,240	20TB7-3242 (93)	-
7782-49-2	Selenium	4/30	0.22 J	2.5 J	LS7SB0100301	0.14 - 1.7
7440-22-4	Silver	3/30	0.75 J	4.1	20TB4-1416 (93)	0.15 - 5.4
7440-23-5	Sodium	30/30	66.8 J	1,880	20MW6-1214 (93)	-
7440-28-0	Thallium	4/30	0.14	0.18	20TB1-0204 (93), 20TB1-0608 (93)	0.08 - 1.6
7440-62-2	Vanadium	30/30	1.9 J	246	LS7SB0100301	-
7440-66-6	Zinc	30/30	11 J	3,440	20TB4-1416 (93)	-

TABLE 4-44

SUMMARY OF ALL ZONE 7 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

CAS Number	Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample with Maximum Concentration	Range of Non-Detects(2)
Petroleum Hydrocarbons (mg/kg)						
--	TPH[3]	19/24	45 J	2,600 J	LS7SB0100201	65 - 72
TCLP Inorganics (µg/L)						
7440-38-2	Arsenic	1/14	146	146	20TB4-1416 (93)	20 - 32.1
7440-39-3	Barium	14/14	122 J	4,210	20TB4-1416 (93)	-
7440-43-9	Cadmium	5/14	2.8 J	10.8	20MW6-1214 (93)	1.8 - 2.5
15723-28-1	Chromium	10/14	3.2 J	46	20TB4-1416 (93)	3.1 - 4
7439-92-1	Lead	13/14	4	45,900	20MW5-0608 (93)	28
7440-22-4	Silver	1/14	8.1 J	8.1 J	20MW5-0608 (93)	2.5 - 4
SPLP Inorganics (µg/L)						
7440-36-0	Antimony	10/11	2.7 J	627 J	Z7PDI-SO-010-0204	7.4 - 7.4
7439-92-1	Lead	13/16	1.9 J	1,820	Z7PDI-SO-010-0204	1.28 - 2.5

B = Compound was detected in the associated blank.
J = Estimated value

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - Method 418.1

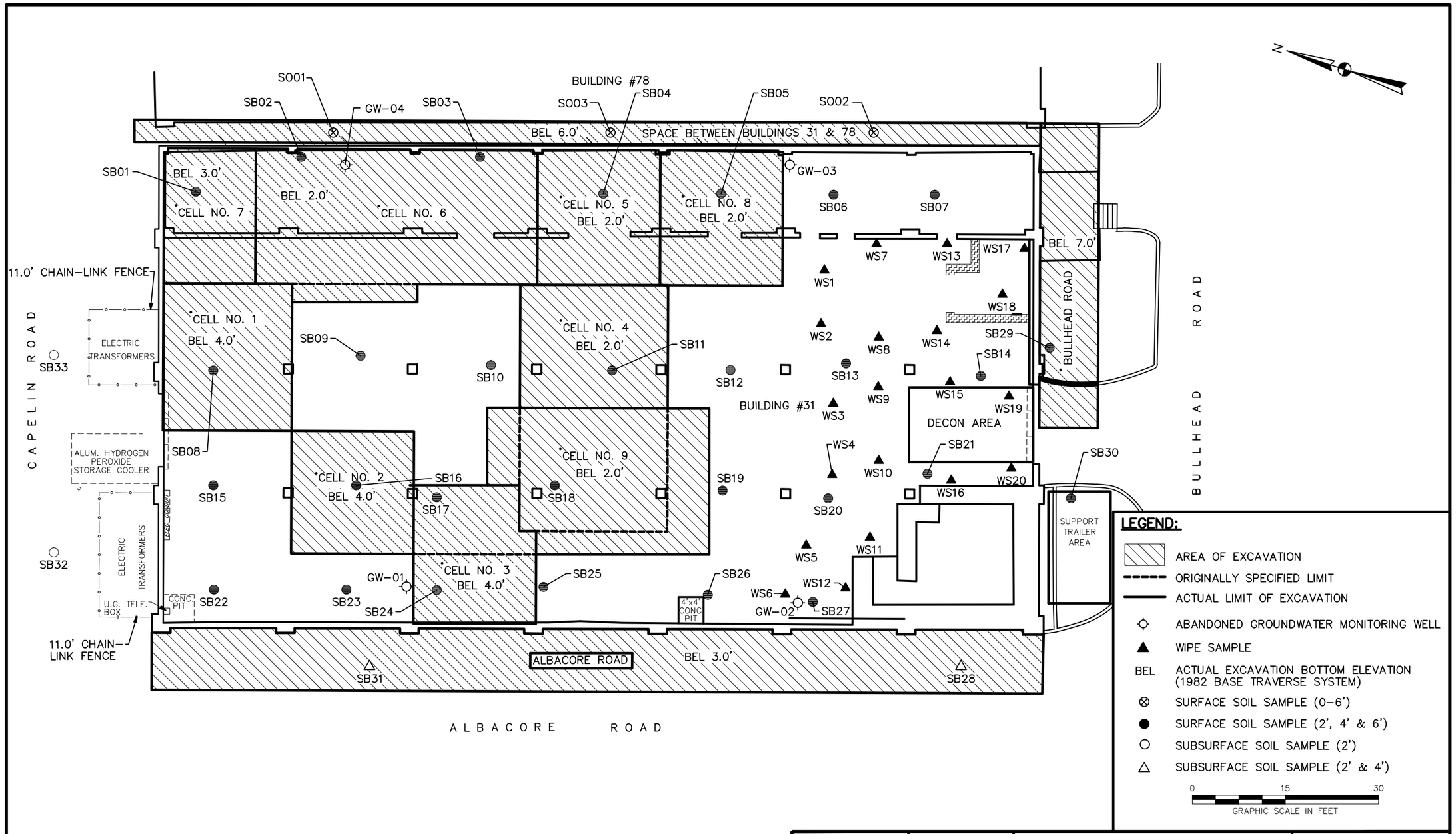
Associated Samples

Z7PDI-SO-001-0204	Z7PDI-SO-010-0204-D	20MW6-1214 (93)	20TB4-0406 (93)-D
Z7PDI-SO-001-0607	Z7PDI-SO-011-0204	20MW7-0204 (93)	20TB4-1416 (93)
Z7PDI-SO-002-0607	Z7PDI-SO-013-0406	20MW7-0406 (93)	20TB5-0406 (93)
Z7PDI-SO-002-0607-D	Z7PDI-SO-014-0204	20TB1-0204 (93)	20TB6-0810 (93)
Z7PDI-SO-003-0204	Z7PDI-SO-015-0204	20TB1-0608 (93)	20TB7-3242 (93)
Z7PDI-SO-003-0204-D	Z7PDI-SO-016-0204	20TB1-0608 (93)-D	20TB7-4852 (93)
Z7PDI-SO-003-0506	Z7PDI-SO-017-0406	20TB2-0204 (93)	20TB7-4852 (93)-D
Z7PDI-SO-004-0304	Z7PDI-SO-020-0406	20TB2-1416 (93)	20TB7-4856 (93)
Z7PDI-SO-004-0406	LS7SB0100301	20TB3-0204 (93)	20TB7-4856 (93)-D
Z7PDI-SO-005-0204	LS7SB0110101	20TB3-1012 (93)	LS7SB0010101
Z7PDI-SO-007-0506	LS7SB0110201	20TB4-0406 (93)	LS7SB0010201
Z7PDI-SO-007-0506-D	LS7SB0050201	LS7SB0020101	LS7SB0090201

TABLE 4-44

SUMMARY OF ALL ZONE 7 SUBSURFACE SOIL RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM

Z7PDI-SO-008-0507	LS7SB0070301	LS7SB0020201	LS7SB0060201
Z7PDI-SO-009-0607	LS7SB0080101	LS7SB0030201	LS7SB0050101
Z7PDI-SO-009-0607-D	LS7SB0080201	20MW5-0608 (93)	LS7SB0040301
Z7PDI-SO-010-0204	LS7SB0090101	20MW6-0204 (93)	LS7SB0030301
20MW1-0.52.5 (93)	LS7SB0040201	LS7SB0100201	
20MW1-0.52.5 (93)-D	20MW3-0810 (93)	LS7SB0100201-D	
20MW2-1416 (93)	20MW4-0204 (93)	LS7SB0060201-D	
20MW3-0204 (93)	20MW4-0406 (93)	LS7SB0060301	



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CHECKED BY NJB DATE 12-21-10			OWNER NO. 2630
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5.0 GROUNDWATER PDI RESULTS

This section describes the DQR process for Groundwater PDI analytical results and the nature and extent of groundwater contamination in Zones 1, 4, 5, and 7, as determined by the updated database. The DQR process considered the data validation process, use of data qualifiers, data completeness, sensitivity, accuracy, precision, comparability, representativeness, data usability. In addition, the results of the 2010 monitoring well condition survey are summarized in this section.

5.1 DATA QUALITY

A description of the data review processes used to determine whether analytical laboratory data were of acceptable technical quality for use in decision making is presented in this DQR. The same process that was used for soil data, as described in Section 4.1, was used for groundwater data. The process included data verification and validation and a data usability assessment.

5.1.1 Data Validation Process

All of the results from analytical laboratory samples were validated according to several specifications. Assignment of data qualification flags conformed to rules established in the Region I USEPA's Data Validation Functional Guidelines - Part II (1996b), National Functional Guidelines for Inorganic Review, (2008), and the DoD document entitled QSM for Environmental Laboratories (2006) to the greatest extent practicable for non-Contract Laboratory Program data. Numerical criteria used in conjunction with these rules were specified in the Groundwater PDI SAP (Tetra Tech, 2010a).

If no qualifier is assigned to a result that has been validated, the data user is assured that no analytical performance deficiencies were identified during validation. The qualification flags used are defined below:

U – Indicates that the chemical was not detected at the numerical detection limit noted. Non-detected results are reported with a "U" qualifier when received from the laboratory. Additionally, a "U" qualifier is added to a result (reported by the laboratory) if the detected concentration is determined to be attributable to contamination introduced during field sampling or laboratory analysis.

UJ – Indicates that the chemical was not detected. However, the detection limit (sample-specific quantitation limit) is considered to be estimated based on problems encountered during laboratory analysis. The associated numerical detection limit is regarded as inaccurate.

J – Indicates that the chemical was detected. However, the associated numerical result may not be an accurate representation of the amount that is actually present in the sample. The laboratory reported concentration is considered to be an estimate of the true concentration.

UR – Indicates that the chemical may or may not be present. The non-detected analytical result reported by the laboratory is considered to be unreliable and unusable. The "UR" qualifier is applied in cases of gross technical deficiencies (i.e., holding time missed by a factor of two times the specified time limit, severe calibration non-compliances, and extremely low QC recoveries).

R – Indicates that the chemical may or may not be present. The analytical result reported by the laboratory is considered to be unreliable and unusable. The "R" qualifier is applied in cases of gross technical deficiencies (i.e., holding time missed by a factor of two times the specified time limit, severe calibration non-compliances, and extremely low QC recoveries).

The preceding data qualifiers may be categorized as indicative of major or minor problems. Major problems are defined as issues that result in the rejection of data and qualification with "UR" or "R" data validation qualifiers. Rejected data are considered invalid and are not used for decision making purposes unless used in a qualitative way and the use is justified and documented. Less severe deficiencies, associated with "J" and "UJ" data validation qualifiers, are defined as issues resulting in the estimation of data. Estimated analytical results are considered to be suitable for decision-making purposes unless the data use requirements are very stringent and the qualifier indicates a deficiency that is incompatible with the intended data use. Also, a "U" qualifier does not necessarily indicate that a data deficiency exists because all non-detect values are flagged with the "U" qualifier regardless of whether a quality deficiency has been detected.

No analytical data were rejected during validation of either Round 1 or Round 2 Groundwater PDI data; therefore, no data had "R" or "UR" qualifiers. Any impacts to the project based on the results of the data evaluation are discussed in the remainder of this review. Data users should be aware that any qualified data, even if it is considered usable, may be less accurate or less precise than non-qualified data.

5.1.2 Data Validation Outputs

After laboratory data were validated, a list was developed of nonconformities requiring data qualifier flags used to alert the data user to inaccurate or imprecise data. For situations in which several QC criteria were out of specification, the data validator made professional judgments and/or comments on the validity of the overall data package. The reviewer then prepared a technical memorandum presenting qualification of the data, if necessary, and the rationale for making such qualifications. The net result was

a data package that had been carefully reviewed for its adherence to prescribed technical requirements. Data validators incorporated data qualifiers into the electronic database and submitted the information to the Tetra Tech Data Management Group. Data tables of all results and data validation reports for groundwater are included in Appendix C.2. Pertinent quality estimates are summarized in a more quantitative format in the following sections.

5.1.3 General Data Quality Review

The DQR provided herein is designed to provide an overall quantitative measure of analytical performance not provided by data validation. The analytical performance quantitative evaluations are frequently analyte specific and reflect deficiencies such as biases associated with the quantification of particular analytes in a particular sample matrix. The data user must be aware that different chemicals in the same analytical fraction (e.g., arsenic and lead in the metals fraction) may exhibit different degrees of quality.

5.1.3.1 Completeness

Completeness is a measure of the number of valid samples or measurements that are available relative to the number of samples or measurements that were intended to be generated. For this project, completeness was measured on two different bases, samples collected and laboratory measurements, as follows:

- Sample collection completeness was a measure of the usable samples collected as compared to those intended to be collected.

- Laboratory measurement completeness was a measure of the amount of usable, valid, laboratory measurements per matrix obtained for each target analyte.

Usable valid samples (or results) were those judged, after data assessment, to represent the sampling populations and to have not been disqualified for use through data validation or additional data review. Completeness was determined using the following equation:

$$\%C = \frac{V}{T} \times 100$$

where %C = percent completeness
V = number of samples (or results) determined to be valid
T = total number of planned samples (or results)

Groundwater sample collection completeness was evaluated for each zone and matrix defined in the Groundwater PDI SAP in Table 5-1. Sample collection completeness values for groundwater QC samples are also presented in Table 5-1. Laboratory measurement completeness values for groundwater samples and QC samples are presented in Table 5-2. Sample collection and laboratory measurement completeness are summarized as follows:

- Sample collection completeness was 100 percent for both Rounds 1 and 2 groundwater data.
- No laboratory measurement completeness deficiencies (i.e., percent completeness values less than 95 percent) were noted for groundwater data from Rounds 1 or 2.

5.1.3.2 Sensitivity

The detection limits reported by the laboratory were less than the PALs provided in the SAP for groundwater data (Tetra Tech, 2010a). Several total lead and dissolved lead results for Round 2 groundwater samples were qualified as non-detected due to blank contamination; however, this did not elevate the detection limits greater than the lowest groundwater criterion evaluated [i.e., CTDEEP Remediation Standard Regulations Surface Water Protection Criteria (SWPC) of 13 µg/L].

5.1.3.3 Laboratory Accuracy

Accuracy in the laboratory was measured through comparison of a spiked sample or LCS/LCSD result to a known or calculated value and is expressed as a %R. Accuracy was also assessed by monitoring the analytical recovery of select surrogate compounds added to samples analyzed by organic chromatographic methods and the analytical recovery of calibration standards for all analyses. LCSs were used to assess the accuracy of laboratory operations with minimal sample matrix effects. MS/MSD and surrogate compound analyses measure the combined accuracy effects of the sample matrix, sample preparation, and sample measurement. LCS and MS analyses were performed at a frequency of 1 per 20 associated samples. Laboratory accuracy was assessed by comparing %R values to accuracy control limits specified by the laboratory using the appropriate SW-846 method.

%R is calculated using the following equation:

$$\%R = \frac{Ss - So}{S} \times 100$$

where	%R	=	percent recovery
	Ss	=	result of spiked sample
	So	=	result of non-spiked sample
	S	=	concentration of spiked amount.

Detected concentrations of lead were qualified as estimated in three groundwater samples from Round 2 due to serial dilution non-compliance. Serial dilution analysis identifies the presence of interferences due to the sample matrix. Qualified data due to serial dilution non-compliance were not rejected and are therefore are considered acceptable for the data usability assessment.

5.1.3.4 Laboratory Precision

Precision is a measure of the degree to which two or more measurements are in agreement and describes the reproducibility of measurements of the same parameter for samples analyzed under similar conditions.

Precision for chemical parameters is expressed as a RPD, which is defined as the ratio of the difference to the mean for the two values being evaluated. RPDs, typically expressed as percentages, are used to evaluate both field and laboratory duplicate precision and are calculated as follows:

$$RPD = \frac{|V1 - V2|}{(V1 + V2)/2} \times 100$$

where RPD = relative percent difference
V1, V2 = two results obtained by analyzing duplicate samples

The precision estimates obtained from duplicate field samples encompass the combined uncertainty associated with sample collection, homogenization, splitting, handling, laboratory and field storage (as applicable), preparation for analysis, and analysis. In contrast, precision estimates obtained from analyzing duplicate laboratory samples incorporate only homogenization, subsampling, preparation for analysis, laboratory storage (if applicable), and analysis uncertainties.

5.1.3.5 Comparability

Comparability is defined as the confidence with which one data set can be compared with another (e.g., among sampling points and among sampling events). Comparability was achieved by using standardized sampling and analysis methods, as well as standardized data reporting formats. Comparability of laboratory measurements was achieved primarily through the use and documentation of standard sampling and analytical methods. Results were reported in units that ensured comparability with current state and federal standards and guidelines. Comparability of laboratory measurements was assessed primarily through the use of QC samples and through adherence to the Groundwater PDI SAP (Tetra Tech, 2010a).

5.1.3.6 Representativeness

Representativeness is an expression of the degree to which data accurately and precisely depict the actual characteristics of a population or environmental condition existing at the site. Compliance with the Groundwater PDI SAP (Tetra Tech, 2010a) and use of standardized sampling, sample handling, sample analysis, and data reporting procedures ensured that the final data would be accurate representations of actual site conditions. The DQR found the data collected to be representative of targeted populations.

5.1.4 Data Usability

No data usability issues were identified with either the Round 1 or Round 2 Groundwater PDI results.

5.2 GROUNDWATER PDI DATA

This section discusses the Groundwater PDI data collected in Zones 1, 4, 5, and 7 at the Lower Subase. Groundwater sampling was previously conducted during the Phase I, Phase II, and Lower Subase RIs and other investigations detailed in Section 1 of the Lower Subase FS (Tetra Tech, 2010d). All historical data are tabulated in Appendix H of the Lower Subase RI (Tetra Tech, 1999). During the Groundwater PDI, groundwater samples were collected from a total of 15 monitoring wells in the four zones to provide further information in the groundwater database for arsenic, copper, and lead. This section summarizes both the groundwater level data collected to confirm groundwater flow directions and the analytical data collected to update of the nature and extent of contamination discussions provided in Lower Subase FS (Tetra Tech, 2010d).

To reduce any potential matrix interferences potentially impacting analytical results, all groundwater samples were subjected to a pre-concentration method (Method SW-846 1640) prior to analysis. This method isolates metals from complex sample matrices (e.g., salt water) using iron and palladium carriers, followed by a pH adjustment and chemical reduction of the metals to their elemental state and borides. The resulting precipitates were then separated and redissolved. After pre-concentration, samples were analyzed via analytical method SW-846 6020B, which measures metals concentrations using inductively coupled plasma-mass spectrometry (ICP-MS).

5.2.1 Zone 1

5.2.1.1 Hydrogeologic Data

Groundwater level measurements taken in Zone 1 wells during Rounds 1 and 2 are summarized in Tables 5-3 and 5-4, respectively. The water level data were used to generate potentiometric surface

maps for each round, as presented on Figures 5-1 and 5-2, respectively. Because of the limited number of wells included in the water level measurements and minimal topographic relief across the zone, a groundwater flow pattern is not generally discernable from the figures. However, considering the available groundwater elevations and the presence of the Thames River on the western boundary of Zone 1, groundwater flow is assumed to be generally from east to west across Zone 1. The flow directions depicted on Figure 5-1 were also observed during the Lower Subase RI. The groundwater flow to the north-northeast is not a significant part of the flow and does not affect the remedy. By comparing Figures 5-1 and 5-2, it is evident that groundwater elevations in April 2010 were approximately 0.1 to 0.4 foot higher than groundwater elevations measured in August 2010. This difference may be the result of seasonal variations or daily tidal fluctuations in the groundwater table.

5.2.1.2 Nature and Extent of Contamination

The Zone 1 monitoring wells sampled during the PDI are shown on Figure 3-1. Analytical results from Rounds 1 and 2 of the PDI are provided in Tables 5-5 and 5-6, respectively, and frequency of detection information for Rounds 1 and 2 are provided in Tables 5-7 and 5-8, respectively. A summary of frequency of detection information for all groundwater data collected in Zone 1 is provided in Table 5-9. Because no VOC, SVOC, or TPH data were collected, the nature and extent of contamination summaries for these parameters that were provided in the Lower Subase FS (Tetra Tech, 2010d) were not updated and are not reiterated in this section. The following discussion focuses on the nature and extent of arsenic, copper, and lead contamination in Zone 1 groundwater.

Prior to the Groundwater PDI, four groundwater sampling events (1991 Phase 1 RI, 1994 Phase 2 RI - Rounds 2-1 and 2-2, and 1997 Lower Subase RI) were performed in Zone 1. During those sampling events, arsenic, copper, and lead were reported at maximum total concentrations of 16.8 µg/L (13MW21), 156 µg/L (13MW20), 55.7 µg/L (13MW20), respectively, and maximum dissolved concentrations of 24.8 µg/L (13MW19), 120 µg/L (13MW20), and 36.3 µg/L (13MW20), respectively. During the Groundwater PDI, all of the wells with maximum concentrations (13MW19, 13MW20, and 13MW21) were resampled along with two additional wells (FOMW14 and MW1-1PDI). FOMW14 was sampled because of reported concentrations of copper and lead greater than criteria and MW1-1PDI was installed to replace 13MW7, the monitoring well closest to the Thames River, and sampled. Maximum concentrations of arsenic, copper, and lead detected during the PDI were significantly less, generally by an order of magnitude, than concentrations reported during previous investigations. The maximum total concentrations of arsenic, copper, and lead were 1.35 µg/L (MW1-1PDI), 7.28 µg/L (13MW20), and 7.3 µg/L (13MW20), respectively, and maximum dissolved concentrations were 1.63 µg/L (MW1-1PDI), 2.12 µg/L (FOMW14), and 0.98 µg/L (FOMW14), respectively. These concentrations were similar to New London background groundwater concentrations for these metals (see Table 5-9). The Zone 1 total and

dissolved concentrations of arsenic, copper, and lead detected in Rounds 1 and 2 of the PDI were similar, indicating that appropriate sampling techniques were used and that minimal suspended solids were incorporated into the samples. In addition, the Round 1 and Round 2 results were comparable, which indicates that seasonality had minimal impact on the concentrations.

As summarized in the Groundwater PDI SAP, during Round 1 of the 1994 Phase 2 RI, total arsenic concentrations in two wells (13MW19 and 13MW21) were greater than the Alternative SWPC (10 µg/L), which was identified as the arsenic PAL in the Groundwater PDI SAP. Analytical data from these wells during subsequent sampling rounds, including the Groundwater PDI, did not show that arsenic was detected at total concentrations greater than the Alternative SWPC. Similarly, the total arsenic concentration (12.4 µg/L) in well 13MW20 during the Lower Subase RI was greater than the Alternative SWPC, but arsenic was not detected at total concentrations greater than the Alternative SWPC during other sampling rounds (Phase 2 RI sampling rounds or the Groundwater PDI).

Total copper concentrations reported in two Zone 1 wells (68.4 µg/L in 3MW19 and 53.3 µg/L in 13MW21) were greater than the CTDEEP SWPC (48 µg/L), the selected PAL for copper, during Round 1 of the 1994 Phase 2 RI. Total copper concentrations in these wells during subsequent sampling events, including the PDI, were less than the SWPC. The total copper concentrations in wells 13MW20 and FOMW14 (156 and 77.9 µg/L, respectively) during the Lower Subase RI were greater than the SWPC, but copper was not detected at total concentrations greater than the SWPC during the PDI or other sampling rounds.

The total lead concentrations in two wells (39.3 µg/L in 13MW19 and 36.1 µg/L in 13MW21) were greater than the CTDEEP SWPC (13 µg/L) during Round 1 of the 1994 Phase 2 RI. Total lead concentrations in wells 13MW20, 13MW21 and FOMW14 during the 1997 Lower Subase RI (55.7, 27.4, and 36.8 µg/L, respectively) were greater than the SWPC. However, none of the total lead concentrations exceeded the lead PAL of 810 µg/L (Alternative SWPC). The maximum total lead concentration detected in all wells during the Groundwater PDI was 7.3 µg/L, less than both the CTDEEP SWPC and lead PAL.

Matrix inferences (turbidity and salinity) were suspected to have impacted historical Zone 1 analytical results. As discussed in the Groundwater PDI SAP, groundwater samples collected from wells 13MW19 and 13MW21 during Round 1 of the Phase 2 RI had elevated turbidities (26 and 43 NTUs, respectively), which likely biased high the reported concentrations of metals in groundwater. Turbidity levels in Groundwater PDI samples were typically less than 10 NTUs, and it does not appear that turbidity impacted the data. Salinity levels in groundwater samples collected during the PDI were typically higher than 0.5 parts per thousand (ppt) (i.e., salinity level that may cause interference with certain metals analyses) and similar to salinity levels in historical samples. Because no elevated detection limits were

reported, the use of the pre-concentration method (Method SW-846 1640) appears to have been effective at eliminating salinity impacts on the analytical method.

5.2.2 Zone 4

5.2.2.1 Hydrogeologic Data

Groundwater level measurements taken in Zone 4 wells during Rounds 1 and 2 are summarized in Tables 5-3 and 5-4, respectively. The water level data were used to generate potentiometric surface maps for each round, as presented on Figures 5-3 and 5-4, respectively. The groundwater flow pattern is generally the same on both figures, and the groundwater flow direction is assumed to be from east to west across Zone 4 towards the Thames River. Figures 5-3 and 5-4 show in the eastern portion of Zone 4 that groundwater elevations in April 2010 were approximately 0.2 to 0.5 foot higher than groundwater elevations measured in August 2010. This difference may be the result of seasonal variations in the groundwater table. In contrast, Figures 5-3 and 5-4 show in the western portion of Zone 4 that the groundwater elevations in April 2010 were approximately 0.2 to 0.5 foot lower than groundwater elevations measured in August 2010. It is likely that the difference is the result of daily fluctuations in the groundwater table associated with the tides.

WE4 was identified damaged but usable and a water level was measured in WE4 during Round 2 of the Groundwater PDI. The well cap for monitoring well WE4 and the well's protective vault/roadbox cover were missing. The measured depth to water was within the screened interval of the well; therefore, a water level measurement was possible and is considered to be correct.

5.2.2.2 Nature and Extent of Contamination

The Zone 4 monitoring wells sampled during the PDI are shown on Figure 3-2. Analytical results from Rounds 1 and 2 of the PDI are provided in Tables 5-10 and 5-11, respectively, and frequency of detection information for Rounds 1 and 2 are provided in Tables 5-12 and 5-13, respectively. A summary of frequency of detection information for all groundwater data collected in Zone 4 is provided in Table 5-14. Because no new VOC, SVOC, or TPH data were collected, the nature and extent of contamination summaries for these parameters that were provided in the Lower Subase FS (Tetra Tech, 2010d) were not updated and are not reiterated in this section. The following discussion focuses on the nature and extent of arsenic, copper, and lead contamination in Zone 4 groundwater.

Prior to the Groundwater PDI, four groundwater sampling events (1991 Phase 1 RI, 1994 Phase 2 RI - Rounds 2-1 and 2-2, and 1997 Lower Subase RI) were performed in Zone 4. Arsenic, copper, and lead were detected in Zone 4 groundwater samples during these four sampling events at maximum total

concentrations of 29.6 µg/L (WE5), 649 µg/L (NESO11), and 2,760 µg/L (NESO11), respectively, and maximum dissolved concentrations of 14.7 µg/L (13MW13), 20.4 µg/L (13MW16), and 14.1 µg/L (NESO11), respectively. Dissolved copper and lead concentrations in NESO11 (3.5 and 10.9 µg/L, respectively) were significantly less than the maximum total concentrations detected in Round 1 of the Phase 2 RI, suggesting that total copper and lead concentrations were impacted by suspended solids. As shown in the Groundwater PDI SAP, the turbidity in NESO11 during Round 1 of the Phase 2 RI was 221 NTUs.

Matrix inferences (turbidity and salinity) were suspected to have impacted historical Zone 4 analytical results. Some turbidity issues were discussed in the previous paragraph. Turbidity levels in Groundwater PDI samples were all less than 10 NTUs. In addition, total and dissolved concentrations of arsenic, copper, and lead detected in Zone 4 groundwater during Rounds 1 and 2 of the PDI were similar, indicating that appropriate sampling techniques were used and that minimal suspended solids were incorporated into the samples. As shown in the Groundwater PDI SAP, groundwater samples collected from wells 13MW14, 13MW15, and NESO10 had high salinity values [17, 20.8, and 5.3 ppt, respectively], which could bias high the concentrations of metals in groundwater. Therefore, it is possible that elevated arsenic concentrations detected during one previous sampling round and elevated detection limits during the Phase 2 RI may have been the result of matrix interferences. The maximum salinity level detected in Zone 4 wells during the PDI (17.6 ppt) was similar to maximum salinity levels detected in historical samples. However, there were no elevated concentrations or detection limits associated with the Groundwater PDI data, indicating that the use of the pre-concentration method (Method SW-846 1640) was effective at eliminating salinity impacts on the analytical method (see Section 5.2). The Round 1 and Round 2 results were also comparable, indicating that seasonality had minimal impact on the concentrations.

The maximum total concentrations of arsenic, copper, and lead detected in groundwater samples collected during the PDI were significantly less, generally by an order of magnitude, than concentrations detected during previous investigations. Maximum total concentrations of arsenic, copper, and lead were 3.49 µg/L (13MW13), 71 µg/L (NESO11), and 72.6 µg/L (NESO11), respectively. Maximum dissolved concentrations detected during the PDI were 2.84 µg/L (13MW13), 37.7 µg/L (NESO11), and 16 µg/L (NESO11), respectively, and these concentrations were similar to maximum dissolved concentrations detected during previous investigations. The maximum total and dissolved concentrations of arsenic and copper detected in groundwater samples collected during the Groundwater PDI were similar to New London background groundwater concentrations for these metals (see Table 5-9). Maximum total and dissolved lead concentrations (72.6 and 16 µg/L, respectively) detected in Groundwater PDI samples were greater than New London background lead concentrations (total 6.63 µg/L and dissolved 2.52 µg/L).

Based on the Groundwater PDI SAP, Zone 4 PDI sampling focused on wells that had previous arsenic concentrations or elevated detection limits in excess of the arsenic PAL (Alternative SWPC of 10 µg/L). The total arsenic concentrations detected in two wells (11 µg/L in 13MW15 and 19 µg/L in NESO10) were slightly greater than the Alternative SWPC during Round 2 of the 1994 Phase 2 RI. In addition, the analytical detection limit for arsenic (20 µg/L) was elevated for several of the samples collected in Zone 4 during the Phase 2 RI. Analytical data from previous and subsequent sampling events did not detect arsenic at concentrations greater than the Alternative SWPC. Wells 13MW13, NESO11, and WE5 also had detections of either total and/or dissolved arsenic concentrations greater than the Alternative SWPC. Typically the elevated concentrations were only reported during one or two of the four rounds of data collection.

Five wells were sampled during the Groundwater PDI, including 13MW13, 13MW14, MW1-4PDI, NESO10, and NESO11. MW1-4PDI was installed as a replacement well for 13MW15 during the PDI. These wells were selected for sampling because maximum concentrations of arsenic, copper, or lead were detected in them at concentrations exceeding criteria, quality of the data was suspect (elevated detection limits), and/or they were located along the downgradient edge of Zone 4 near the Thames River and were useful in determining if the metals were migrating off site. Total and dissolved arsenic were detected in all 10 samples collected during the PDI, but none of the concentrations were greater than the arsenic PAL. Copper and lead were also included in the analytical program for the Zone 4 Groundwater PDI because maximum total copper and lead concentrations detected in Zone 4 wells during previous investigations exceeded their respective PALs and because the quality of the historical data in several of the wells was suspect (e.g., well 13MW15 copper data were rejected and lead results had elevated detection limits). Total and dissolved copper and lead were detected in all 10 samples collected during the PDI, but none of the concentrations were greater than PALs.

5.2.3 Zone 5

5.2.3.1 Hydrogeologic Data

Groundwater level measurements taken in Zone 5 wells during Rounds 1 and 2 are summarized in Tables 5-3 and 5-4, respectively. The water level data were used to generate potentiometric surface maps for each round, as presented on Figures 5-5 and 5-6, respectively. The groundwater flow pattern is generally the same on both figures, and the groundwater flow direction is assumed to be from east to west across Zone 5 towards the Thames River. Figures 5-5 and 5-6 show that groundwater elevations in April 2010 were the same to approximately 0.6 foot lower than groundwater elevations in August 2010. This difference is likely that the result of daily fluctuations in the groundwater table associated with the tides.

5.2.3.2 Nature and Extent of Contamination

The Zone 5 monitoring wells sampled during the PDI are shown on Figure 3-3. Analytical results from Rounds 1 and 2 of the PDI are provided in Tables 5-15 and 5-16, respectively, and frequency of detection information for Rounds 1 and 2 are provided in Tables 5-17 and 5-18, respectively. A summary of frequency of detection information for all groundwater data collected in Zone 5 is provided in Table 5-19. Because no new VOC, SVOC, or TPH data were collected, the nature and extent of contamination summaries for these parameters that were provided in the Lower Subase FS (Tetra Tech, 2010d) were not updated and are not reiterated in this section. The following discussion focuses on the nature and extent of arsenic, copper, and lead contamination in Zone 5 groundwater.

Arsenic, copper, and lead were detected in Zone 5 groundwater samples during two previous sampling events (1993 Site Investigation and 1997 Lower Subase RI), but total arsenic was not detected during these events. Maximum total concentrations of copper and lead reported in Zone 5 wells were 4.2 µg/L (19MW2) and 1.3 µg/L (19MW2), respectively. Maximum dissolved concentrations of arsenic, copper, and lead were 34.3 µg/L (19MW4), 11.4 µg/L (19MW3), and 2.2 µg/L (19MW3), respectively. Only the dissolved arsenic concentration in well 19MW4 (34.3 µg/L) during the 1993 Site Inspection was greater than the Alternative SWPC (arsenic PAL), and the total concentration in this well was non-detect with an elevated detection limit of 30.2 µg/L. No turbidity or salinity data were available for this sample to determine if matrix interferences may have impacted the data. Well 19MW4 was destroyed after the 1993 Site Inspection so additional samples could not be collected to verify the 1993 results. Well MW1-5PDI was installed as a replacement for this well and sampled during the Groundwater PDI.

As mentioned above, turbidity and salinity information is not available for some historical Zone 5 samples; therefore, it was not possible to determine if matrix inferences (turbidity and salinity) may have impacted analytical results. Turbidity levels in Groundwater PDI samples were all less than 3 NTUs, and Zone 5 total and dissolved concentrations of arsenic, copper, and lead detected in Rounds 1 and 2 of the PDI were similar, indicating that appropriate sampling techniques were used and that minimal suspended solids were incorporated into the samples. The maximum salinity level detected in Zone 5 wells during the PDI (2.04 ppt) was greater than 0.5 ppt (level that could interfere with certain metals analyses). However, there were no elevated concentrations or detection limits associated with the Zone 5 Groundwater PDI data, indicating that use of the pre-concentration method (Method SW-846 1640) was effective at eliminating salinity impacts on the analytical method (see Section 5.2). The Round 1 and Round 2 results were also comparable, indicating seasonality had minimal impact on the concentrations.

During the Groundwater PDI, groundwater samples were collected from wells 19MW3 and MW1-5PDI. The maximum total concentrations of arsenic, copper, and lead detected in PDI groundwater samples

were 5.76 µg/L (MW1-5PDI), 5.14 µg/L (MW1-5PDI), and 2.15 µg/L (MW1-5PDI), respectively, and maximum dissolved concentrations were 5.88 µg/L (MW1-5PDI), 2.51 µg/L (19MW3), and 0.37 µg/L (MW1-5PDI). The maximum total and dissolved concentrations of arsenic, copper, and lead were less than or similar to New London background groundwater concentrations for these metals (see Table 5-19). None of the detected concentrations were greater than the PALs identified in the Groundwater PDI SAP.

5.2.4 Zone 7

5.2.4.1 Hydrogeologic Data

Groundwater level measurements taken in Zone 7 wells during Rounds 1 and 2 are summarized in Tables 5-3 and 5-4, respectively. The water level data were used to generate potentiometric surface maps for each round, as presented on Figures 5-7 and 5-8, respectively. The groundwater flow pattern is generally the same on both figures, and the groundwater flow direction is from east to west across Zone 7 towards the Thames River. Comparing Figures 5-7 and 5-8 shows that groundwater elevations in April 2010 were between 0.05 to 0.4 foot lower than groundwater elevations measured in August 2010. This difference is likely that the result of daily fluctuations in the groundwater table associated with the tides.

5.2.4.2 Nature and Extent of Contamination

The Zone 7 monitoring wells sampled during the PDI are shown on Figure 3-4. Analytical results from Rounds 1 and 2 of the PDI are provided in Tables 5-20 and 5-21, respectively, and frequency of detection information for Rounds 1 and 2 are provided in Tables 5-22 and 5-23, respectively. A summary of frequency of detection information for all groundwater data collected in Zone 7 is provided in Table 5-24. Because no new VOC, SVOC, or TPH data were collected, the nature and extent of contamination summaries for these parameters that were provided in the Lower Subase FS (Tetra Tech, 2010d) were not updated and are not reiterated in this section. The following discussion focuses on the nature and extent of arsenic, copper, and lead contamination in Zone 7 groundwater.

Arsenic, copper, and lead were detected in Zone 7 groundwater samples collected during two previous investigations (1993 Site Inspection and 1997 Lower Subase RI) at maximum total concentrations of 18.8 µg/L (20MW7), 24.4 µg/L (20MW6), and 117 µg/L (20MW6), respectively, and maximum dissolved concentrations of 20 µg/L (20MW7), 21.1 µg/L (20MW6), and 97.5 µg/L (20MW6), respectively. Maximum copper and lead concentrations were detected in monitoring well 20MW6 located near Building 456. Lead was detected at elevated concentrations in this well during both previous sampling events and also in soil in this area. Well 20MW6 was not sampled during the Groundwater PDI because maximum copper and lead concentrations did not exceed PALs (310 µg/L for copper and 810 µg/L for lead)

established in the Groundwater PDI SAP, and it was located in the center as opposed to the downgradient edge of the zone and was not key to determining what is migrating from the site.

Three monitoring wells (MW1-7PDI, MW3-7RI, and MW4-7RI) located on the western side of the northern portion of Zone 7 were sampled during the Groundwater PDI. Monitoring well MW1-7PDI was installed as a replacement well for 20MW7 during the Groundwater PDI. Maximum detected total concentrations of arsenic, copper, and lead were 15 µg/L (MW4-7RI), 0.81 µg/L (MW3-7RI), and 0.27 µg/L (MW3-7RI), respectively, and maximum detected dissolved concentrations were 15.1 µg/L (20MW7), 0.81 µg/L (MW3-7RI), and 0.05 µg/L (MW3-7RI), respectively. The maximum total and dissolved arsenic concentrations were similar to maximum concentrations detected during previous sampling rounds and were greater than New London background arsenic concentrations (see Table 5-24). Maximum total and dissolved copper and lead concentrations were significantly less than maximum concentrations detected during previous sampling rounds; however, it is should be noted that well 20MW6, the well with previous maximum concentrations of copper and lead, was not sampled during the PDI. The copper and lead concentrations detected during the PDI were less than New London background concentrations (see Table 5-24).

Results from the 1997 Lower Subase RI showed that total arsenic concentrations in two wells (18.8 µg/L in 20MW7 and 11.0 µg/L in MW4-7RI) were greater than the PAL (10 µg/L) established in the Groundwater PDI SAP. In addition, the dissolved concentration of arsenic (20 µg/L) in well 20MW7 during the same event was also greater than the PAL. Arsenic was not detected at concentrations greater than the PAL during the 1993 Site Inspection. Arsenic concentrations detected in well MW4-7RI, located near the southwestern corner of Building 478, varied between Rounds 1 and 2 of the Groundwater PDI. Round 1 total and dissolved concentrations were less than the PAL, but Round 2 total and dissolved concentrations were greater than the PAL. These data could indicate a seasonality impact. Arsenic data from well MW1-7PDI, the replacement well for 20MW7, did not show similar variability between rounds, and no concentrations were greater than the PAL. Therefore, there is some remaining uncertainty regarding arsenic impacts on groundwater in this area.

Matrix inferences (turbidity and salinity) were not suspected to have impacted historical Zone 7 analytical results and generally do not appear to have impacted the Groundwater PDI results. Turbidity levels in the Groundwater PDI samples were all less than 4 NTUs, and Zone 7 total and dissolved concentrations of arsenic, copper, and lead detected during Rounds 1 and 2 of the PDI were similar, indicating that appropriate sampling techniques were used and that minimal suspended solids were incorporated into the samples. As shown in the Groundwater PDI SAP, salinity levels in the samples collected during the 1997 Lower Subase RI were less than 0.4 ppt, which is unlikely to bias high the concentrations of metals in groundwater. The maximum salinity level detected in Zone 7 wells during the PDI (1.07 ppt) was

greater than the maximum salinity levels detected in historical samples. The maximum salinity level was detected in well MW4-7RI during Round 1 of the PDI, but the salinity level in the well during Round 2 (0.45 ppt), when elevated total and dissolved arsenic concentrations (15 µg/L and 15.1 µg/L, respectively) were detected, was less than the salinity level (0.5 ppt) at which interferences to the analytical method are expected. There were no elevated concentrations or detection limits associated with copper or lead Groundwater PDI data, indicating that the use of the pre-concentration method (Method SW-846 1640) was effective at eliminating salinity impacts on the analytical method; however, there is uncertainty regarding salinity impacts on the arsenic Groundwater PDI data from well MW4-7RI.

5.2.5 Conclusions and Recommendations

The primary purpose of the Groundwater PDI was to determine if arsenic, copper, and lead were present in the groundwater of Zones 1, 4, 5, and 7 at concentrations greater than the PALs identified in the Groundwater PDI SAP. The following conclusions were reached based on the Groundwater PDI data:

- The low-flow sampling techniques and appropriate analytical methods used during the Groundwater PDI resulted in high quality groundwater data with generally no matrix interference issues. Very few validation actions were required, and detection limits were significantly less than the PALs identified in the Groundwater PDI SAP. The only potential matrix inference issue was associated with salinity in the Round 2 sample from well MW4-7RI in Zone 7.

- All Zones 1, 4, and 5 arsenic, copper, and lead concentrations detected during the Groundwater PDI were much less than their respective PALs. These results indicate that further investigation for these metals in Zones 1, 4, and 5 groundwater is not warranted.

- All Zone 7 copper and lead concentrations detected during the Groundwater PDI were less than their respective PALs. These results indicate that further investigation for these metals in Zone 7 groundwater is not warranted. Regarding arsenic in Zone 7 groundwater, all Round 1 results were less than the PAL, but the Round 2 sample from well MW4-7RI had a total arsenic concentration (15 µg/L) that was marginally greater than the PAL (10 µg/L). CTDEEP guidance indicates that only total groundwater concentrations should be compared to criteria. It is possible that salinity impacted the analysis of this sample and resulted in the elevated concentration. Because of the low frequency of PAL exceedance (one of six) and the fact that the exceedance is only marginally greater than the PAL, further investigation of arsenic in Zone 7 groundwater is not warranted.

5.3 MONITORING WELL CONDITION SURVEY

In February and March 2007, a well inventory was conducted by Tetra Tech personnel in accordance with the Work Plan for Monitoring Well Inventory (Tetra Tech, 2007). Information collected during the inventory was used to determine the current conditions of the wells, wells that should be abandoned, and information necessary to conduct well abandonment.

An additional Lower Subase monitoring well condition survey was conducted by Tetra Tech on 62 monitoring wells on August 25, 2010 in accordance with the Soil PDI SAP (Tetra Tech, 2010b). The Lower Subase wells that were surveyed in 2010 are shown on Figures 2-2, 2-3, and 2-6 for Zones 2, 3, and 6, respectively, and Figures 3-1 through 3-4 for Zones 1, 4, 5, and 7, respectively. Well construction information and 2010 field measurements are presented in Table 5-25. A total of 41 wells were found, of which 37 could be opened and water level measurements taken. Free product was detected in one well (unnamed well 4 feet north of 13MW8), and the depth to the product was measured in the well.

The conditions of found wells are summarized in Table 5-26, which was developed from field notes provided in Appendix B.2.6. It should be noted that modifications to the field notes were made during preparation of Table 5-26 because the field technician used slightly different definitions to catergorize well conditions. In Table 5-26, the wells were identified as being not deficient, unable to determine, not usable, damaged – usable, or not found based on the following considerations:

- **Not Deficient Wells** - Wells were considered to be not deficient if the well was located, opened, water level measurement was taken, and no conditions were present that would compromise the integrity of groundwater samples from the wells. A total of 38 wells were found to be in this category during the 2010 survey.

- **Wells of Undetermined Condition** - Wells that were found but were not opened were identified as “unable to determine” on Table 5-26. Issues that place wells in this category included cars, equipment, or other materials being parked, placed, or stored on top of the well such that the field technician could not gain access. Two wells were identified to be in this category during the 2010 survey.

- **Damaged Wells** - Significantly damaged wells were identified as “not usable” or “damaged - usable”. "Not usable" refers to wells that are in disrepair and cannot be repaired or that would require extensive repairs. Wells with destroyed vaults or that were filled with sediment were deemed not usable. "Damaged - usable" refers to wells that would require less extensive repairs, but should be repaired if not abandoned. Wells with bent risers, cracked covers, or construction defects were

identified as damaged - usable. During the 2010 survey, two wells, one fitting each damaged well category, were identified.

- **Wells Not Found** - The remaining 20 wells were not found at the documented coordinates. Seventeen of these wells were also not found during the 2007 well inventory. Based on these two inventories, the accuracy of the Global Positioning System (GPS) unit, and documented coordinates for the found wells, it is believed that these 17 "not found" wells no longer exist. Three additional wells were not found in 2010 that were found during the 2007 inventory. Two of those wells (WE1 and WE5 in Zone 4) were in areas of new pavement, and one well (MW2-6RI in Zone 6) was in an area on which heavy machinery was stored.

5.3.1 General Monitoring Well Condition Survey Results

The results of the monitoring well condition survey of the 62 wells within the Lower Subase are summarized as follows:

- Thirty-eight wells were not deficient.
- Two wells were not able to be determined.
- One well was not usable.
- One well was damaged but usable.
- Twenty wells were not found.

The recommended maintenance activities based on the findings of the 2010 well condition survey are summarized in Table 5-27 and as follows:

- Casing maintenance
  - Nine wells need new protective casings installed.
  - Two wells need the flush-mount vaults raised.
  - One well needs the vault bolt tabs rethreaded.
  - Five wells need bolts replaced.
  - One well needs the custom aluminum outer cap replaced.

- Cap/cover maintenance
  - Nine wells need a new flush mount cover installed.
  - Three wells in the Lower Subase need new inner caps (plugs) installed.
- Surface maintenance
  - Seventeen wells need new concrete pads installed.

- Identification maintenance
  - Twenty-seven wells need permanent client-specified well tags installed.
  - Six wells need existing well tags upgraded to permanent client-specified well tags.

Detailed descriptions of recommended maintenance activities for each well are described in the following zone-specific well results sections. A total of four new wells were installed in Zones 1, 4, 5, and 7 in April 2010 to replace abandoned wells or wells that could not be found. No maintenance activities are required for these wells, and they are not summarized in Table 5-27.

5.3.2 Zone-Specific Monitoring Well Condition Survey Results

5.3.2.1 Zone 1

Site 10

Of the seven Site 10 wells inventoried, six were identified as not deficient and the condition of the remaining well was unable to be determined. The organic vapor readings for the wells identified as not deficient were non-detect.

Recommended maintenance on Site 10 wells includes the following:

- Casing maintenance
  - Install new protective casings at 13MW1 and FOMW16.
  - Raise flush-mount vault at FOMW13.
  - Rethread vault bolt tabs at FOMW14.

- Cap/cover maintenance
  - Install new flush mount cover at 13MW1, FOMW13, and FOMW16.
- Surface maintenance
  - Install a new concrete pad at FOMW13.

- Identification maintenance
  - Install permanent client-specified well tags at FOMW13, FOMW15, and FOMW16.
  - Upgrade existing well tags to permanent client-specified well tags at 13MW1 and 13MW2.

Site 11

Of the 11 Zone 1 Site 11 wells inventoried, five were identified as not deficient and six were not found. Five of the wells not found during the 2010 condition survey (13MW4, 13MW5, 13MW8, 13MW9, and NES04) were also not found during the 2007 inventory and should be considered abandoned. Well 13MW7, which was filled with sediment and identified as being improperly abandoned during the 2007 well inventory, was not found in 2010. The organic vapor readings for the wells identified as not deficient were non-detect.

Recommended maintenance on Site 11 wells includes the following:

- Casing maintenance
  - Replace bolts at 13MW20 and 13MW21.
  - Raise the flush-mount vault at 13MW20.

- Surface maintenance
  - Install a new concrete pad at 13MW20 and 13MW21.

- Identification maintenance
  - Install permanent client-specified well tags at 13MW19, 13MW20, and 13MW21.

5.3.2.2 Zone 2

Sites 11

Of the five wells Zone 2 inventoried, two were not deficient. The three wells not found during the 2010 condition survey (13MW17, MW-6, and NESO6) were also not found during the 2007 inventory and should be considered abandoned. The organic vapor readings for the wells identified as not deficient were non-detect.

Recommended maintenance on the Zone 2 wells includes the following:

- Surface maintenance
  - Install a new concrete pad at 13MW10.

- Identification maintenance
  - Install a permanent client-specified well tag at 13MW6.
  - Upgrade the existing well tag to a permanent client-specified well tag at 13MW10.

5.3.2.3 Zone 3

Sites 13 and 17

Of the three Zone 3 wells inventoried (one Site 13 and two Site 17), two were not deficient and one was unable to be determined. The organic vapor readings for the wells identified as not deficient were non-detect.

Recommended maintenance on the Zone 3 wells includes the following:

- Surface maintenance
  - Install a new concrete pad at MW2-3RI.

- Identification maintenance
  - Install a permanent client-specified well tag at 13MW11.
  - Upgrade the existing well tag to a permanent client-specified well tag at 13MW12.

5.3.2.4 Zone 4

Sites 13 and 19

Of the 17 Zone 4 wells inventoried (16 Site 13 and one Site 17), nine were identified as not deficient, one was damaged but usable, six were not found, and one was unusable. Three of the wells not found during the 2010 inventory (13MW16, MW1-4RI, and QW-4) were also not found during the 2007 inventory and should be considered abandoned. The organic vapor readings for the wells identified as not deficient were non-detect, with the exception of QW-3 [0.5 parts per million (ppm)].

Recommended maintenance on the Zone 4 wells includes the following:

- Casing maintenance
  - Install new protective casings at QW-3, QW-5, and MW2-4RI.
  - Remove obstructions from the inside of the well casing at QW-1.

- Cap/cover maintenance
  - Install new inner cap at NESO10, NESO11, and QW-1.
  - Install new flush mount cover at QW-3, QW-5, and MW2-4RI.

- Surface maintenance
  - Install a new concrete pad at NES011, QW-3, QW-5, and MW2-4RI.

- Identification maintenance
  - Install permanent client-specified well tags at 13MW13, 13MW14, QW-1, QW-3, QW-5, and MW2-4RI.
  - Upgrade existing well tags to permanent client-specified well tags at 13MW12, NES010, and NES011.

WE4 was identified damaged but usable and a water level was measured in WE4 during Round 2 of the Groundwater PDI. The well cap for monitoring well WE4 and the well's protective vault/roadbox cover were missing. Previous measurements of the depth to bottom show that the well has been partially silted in, presumably by material entering from the surface. It would be possible to collect samples from this well, but because this well had been open and was below grade, it is likely that surface water has entered the well and the quality of the samples would be compromised. Therefore, although the well was usable, abandonment is recommended. In addition, riser plugs are missing from flush-mount wells NESO10 (3-inch diameter), NESO11 (3-inch diameter), and QW-1 (6-inch diameter) and plastic bags were placed over the risers. A review of the 2007 well inventory indicates the same well conditions in 2007.

5.3.2.5 Zone 5

<u>Site 22</u>

Of the four wells inventoried at Site 22, three were identified as not deficient and one was not found. Well 19MW4 was not found during the 2010 inventory or the 2007 inventory and should be considered abandoned. The organic vapor readings for the wells identified as not deficient were non-detect.

Recommended maintenance on Site 22 wells includes the following:

- Casing maintenance
  - Replace bolts at 19MW2.
  - Replace the custom aluminum outer cap at 19MW3.

- Identification maintenance
  - Install permanent client-specified well tags at 19MW2 and 19MW3.

- Cap/cover maintenance
  - Install new flush mount cover at 19MW3.

5.3.2.6 Zone 6

Site 24

Of the five wells inventoried at Site 24, four were identified as not deficient and one was not found. MW2-6RI was not found due to heavy machinery being stored on top of the well location. The organic vapor readings for the wells identified as not deficient were non-detect.

Recommended maintenance on Site 24 wells includes the following:

- Casing maintenance
  - Install a new protective casing at MW5-6RI.

- Surface maintenance
  - Install a new concrete pad at MW1-6RI and MW5-6RI.

- Identification maintenance
  - Install permanent client-specified well tags at MW1-6RI, MW3-6RI, MW4-6RI, and MW5-6RI.

5.3.2.7 Zone 7

Sites 21 and 25

Of the ten Zone 7 wells inventoried (eight Site 21 and two Site 25), seven were identified as not deficient and three were not found. The three wells not found during the 2010 inventory (20MW3, 20MW7, and MW5-7RI) were also not found during the 2007 inventory and should be considered abandoned. The organic vapor readings for the wells identified as not deficient were non-detect.

Recommended maintenance on Zone 7 wells includes the following:

- Casing maintenance
  - Replace bolts at 20MW2 and MW2-7RI.
  - Install new protective casings at MW1-7RI and MW3-7RI.

- Cap/cover maintenance
  - Install new flush mount cover at MW1-7RI and MW3-7RI.

- Surface maintenance
  - Install new concrete pads at 20MW2, MW1-7RI, MW3-7RI, and MW4-7RI.

- Identification maintenance
  - Install permanent client-specified well tags at 20MW2, 20MW6, MW1-7RI, MW2-7RI, MW3-7RI, and MW4-7RI.

5.3.3 Conclusions and Recommendations

The conclusions and recommendations of the 2010 monitoring well condition survey are as follows:

- Monitoring wells in the Lower Subase were surveyed in 2010 and found to be in various conditions [38 (61 percent) of the wells found to be in good working condition, 4 (6 percent) of the wells were damaged or in an undetermined condition, and 20 (32 percent) were not found].

- Additional deterioration of the wells occurred between the 2010 and 2007 well surveys. Many of the wells are more than 15 years old, and minimal maintenance has been performed on the wells. In addition to the age of the wells, redevelopment activities (building demolition and paving) and maintenance operations (snow plowing) have impacted the conditions of some wells.

- The maintenance activities recommended in Table 5-27 should be completed on those wells that the Navy intends to retain. Otherwise, the wells should be properly abandoned. Caps should be promptly installed for flush-mount wells without caps whether or not abandonment is planned.

- Additional survey efforts should be completed for the wells identified as paved over, obstructed by equipment, etc. (i.e., 13MW1, 13MW11, MW2-3RI, WE1, WE5, and MW2-6RI).

- For those wells that are retained, well condition surveys and well maintenance should be conducted routinely to maintain the integrity of the wells. The efforts could be conducted with other ongoing operation and maintenance activities performed by the Navy at IR sites.

- The map that depicts existing wells in the SOPA New London Instruction 5090.25 (current version) should be updated to show the new wells installed in April 2010 and to remove any wells that are abandoned. Maintaining an up-to-date well location map should help identify conflicts with new construction projects.

Table 5-1

Sample Collection Completeness Evaluation
Lower Subase Soil and Groundwater PDI Completion Report and FS Addendum
NSB-NLON, Groton, Connecticut

Zone 1 - Groundwater

Round of Sampling	Analytical Fraction	Planned Environmental Samples	Environmental Samples Collected	Environmental Sample Collection Percent Completeness
1	Select Total and Dissolved Metals (As, Cu, Pb)	5	5	100
2	Select Total and Dissolved Metals (As, Cu, Pb)	5	5	100

Zone 4 - Groundwater

Round of Sampling	Analytical Fraction	Planned Environmental Samples	Environmental Samples Collected	Environmental Sample Collection Percent Completeness
1	Select Total and Dissolved Metals (As, Cu, Pb)	5	5	100
2	Select Total and Dissolved Metals (As, Cu, Pb)	5	5	100

Zone 5 - Groundwater

Round of Sampling	Analytical Fraction	Planned Environmental Samples	Environmental Samples Collected	Environmental Sample Collection Percent Completeness
1	Select Total and Dissolved Metals (As, Cu, Pb)	2	2	100
2	Select Total and Dissolved Metals (As, Cu, Pb)	2	2	100

Zone 7 - Groundwater

Round of Sampling	Analytical Fraction	Planned Environmental Samples	Environmental Samples Collected	Environmental Sample Collection Percent Completeness
1	Select Total and Dissolved Metals (As, Cu, Pb)	3	3	100
2	Select Total and Dissolved Metals (As, Cu, Pb)	3	3	100

QC Samples - Groundwater

Round of Sampling	Analytical Fraction	Field Duplicates Expected	Field Duplicates Collected	Field Duplicate Percent Completeness	Planned Rinsate Blanks	Rinsate Blanks Collected	Rinsate Blank Percent Completeness	Planned MS/MSD	MS/MSD Collected	MS/MSD Percent Completeness
1	Select Total and Dissolved Metals (As, Cu, Pb)	2	2	100	0	0	100	1	1	100
2	Select Total and Dissolved Metals (As, Cu, Pb)	2	2	100	0	0	100	1	1	100

Acronyms

MS/MSD = matrix spike/matrix spike duplicate

QC = quality control

Table 5-2

Laboratory Measurement Completeness Evaluation - Groundwater
Lower Subase Soil and Groundwater PDI Completion Report and FS Addendum
NSB-NLON, Groton, Connecticut

Zone 1 - Groundwater

Round of Sampling	Analytical Fraction	Environmental Samples Collected	Number of Parameters	Valid Analytical Results (1)	Percent Completeness
1	Select Total and Dissolved Metals (As, Cu, Pb)	5	6	30	100
2	Select Total and Dissolved Metals (As, Cu, Pb)	5	6	30	100

Zone 4 - Groundwater

Round of Sampling	Analytical Fraction	Environmental Samples Collected	Number of Parameters	Valid Analytical Results (1)	Percent Completeness
1	Select Total and Dissolved Metals (As, Cu, Pb)	5	6	30	100
2	Select Total and Dissolved Metals (As, Cu, Pb)	5	6	30	100

Zone 5 - Groundwater

Round of Sampling	Analytical Fraction	Environmental Samples Collected	Number of Parameters	Valid Analytical Results (1)	Percent Completeness
1	Select Total and Dissolved Metals (As, Cu, Pb)	2	6	12	100
2	Select Total and Dissolved Metals (As, Cu, Pb)	2	6	12	100

Zone 7 - Groundwater

Round of Sampling	Analytical Fraction	Environmental Samples Collected	Number of Parameters	Valid Analytical Results (1)	Percent Completeness
1	Select Total and Dissolved Metals (As, Cu, Pb)	3	6	18	100
2	Select Total and Dissolved Metals (As, Cu, Pb)	3	6	18	100

QC Samples - Groundwater

Round of Sampling	Parameter	Field Duplicates Collected	Number of Parameters	Valid Analytical Results (1)	Percent Completeness	Rinsate Blanks Collected	Valid Analytical Results (1)	Percent Completeness	MS/MSD Collected	Valid Analytical Results (1)	Percent Completeness
1	Select Total and Dissolved Metals (As, Cu, Pb)	2	6	12	100	0	0	100	1	6	100
2	Select Total and Dissolved Metals (As, Cu, Pb)	2	6	12	100	0	0	100	1	6	100

Footnotes

1. Valid Analytical Results = The number of parameters per matrix multipled by the number of samples collected.

Acronyms

MS/MSD = matrix spike/matrix spike duplicate

NA = not applicable

QC = quality control

TABLE 5-3

GROUNDWATER PDI ROUND 1 WATER LEVEL MEASUREMENTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Well Number	Northing (NAD 83)	Easting (NAD 83)	Installation Date	Ground Elevation (feet, NAVD 1988)	Top of Riser Elevation (feet, NAVD 1988)	Water Level Information 4/30/2010		Well Details						
						DTW (feet)	El. (feet, NAVD 1988)	Well Completion	Hole Diameter (inches)	Casing Material	Log Total Depth (1) (ft RP)	Screen Material	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)
ZONE 1														
13MW1	705452.600	1180818.100	11/5/1990	11.34	10.97	9.62	1.35	FM	2	PVC	17.00	PVC	7.49	17.49
13MW2	705419.900	1180831.200	11/5/1990	10.84	10.41	8.84	1.57	FM	2	PVC	17.00	PVC	7.67	17.67
13MW3	705396.100	1180734.500	11/7/1990	10.76	10.50	8.97	1.53	FM	2	PVC	17.00	PVC	7.36	17.36
FOMW14	705477.500	1180721.100	6/28/1989	10.56	10.29	8.74	1.55	FM	2	PVC	10.00	PVC	3.20	10.20
FOMW15	705514.100	1180739.100	6/28/1989	10.94	10.29	8.75	1.54	FM	2	PVC	10.00	PVC	3.40	10.40
FOMW16	705499.400	1180712.000	6/28/1989	10.50	10.23	8.68	1.55	FM	2	PVC	10.00	PVC	2.90	9.90
13MW19	705449.900	1180513.800	1/25/1994	5.95	5.66	4.01	1.65	FM	2	PVC	15.00	PVC	5.00	15.00
13MW20	705513.300	1180578.400	1/25/1994	8.32	8.06	6.52	1.54	FM	2	PVC	13.00	PVC	3.00	13.00
13MW21	705485.900	1180525.600	1/25/1994	6.64	6.31	4.80	1.51	FM	2	PVC	15.00	PVC	5.00	15.00
MW1-1PDI	705393.439	1180442.314	4/28/2010	5.90	5.46	4.58	0.88	FM	2	PVC	14.00	PVC	4.00	14.00
ZONE 4														
13MW13	704363.700	1181030.600	11/13/1990	6.55	6.11	4.91	1.20	FM	2	PVC	14.00	PVC	4.60	14.60
13MW14	704343.400	1180927.200	11/13/1990	6.09	5.59	5.45	0.14	FM	2	PVC	14.00	PVC	4.80	14.80
MW2-4RI	704205.240	1181147.560	9/26/1997	6.96	6.46	4.44	2.02	FM	2	PVC	8.00	PVC	3.00	8.00
NESO10	704284.400	1180956.400	1979	6.03	5.71	5.36	0.35	FM	3	other	9.00	PVC	4.30	9.30
NESO11	704286.800	1181077.600	1979	6.50	6.39	4.88	1.51	FM	2	PVC	8.00	PVC	3.60	8.60
WE1	704427.100	1181035.100	7/16/1986	7.23	7.03	5.26	1.77	FM	2	PVC	15.00	PVC	5.30	15.30
MW1-4PDI	704303.210	1180917.204	4/28/2010	5.60	5.06	5.02	0.04	FM	2	PVC	14.00	PVC	3.00	13.00
ZONE 5														
19MW2	708546.100	1180159.400	3/24/1993	4.89	4.59	4.14	0.45	FM	2	PVC	5.00	PVC	1.78	5.78
19MW3	708438.100	1180160.400	3/25/1993	4.79	4.50	3.78	0.72	FM	2	PVC	6.00	PVC	2.30	6.30
MW1-5PDI	708330.130	1180166.318	4/28/2010	5.10	4.68	3.58	1.10	FM	2	PVC	6.25	PVC	1.00	6.00
ZONE 7														
MW1-7RI	706203.780	1180331.320	9/27/1997	6.13	5.72	4.81	0.91	FM	2	PVC	9.00	PVC	5.00	9.00
MW2-7RI	706342.540	1180271.120	9/27/1997	5.81	5.43	4.38	1.05	FM	2	PVC	9.00	PVC	4.50	9.50
MW3-7RI	706602.500	1180250.840	9/27/1997	4.67	4.27	2.97	1.30	FM	2	PVC	8.00	PVC	3.00	8.00
MW4-7RI	706758.130	1180277.230	9/25/1997	6.03	5.67	4.48	1.19	FM	2	PVC	8.00	PVC	3.00	8.00
MW1-7PDI	706684.822	1180243.449	4/28/2010	4.10	3.84	2.63	1.21	FM	2	PVC	14.00	PVC	3.00	13.00

(1) Total well depth based on well construction logs.
All water level measurements taken from top of riser pipe.
DTW - Depth to water.
El. - Elevation
FM - Flush Mount
NA - Not applicable.
NAVD - North American Vertical Datum.
RP - Reference Point

TABLE 5-4

GROUNDWATER PDI ROUND 2 WATER LEVEL MEASUREMENTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Well Number	Northing (NAD 83)	Easting (NAD 83)	Installation Date	Ground Elevation (feet, NAVD 1988)	Top Of Riser Elevation (feet, NAVD 1988)	Water Level Information 8/25/2010		Well Details						
						DTW (ft)	El. (feet, NAVD 1988)	Well Completion	Hole Diameter (inches)	Casing Material	Log Total Depth (1) (ft RP)	Screen Material	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)
ZONE 1														
13MW1	705452.600	1180818.100	11/5/1990	11.34	10.97	NM	NM	FM	2	PVC	17.00	PVC	7.49	17.49
13MW2	705419.900	1180831.200	11/5/1990	10.84	10.41	9.24	1.17	FM	2	PVC	17.00	PVC	7.67	17.67
13MW3	705396.100	1180734.500	11/7/1990	10.76	10.50	9.36	1.14	FM	2	PVC	17.00	PVC	7.36	17.36
FOMW13	705491.000	1180757.200	6/28/1989	10.80	10.11	8.95	1.16	FM	2	PVC	12.00	PVC	9.66	2.66
FOMW14	705477.500	1180721.100	6/28/1989	10.56	10.29	9.12	1.17	FM	2	PVC	10.00	PVC	3.20	10.20
FOMW15	705514.100	1180739.100	6/28/1989	10.94	10.29	9.14	1.15	FM	2	PVC	10.00	PVC	3.40	10.40
FOMW16	705499.400	1180712.000	6/28/1989	10.50	10.23	9.08	1.15	FM	2	PVC	10.00	PVC	2.90	9.90
13MW19	705449.900	1180513.800	1/25/1994	5.95	5.66	4.4	1.26	FM	2	PVC	15.00	PVC	5.00	15.00
13MW20	705513.300	1180578.400	1/25/1994	8.32	8.06	6.89	1.17	FM	2	PVC	13.00	PVC	3.00	13.00
13MW21	705485.900	1180525.600	1/25/1994	6.64	6.31	5.09	1.22	FM	2	PVC	15.00	PVC	5.00	15.00
MW1-1PDI	705393.439	1180442.314	4/28/2010	5.90	5.46	4.71	0.75	FM	2	PVC	14.00	PVC	4.00	14.00
ZONE 4														
13MW13	704363.700	1181030.600	11/13/1990	6.55	6.11	5.07	1.04	FM	2	PVC	14.00	PVC	4.60	14.60
13MW14	704343.400	1180927.200	11/13/1990	6.09	5.59	4.98	0.61	FM	2	PVC	14.00	PVC	4.80	14.80
MW2-4RI	704205.239	1181147.561	9/26/1997	6.96	6.46	4.81	1.65	FM	2	PVC	8.00	PVC	3.00	8.00
NESO10	704284.400	1180956.400	1979	6.03	5.71	5.19	0.52	FM	**3**	other	9.00	PVC	4.30	9.30
NESO11	704286.800	1181077.600	1979	6.50	6.39	NM	NM	FM	2	PVC	8.00	PVC	3.60	8.60
QW-1	704375.600	1180888.400	11/29/1994	5.47	5.07	5.47	-0.40	FM	6	Steel	11.00	Steel	6.50	11.00
QW-2	704422.500	1180871.000	11/30/1994	5.55	5.19	6.73	-1.54	FM	4	PVC	13.00	PVC	6.00	13.00
QW-3	704284.100	1180930.600	12/1/1994	5.47	5.17	5.55	-0.38	FM	4	Other	10.00	Other	7.00	10.00
QW-5	704108.100	1181007.500	12/12/1994	5.45	5.26	5.11	0.15	FM	4	--	10.00	--	7.50	10.00
WE1	704427.100	1181035.100	7/16/1986	7.23	7.03	NM	NM	FM	2	PVC	15.00	PVC	5.30	15.30
WE4	704387.300	1180999.700	7/16/1986	6.32	6.22	5.16	1.06	FM	2	PVC	13.00	PVC	3.40	13.40
MW1-4PDI	704303.210	1180917.204	4/28/2010	5.60	5.06	5.3	-0.24	FM	2	PVC	14.00	PVC	3.00	13.00
ZONE 5														
19MW2	708546.100	1180159.400	3/24/1993	4.89	4.59	3.49	1.10	FM	2	PVC	5.00	PVC	1.78	5.78
19MW3	708438.100	1180160.400	3/25/1993	4.79	4.50	3.53	0.97	FM	2	PVC	6.00	PVC	2.30	6.30
MW1-5PDI	708330.130	1180166.318	4/28/2010	5.10	4.68	3.58	1.10	FM	2	PVC	6.25	PVC	1.00	6.00
ZONE 7														
20MW2	706174.700	1180251.600	3/31/1993	5.57	5.35	4.19	1.16	FM	2	PVC	16.00	PVC	2.50	12.50
20MW6	706614.900	1180371.900	3/27/1993	7.80	7.63	6.00	1.63	FM	3	PVC	16.00	PVC	4.00	14.00
MW1-7RI	706203.779	1180331.319	9/28/1997	6.13	5.72	4.44	1.28	FM	3	PVC	10.00	PVC	5.00	9.00
MW2-7RI	706342.543	1180271.125	9/27/1997	5.81	5.43	4.28	1.15	FM	2	PVC	9.00	PVC	4.50	9.50
MW3-7RI	706602.498	1180250.838	9/27/1997	4.67	4.27	2.92	1.35	FM	2	PVC	8.00	PVC	3.00	8.00
MW4-7RI	706758.130	1180277.227	9/25/1997	6.03	5.67	4.25	1.42	FM	2	PVC	8.00	PVC	3.00	8.00
MW1-7PDI	706684.822	1180243.449	4/28/2010	4.10	3.84	2.45	1.39	FM	2	PVC	14.00	PVC	3.00	13.00

(1) Total well depth based on well construction logs.
All water level measurements taken from top of riser pipe.
DTW - Depth to water.
El. - Elevation
FM - Flush Mount
NM - Not measured
NAVD - North American Vertical Datum.
RP - Reference Point

TABLE 5-5

SUMMARY OF DETECTED GROUNDWATER PDI RESULTS FOR ZONE 1, ROUND 1
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	13MW19 LS1-GW-13MW19-10-01 20100423	13MW20 LS1-GW-13MW20-10-01 20100423	13MW21 LS1-GW-13MW21-10-01 20100423
INORGANICS (UG/L)			
ARSENIC	1.27	0.76	0.39 J
COPPER	1.27	4.57	1.42
LEAD	0.587	3.09	7.3
INORGANICS, FILTERED (UG/L)			
ARSENIC	1.37	0.72	0.37 J
COPPER	0.648	1.27	0.332
LEAD	0.203	0.126	0.504
FIELD (C)			
TEMPERATURE	21.01	16.95	14.42
FIELD (MG/L)			
DISSOLVED OXYGEN	0.95	0.71	0.63
FIELD (MS/CM)			
SPECIFIC CONDUCTANCE	2.097	0.997	1.097
FIELD (NTU)			
TURBIDITY	2	4.9	4.3
FIELD (PPT)			
SALINITY	1.19	0.59	0.63
FIELD (S.U.)			
pH	8.11	7.19	8.78

TABLE 5-5

SUMMARY OF DETECTED GROUNDWATER PDI RESULTS FOR ZONE 1, ROUND 1
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	FOMW14		MW1-1PDI
	LS1-GW-FOMW14-10-01 20100423	LS1-GW-FOMW14-10-01-D 20100423	LS1-GW-MW1-1PDI-10-01 20100430
INORGANICS (UG/L)			
ARSENIC	0.18 J	0.18 J	1.35
COPPER	2.24	2.22	2.55
LEAD	1.28	1.19	1.42
INORGANICS, FILTERED (UG/L)			
ARSENIC	0.18 J	0.19 J	1.63
COPPER	2.12	1.97	0.256
LEAD	0.963	0.977	0.089
FIELD (C)			
TEMPERATURE	12.36	NA	15.17
FIELD (MG/L)			
DISSOLVED OXYGEN	0.34	NA	1.2
FIELD (MS/CM)			
SPECIFIC CONDUCTANCE	2.173	NA	2.306
FIELD (NTU)			
TURBIDITY	1	NA	9
FIELD (PPT)			
SALINITY	1.5	NA	1.48
FIELD (S.U.)			
pH	6.75	NA	8.46

TABLE 5-6

SUMMARY OF DETECTED PDI RESULTS FOR ZONE 1, ROUND 2
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	13MW19 LS1-GW-13MW19-10-02 20100829	13MW20 LS1-GW-13MW20-10-02 20100827	13MW21 LS1-GW-13MW21-10-02 20100827
INORGANICS (UG/L)			
ARSENIC	1.21	0.9	0.48 J
COPPER	1.4	7.28	1.28
LEAD	0.427 U	2.83	1.17
INORGANICS, FILTERED (UG/L)			
ARSENIC	1.18	0.83	0.47 J
COPPER	0.782	1.18	0.872
LEAD	0.088 U	0.202	0.47
FIELD (C)			
TEMPERATURE	26.12	23.21	24.3
FIELD (MG/L)			
DISSOLVED OXYGEN	0.8	0.36	0.42
FIELD (MS/CM)			
SPECIFIC CONDUCTANCE	1.382	1.351	8.178
FIELD (MV)			
OXIDATION REDUCTION POTENTIAL	159.4	0	65
FIELD (NTU)			
TURBIDITY	5.2	1.2	0.5
FIELD (PPT)			
SALINITY	0.7	0.68	4.52
FIELD (S.U.)			
pH	7.63	7.21	8.15

TABLE 5-6

SUMMARY OF DETECTED PDI RESULTS FOR ZONE 1, ROUND 2
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	FOMW14 LS1-GW-FOMW14-10-02 20100830	MW1-1PDI LS1-GW-MW1-1PDI-10-02 20100829
INORGANICS (UG/L)		
ARSENIC	0.76	0.6
COPPER	2	4.17
LEAD	1.12 J	2.33 J
INORGANICS, FILTERED (UG/L)		
ARSENIC	0.67	0.49 J
COPPER	0.866	0.131
LEAD	0.331 U	0.188 U
FIELD (C)		
TEMPERATURE	20.6	23.8
FIELD (MG/L)		
DISSOLVED OXYGEN	4.37	0.31
FIELD (MS/CM)		
SPECIFIC CONDUCTANCE	1.012	3.399
FIELD (MV)		
OXIDATION REDUCTION POTENTIAL	6.2	-120
FIELD (NTU)		
TURBIDITY	2.6	12
FIELD (PPT)		
SALINITY	0.48	1.78
FIELD (S.U.)		
pH	6.92	8.57

TABLE 5-7

FREQUENCY OF DETECTION FOR ZONE 1, ROUND 1 GROUNDWATER PDI DATA
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Parameter	Frequency of Detection	Mimimum Concentration	Maximum Conentration	Sample with Maximum Concentration	Range of Non-Detects	Average of All Data
Inorganics (µg/L)							
7440-38-2	Arsenic	5/5	0.18 J	1.35	LS1-GW-MW1-1PDI-10-01	0	0.79
7440-50-8	Copper	5/5	1.27	4.57	LS1-GW-13MW20-10-01	0	2.41
7439-92-1	Lead	5/5	0.59	7.3	LS1-GW-13MW21-10-01	0	2.73
Inorganics, Filtered (µg/L)							
7440-38-2	Arsenic	5/5	0.18 J	1.63	LS1-GW-MW1-1PDI-10-01	0	0.86
7440-50-8	Copper	5/5	0.26	2.12	LS1-GW-FOMW14-10-01	0	0.91
7439-92-1	Lead	5/5	0.09	0.977	LS1-GW-FOMW14-10-01-D	0	0.38
Field Parameters							
NA	Dissolved Oxygen (mg/L)	5/5	0.34	1.2	LS1-GW-MW1-1PDI-10-01	NA	0.87
NA	pH (S.U.)	5/5	6.75	8.78	LS1-GW-13MW21-10-01	NA	8.14
NA	Salinity (ppt)	5/5	0.59	1.5	LS1-GW-FOMW14-10-01	NA	0.97
NA	Specific Conductance (ms/cm)	5/5	1.00	2.31	LS1-GW-MW1-1PDI-10-01	NA	1.62
NA	Temperature (deg C)	5/5	12.36	21.01	LS1-GW-13MW19-10-01	NA	16.89
NA	Turbidity (ntu)	5/5	1	9	LS1-GW-MW1-1PDI-10-01	NA	5.05

Associated Samples:

LS1-GW-13MW19-10-01
LS1-GW-13MW20-10-01
LS1-GW-13MW21-10-01
LS1-GW-FOMW14-10-01
LS1-GW-FOMW14-10-01-AVG
LS1-GW-FOMW14-10-01-D
LS1-GW-MW1-1PDI-10-01

TABLE 5-8

FREQUENCY OF DETECTION FOR ZONE 1, ROUND 2 GROUNDWATER PDI DATA
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Parameter	Frequency of Detection	Minimum Concnetration		Maximum Concentration	Sample with Maximum Concentration	Range of Non-Detects	Average of Positive Hits Data	Average of All Data
Inorganics (ug/L)									
7440-38-2	Arsenic	5/5	0.48	J	1.21	LS1-GW-13MW19-10-02	0	0.790	0.790
7440-50-8	Copper	5/5	1.28		7.28	LS1-GW-13MW20-10-02	0	3.226	3.226
7439-92-1	Lead	4/5	1.12	J	2.83	LS1-GW-13MW20-10-02	0.427	1.863	1.533
Inorganics, Filtered (ug/L)									
7440-38-2	Arsenic	5/5	0.47	J	1.18	LS1-GW-13MW19-10-02	0	0.728	0.728
7440-50-8	Copper	5/5	0.131		1.18	LS1-GW-13MW20-10-02	0	0.766	0.766
7439-92-1	Lead	2/5	0.202		0.47	LS1-GW-13MW21-10-02	0.088 - 0.331	0.336	0.195
Field Parameters									
NA	Dissolved Oxygen (mg/L)	5/5	0.31		4.37	LS1-GW-FOMW14-10-02	NA	1.252	1.252
NA	Oxidation Reduction (mV)	5/5	-120		159.4	LS1-GW-13MW19-10-02	NA	22.120	22.120
NA	pH (S.U.)	5/5	6.92		8.57	LS1-GW-MW1-1PDI-10-02	NA	7.696	7.696
NA	Salinity (ppt)	5/5	0.48		4.52	LS1-GW-13MW21-10-02	NA	1.632	1.632
NA	Specific Conductance (ms/cm)	5/5	1.012		8.178	LS1-GW-13MW21-10-02	NA	3.064	3.064
NA	Temperature (deg C)	5/5	20.6		26.12	LS1-GW-13MW19-10-02	NA	23.606	23.606
NA	Turbidity (ntu)	5/5	0.5		12	LS1-GW-MW1-1PDI-10-02	NA	4.300	4.300

Associated Samples:

LS1-GW-13MW19-10-02
LS1-GW-13MW20-10-02
LS1-GW-13MW21-10-02
LS1-GW-FOMW14-10-02
LS1-GW-MW1-1PDI-10-02

TABLE 5-9

FREQUENCY OF DETECTION FOR ALL ZONE 1 GROUNDWATER RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondects(2)	Background Concentrations(3)
Volatile Organics								
75-34-3	1,1-Dichloroethane	3 J	3 J	ug/L	13MW19	1/29	5 - 10	NA
71-43-2	Benzene	3 J	3 J	ug/L	13GW2, 13GW2-2	2/33	1 - 10	NA
75-15-0	Carbon Disulfide	1 J	3 J	ug/L	13MW9-2	3/29	5 - 10	NA
100-41-4	Ethylbenzene	2 J	11	ug/L	13MW19	3/33	1 - 10	NA
100-42-5	Styrene	2 J	2 J	ug/L	021191-13MW8	1/29	5 - 10	NA
108-88-3	Toluene	11	11	ug/L	MW-13 (89)	1/33	1 - 10	NA
1330-20-7	Total Xylenes	8 J	44	ug/L	13MW19	3/33	1 - 10	NA
Semivolatile Organics								
120-82-1	1,2,4-Trichlorobenzene	0.7 J	0.7 J	ug/L	NES04-2	1/33	10 - 12	NA
541-73-1	1,3-Dichlorobenzene	0.5 J	0.5 J	ug/L	13GW3-2, NES04-2	2/37	1 - 12	NA
91-57-6	2-Methylnaphthalene	1 J	47	ug/L	13GW2	6/33	10 - 12	NA
106-44-5	4-Methylphenol	1 J	6 J	ug/L	13GW3-2	5/33	10 - 12	NA
83-32-9	Acenaphthene	0.6 J	10 J	ug/L	13GW2	13/33	10 - 12	NA
208-96-8	Acenaphthylene	1 J	1 J	ug/L	13GW2	1/33	10 - 12	NA
120-12-7	Anthracene	1 J	2 J	ug/L	13GW2, LS1GW13MW201	3/33	10 - 12	NA
65-85-0	Benzoic Acid	0.6 J	0.6 J	ug/L	13GW1	1/20	50 - 50	NA
117-81-7	Bis(2-ethylhexyl)phthalate	0.8 J	3 J	ug/L	13GW1-2	3/33	10 - 12	NA
85-68-7	Butyl Benzyl Phthalate	2 J	2 J	ug/L	LS1GW13MW201	1/33	10 - 12	NA
86-74-8	Carbazole	0.6 J	1 J	ug/L	13GW2, 13MW20, 13MW20-D, 13GW20-2	4/33	10 - 12	NA
84-74-2	di-n-Butyl Phthalate	0.6 J	1 J	ug/L	13MW21	2/33	10 - 12	NA
117-84-0	di-n-Octyl Phthalate	1 J	1 J	ug/L	LS1GW13MW201	1/33	10 - 12	NA
132-64-9	Dibenzofuran	1 J	11	ug/L	13GW2	6/33	10 - 12	NA
84-66-2	Diethyl Phthalate	0.6 J	3 J	ug/L	13GW1	10/33	10 - 12	NA
206-44-0	Fluoranthene	0.7 J	2 J	ug/L	13GW2, LS1GW13MW201	6/33	10 - 12	NA
86-73-7	Fluorene	1 J	15	ug/L	13GW2	6/33	10 - 12	NA
91-20-3	Naphthalene	1 J	28	ug/L	13GW2	5/33	10 - 12	NA
85-01-8	Phenanthrene	1 J	9 J	ug/L	13GW2, LS1GW13MW201	5/33	10 - 12	NA
108-95-2	Phenol	5 J	28 J	ug/L	13GW3-2	2/33	10 - 12	NA
129-00-0	Pyrene	0.5 J	2 J	ug/L	LS1GW13MW201	9/33	10 - 12	NA
Inorganics								
7429-90-5	Aluminum	23.5 J	26,100	ug/L	13MW19	19/42	10 - 342	2,560
7440-36-0	Antimony	6.6	6.6	ug/L	LS1GW13MW2001	1/42	2.5 - 25	2.9
7440-38-2	Arsenic - Historic	1.5 J	16.8 J	ug/L	13MW21	21/42	2-3	1.92
7440-38-2	Arsenic - PDI	0.18 J	1.35	ug/L	LS1-GW-MW1-1PDI-10-01	10/10	-	1.92
7440-39-3	Barium	3.5	210	ug/L	011791-13MW5S	30/42	2.9 - 40.6	227

TABLE 5-9

FREQUENCY OF DETECTION FOR ALL ZONE 1 GROUNDWATER RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondects(2)	Background Concentrations(3)
7440-41-7	Beryllium	1.3 J	1.3 J	ug/L	13MW19	1/42	0.11 - 1	ND
7440-42-8	Boron	52 J	1,430	ug/L	13MW9-2	17/20	50 - 50	NA
7440-43-9	Cadmium	1.4 J	20.9 J	ug/L	NES04	4/42	0.22 - 5	ND
7440-70-2	Calcium	4,820	207,000	ug/L	LS1GW13MW901	42/42	-	188,000
15723-28-1	Total Chromium	1.1 J	11.6 J	ug/L	011591-13MW7S-D	9/42	0.68 - 14	49.9
7440-48-4	Cobalt	1.9 J	8.2	ug/L	011691-13MW3S	6/42	0.8 - 5	48.6
7440-50-8	Copper - Historic	1.6 J	156	ug/L	LS1GW13MW2001	14/42	1.5 - 5	107
7440-50-8	Copper - PDI	1.27	7.28	ug/L	LS1-GW-13MW20-10-02	10/10	-	107
7439-89-6	Iron	43.1	11,600	ug/L	011691-13MW2S	38/42	17 - 214	28,200
7439-92-1	Lead - Historic	2 J	55.7	ug/L	LS1GW13MW2001	18/41	1 - 10	6.63
7439-92-1	Lead - PDI	0.587	7.3	ug/L	LS1-GW-13MW20-10-02	10/10	-	6.63
7439-95-4	Magnesium	129	615,000 J	ug/L	LS1GW13MW901	38/42	226 - 5800	191,000
7439-96-5	Manganese	9.6 J	3,540	ug/L	LS1GW13MW801	42/42	-	11,700
7439-97-6	Mercury	0.24	0.97	ug/L	13MW19	4/42	0.01 - 0.2	ND
7440-02-0	Nickel	1 J	27.2 J	ug/L	011691-13MW1S	21/42	3 - 11	32.2
7440-09-7	Potassium	2,090	194,000	ug/L	LS1GW13MW901	42/42	-	70,800
7782-49-2	Selenium	1	22	ug/L	011791-13MW9S	4/42	1 - 30	3.19
7440-22-4	Silver	1.6 J	7.4 J	ug/L	021191-13MW8	4/42	1.1 - 7	ND
7440-23-5	Sodium	14,800 J	4,950,000 J	ug/L	LS1GW13MW901	42/42	-	1,900,000
7440-28-0	Thallium	5.4 J	5.4 J	ug/L	LS1GW13MW301, LS1GWFOMW1601	2/42	1 - 20	ND
7440-62-2	Vanadium	0.72 J	689	ug/L	13MW19	16/42	0.55 - 20	10.2
7440-66-6	Zinc	4 J	121	ug/L	13MW19	22/42	2 - 26.5	131
Inorganics, Filtered								
7429-90-5	Aluminum	20 J	18,700	ug/L	13MW19	10/33	10 - 88.7	64.4
7440-36-0	Antimony	2.6 J	8	ug/L	LS1GW13MW2001	3/33	2.5 - 15.6	2.01
7440-38-2	Arsenic - Historic	1.2 J	24.8	ug/L	13MW19	15/33	2 - 2.5	2.55
7440-38-2	Arsenic - PDI	0.18 J	1.63	ug/L	LS1-GW-MW1-1PDI-10-01	10/10	-	2.55
7440-39-3	Barium	9.4	138	ug/L	LS1GW13MW2001	22/33	1.4 - 40.3	124
7440-41-7	Beryllium	1 J	1 J	ug/L	13MW19	1/33	0.11 - 1	ND
7440-42-8	Boron	50 J	1,410 J	ug/L	13MW9-2	17/20	50 - 50	NA
7440-70-2	Calcium	5,730	203,000	ug/L	LS1GW13MW901	33/33	-	152,000
15723-28-1	Total Chromium	0.76 J	9.3	ug/L	13MW19	8/33	0.68 - 4	16
7440-48-4	Cobalt	1.4 J	3.1	ug/L	LS1GWFOMW1401	3/33	0.8 - 5	43.3
7440-50-8	Copper - Historic	2.3 J	120	ug/L	LS1GW13MW2001	12/33	1.3 - 5	39.4
7440-50-8	Copper - PDI	0.131	2.12	ug/L	LS1-GW-FOMW14-10-01	10/10	-	39.4
7439-89-6	Iron	127	8,490	ug/L	LS1GW13MW201	26/33	17 - 239	25,300

TABLE 5-9

FREQUENCY OF DETECTION FOR ALL ZONE 1 GROUNDWATER RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondects(2)	Background Concentrations(3)
7439-92-1	Lead - Historic	2.1 J	36.3	ug/L	LS1GW13MW2001	7/31	1 - 2	2.52
7439-92-1	Lead - PDI	0.089	0.977	ug/L	LS1-GW-FOMW14-10-01-D	7/10	0.202 - 0.47	2.52
7439-95-4	Magnesium	195 J	609,000 J	ug/L	LS1GW13MW901	32/33	161 - 161	150,000
7439-96-5	Manganese	8.3	3,810	ug/L	LS1GW13MW801	31/33	8.3 - 10.6	9,400
7439-97-6	Mercury	0.2 J	0.35 J	ug/L	13MW21	3/33	0.01 - 0.2	ND
7440-02-0	Nickel	1 J	9.8 J	ug/L	LS1GWFOMW1401	8/33	0.75 - 11	15.3
7440-09-7	Potassium	2,710 J	191,000	ug/L	LS1GW13MW901	33/33	-	60,000
7782-49-2	Selenium	3.1 J	3.1 J	ug/L	LS1GWFOMW1601	1/31	1.9 - 4.4	ND
7440-22-4	Silver	1.2 J	2.6	ug/L	LS1GW13MW901	2/33	1.1 - 3	ND
7440-23-5	Sodium	30,100	4,860,000 J	ug/L	LS1GW13MW901	33/33	-	1,500,000
7440-62-2	Vanadium	0.67 J	593	ug/L	13MW19	14/33	0.55 - 5	9.9
7440-66-6	Zinc	3.4 J	60.5	ug/L	LS1GW13MW1801	8/33	2 - 23.9	109
Miscellaneous Parameters								
--	Nitrate	0.056 J	1.5 J	mg/L	LS1GWFOMW1301	11/13	0.05 - 0.05	NA
Petroleum Hydrocarbons								
--	Diesel Range Organics	21,000	1,100,000	ug/L	MW-14 (89)	4/4	-	NA
--	Total Petroleum Hydrocarbons	600	16,000 J	ug/L	LS1GWFOMW1401	9/42	500 - 3000	NA

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - Basewide Groundwater Operable Unit Remedial Investigation Report (TtNUS, 2001).

Associated Samples

011691-13MW1S
13GW1
13GW1-2
LS1GW13MW101
LS1GW13MW101-D
13MW18
13GW18-2
LS1GW13MW1801
13MW19
13GW19-2
LS1GW13MW1901
011691-13MW2S
13GW2
LS1GW13MW301
011791-13MW4S
011791-13MW5S
011591-13MW7S
011591-13MW7S-D
021191-13MW8
13GW8
13GW8-2
LS1GW13MW801
011791-13MW9S
13GW9
13MW9-2
LS1GW13MW901
LS1-GW-13MW19-10-02
LS1-GW-13MW20-10-02
LS1-GW-13MW21-10-02
LS1-GW-FOMW14-10-02
LS1-GW-MW1-1PDI-10-02
LS1-GW-13MW19-10-01
LS1-GW-13MW20-10-01
LS1-GW-13MW21-10-01
LS1-GW-FOMW14-10-01
LS1-GW-MW1-1PDI-10-01
LS1-GW-FOMW14-10-01-D

TABLE 5-9

FREQUENCY OF DETECTION FOR ALL ZONE 1 GROUNDWATER RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondects(2)	Background Concentrations(3)
13GW2-2		MW-13 (89)						
LS1GW13MW201		LS1GWFOMW13						
13MW20		LS1GWFOMW1301						
13MW20-D		MW-14 (89)						
13GW20-2		LS1GWFOMW1401						
LS1GW13MW2001		MW-15 (89)						
13MW21		LS1GWFOMW1501						
13GW21-2		MW-16 (89)						
LS1GW13MW2101		LS1GWFOMW1601						
011691-13MW3S		011891-NESOMW4S						
13GW3		NES04						
13GW3-2		NES04-2						

Definitions:
J = Estimated value
NA = Not Applicable/Not Available
ND = Non Detect

TABLE 5-10

SUMMARY OF DETECTED GROUNDWATER PDI RESULTS FOR ZONE 4, ROUND 1
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	13MW13 LS4-GW-13MW13-10-01 20100422	13MW14 LS4-GW-13MW14-10-01 20100424	MW1-4PDI LS4-GW-MW1-4PDI-10-01 20100430
INORGANICS (UG/L)			
ARSENIC	2.6	0.27 J	0.97
COPPER	1.09	2.18	1.67
LEAD	0.542	5.84	10.2
INORGANICS, FILTERED (UG/L)			
ARSENIC	2.37	0.27 J	0.83
COPPER	0.331	0.844	0.701
LEAD	0.077	0.512	3.12
FIELD (C)			
TEMPERATURE	16.02	20.45	10.1
FIELD (MG/L)			
DISSOLVED OXYGEN	0.22	0.95	5.8
FIELD (MS/CM)			
SPECIFIC CONDUCTANCE	0.621	12.36	14.74
FIELD (NTU)			
TURBIDITY	4	1	4.8
FIELD (PPT)			
SALINITY	0.37	7.81	12.34
FIELD (S.U.)			
pH	6.83	6.63	6.73

TABLE 5-10

SUMMARY OF DETECTED GROUNDWATER PDI RESULTS FOR ZONE 4, ROUND 1
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	NESO10 LS4-GW-NESO10-10-01 20100424	NESO11 LS4-GW-NESO11-10-01 20100424
INORGANICS (UG/L)		
ARSENIC	0.65	0.74
COPPER	0.671	57
LEAD	0.611	43.5
INORGANICS, FILTERED (UG/L)		
ARSENIC	0.58	0.79
COPPER	0.467	37.7
LEAD	0.121	10.5
FIELD (C)		
TEMPERATURE	14.2	17.46
FIELD (MG/L)		
DISSOLVED OXYGEN	1.1	1.4
FIELD (MS/CM)		
SPECIFIC CONDUCTANCE	4.33	4.452
FIELD (NTU)		
TURBIDITY	9.4	3.5
FIELD (PPT)		
SALINITY	3.3	1.56
FIELD (S.U.)		
pH	6.94	6.63

TABLE 5-11

SUMMARY OF DETECTED GROUNDWATER PDI RESULTS FOR ZONE 4, ROUND 2
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	13MW13 LS4-GW-13MW13-10-02 20100827	13MW14 LS4-GW-13MW14-10-02 20100828	MW1-4PDI LS4-GW-MW1-4PDI-10-02 20100828
INORGANICS (UG/L)			
ARSENIC	3.49	0.24 J	1.15
COPPER	3.51	1.86	3.63
LEAD	1.2	4.57	11.5
INORGANICS, FILTERED (UG/L)			
ARSENIC	2.84	0.24 J	1.01
COPPER	0.258	0.282	0.271
LEAD	0.034	0.175	0.103
FIELD (C)			
TEMPERATURE	22	23.18	20.2
FIELD (MG/L)			
DISSOLVED OXYGEN	0.3	0.48	0.63
FIELD (MS/CM)			
SPECIFIC CONDUCTANCE	0.662	28.52	27
FIELD (MV)			
OXIDATION REDUCTION POTENTIAL	27	61.6	75.2
FIELD (NTU)			
TURBIDITY	2.5	0	2.5
FIELD (PPT)			
SALINITY	0.32	17.61	16.61
FIELD (S.U.)			
pH	6.76	6.79	6.75

TABLE 5-11

SUMMARY OF DETECTED GROUNDWATER PDI RESULTS FOR ZONE 4, ROUND 2
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	NESO10 LS4-GW-NESO10-10-02 20100829	NESO11 LS4-GW-NESO11-10-02 20100827
INORGANICS (UG/L)		
ARSENIC	1.45	0.96
COPPER	3.72	71
LEAD	1.22 J	72.6
INORGANICS, FILTERED (UG/L)		
ARSENIC	1.46	0.82
COPPER	0.351	36.3
LEAD	0.068 U	16
FIELD (C)		
TEMPERATURE	23.6	24.42
FIELD (MG/L)		
DISSOLVED OXYGEN	0.74	0.43
FIELD (MS/CM)		
SPECIFIC CONDUCTANCE	3.886	0.652
FIELD (MV)		
OXIDATION REDUCTION POTENTIAL	39	148.7
FIELD (NTU)		
TURBIDITY	2.3	2
FIELD (PPT)		
SALINITY	2.18	0.32
FIELD (S.U.)		
pH	6.7	6.25

TABLE 5-12

FREQUENCY OF DETECTION FOR ZONE 4, ROUND 1 GROUNDWATER PDI DATA
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Parameter	Frequency of Detection	Mimimum Concentration	Maximum Conentration	Sample with Maximum Concentration	Range of Non-Detects	Average of All Data
Inorganics (ug/L)							
7440-38-2	Arsenic	5/5	0.27 J	2.6	LS4-GW-13MW13-10-01	0	1.046
7440-50-8	Copper	5/5	0.671	57	LS4-GW-NESO11-10-01	0	12.522
7439-92-1	Lead	5/5	0.542	43.5	LS4-GW-NESO11-10-01	0	12.139
Inorganics, Filtered (ug/L)							
7440-38-2	Arsenic	5/5	0.27 J	2.37	LS4-GW-13MW13-10-01	0	0.968
7440-50-8	Copper	5/5	0.331	37.7	LS4-GW-NESO11-10-01	0	8.009
7439-92-1	Lead	5/5	0.077	10.5	LS4-GW-NESO11-10-01	0	2.866
Field Parameters							
TTNUS034	Dissolved Oxygen (mg/L)	5/5	220	5800	LS4-GW-MW1-4PDI-10-01	0	1894.000
TTNUS002	pH (S.U.)	5/5	6.63	6.94	LS4-GW-NESO10-10-01	0	6.752
TTNUS036	Salinity (ppt)	5/5	0.37	12.34	LS4-GW-MW1-4PDI-10-01	0	5.076
TTNUS038	Specific Conductance (ms/cm)	5/5	0.621	14.74	LS4-GW-MW1-4PDI-10-01	0	7.301
TTNUS047	Temperature (deg C)	5/5	10.1	20.45	LS4-GW-13MW14-10-01	0	15.646
TTNUS023	Turbidity (ntu)	5/5	1	9.4	LS4-GW-NESO10-10-01	0	4.540

Associated Samples:

LS4-GW-13MW13-10-01
LS4-GW-13MW14-10-01
LS4-GW-MW1-4PDI-10-01
LS4-GW-NESO10-10-01
LS4-GW-NESO11-10-01

TABLE 5-13

FREQUENCY OF DETECTION FOR ZONE 4, ROUND 2 GROUNDWATER PDI DATA
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Parameter	Frequency of Detection	Minimum Concnetration		Maximum Concentration		Sample with Maximum Concentration	Range of Non-Detects	Average of Positive Hits Data	Average of All Data
Inorganics (ug/L)										
7440-38-2	Arsenic	5/5	0.24	J	3.49		LS4-GW-13MW13-10-02	0	1.458	1.458
7440-50-8	Copper	5/5	1.86		71		LS4-GW-NESO11-10-02	0	16.744	16.744
7439-92-1	Lead	5/5	1.2		72.6		LS4-GW-NESO11-10-02	0	18.218	18.218
Inorganics, Filtered (ug/L)										
7440-38-2	Arsenic	5/5	0.24	J	2.84		LS4-GW-13MW13-10-02	0	1.274	1.274
7440-50-8	Copper	5/5	0.258		36.3		LS4-GW-NESO11-10-02	0	7.492	7.492
7439-92-1	Lead	4/5	0.034		16		LS4-GW-NESO11-10-02	0.068	4.078	3.269
Field Parameters										
NA	Dissolved Oxygen (mg/L)	5/5	0.3		0.74		LS4-GW-NESO10-10-02	NA	0.516	0.516
NA	Oxidation Reduction (mV)	5/5	27		148.7		LS4-GW-NESO11-10-02	NA	70.300	70.300
NA	pH (S.U.)	5/5	6.25		6.79		LS4-GW-13MW14-10-02	NA	6.650	6.650
NA	Salinity (ppt)	5/5	0.32		17.61		LS4-GW-13MW14-10-02	NA	7.408	7.408
NA	Specific Conductance (ms/cm)	5/5	0.652		28.52		LS4-GW-13MW14-10-02	NA	12.144	12.144
NA	Temperature (deg C)	5/5	20.2		24.42		LS4-GW-NESO11-10-02	NA	22.680	22.680
NA	Turbidity (ntu)	5/5	0		2.5		LS4-GW-13MW13-10-02	NA	1.860	1.860

Associated Samples:

LS4-GW-13MW13-10-02
LS4-GW-13MW14-10-02
LS4-GW-MW1-4PDI-10-02
LS4-GW-NESO10-10-02
LS4-GW-NESO11-10-02

TABLE 5-14

FREQUENCY OF DETECTION FOR ALL ZONE 4 GROUNDWATER RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondects(2)	Background Concentrations(3)
Volatile Organics								
71-55-6	1,1,1-Trichloroethane	1 J	1 J	ug/L	012191-NESO11	1/25	5 - 10	NA
75-34-3	1,1-Dichloroethane	1 J	15	ug/L	012191-13MW13S	7/25	5 - 10	NA
75-35-4	1,1-Dichloroethene	4 J	57	ug/L	012191-13MW13S	4/25	5 - 10	NA
100-41-4	Ethylbenzene	2 J	8 J	ug/L	WE1-2	2/25	5 - 10	NA
75-09-2	Methylene Chloride	9 J	9 J	ug/L	WE5-2	1/25	5 - 11	NA
108-88-3	Toluene	36	36	ug/L	012191-NESOMW10S	1/25	5 - 10	NA
1330-20-7	Total Xylenes	5 J	27	ug/L	WE1-2	3/25	5 - 10	NA
75-01-4	Vinyl Chloride	5 J	12	ug/L	012191-13MW13S	2/25	10 - 10	NA
Semivolatile Organics								
105-67-9	2,4-Dimethylphenol	1 J	1 J	ug/L	LS4GW13MW1601	1/26	10 - 12	NA
83-32-9	Acenaphthene	0.8 J	2 J	ug/L	LS4GW13MW1601	4/26	10 - 12	NA
56-55-3	Benzo(a)anthracene	1 J	1 J	ug/L	NESO11	1/26	10 - 12	NA
50-32-8	Benzo(a)pyrene	0.8 J	0.8 J	ug/L	NESO11	1/26	10 - 12	NA
205-99-2	Benzo(b)fluoranthene	0.6 J	0.6 J	ug/L	NESO11	1/26	10 - 12	NA
191-24-2	Benzo(g,h,i)perylene	1 J	1 J	ug/L	NESO11	1/26	10 - 12	NA
207-08-9	Benzo(k)fluoranthene	1 J	1 J	ug/L	NESO11	1/26	10 - 12	NA
117-81-7	Bis(2-ethylhexyl)phthalate	1 J	10 J	ug/L	NESO11	2/26	10 - 15	NA
86-74-8	Carbazole	0.7 J	0.7 J	ug/L	LS4GW13MW1601	1/26	10 - 12	NA
218-01-9	Chrysene	0.9 J	0.9 J	ug/L	NESO11	1/26	10 - 12	NA
84-74-2	di-n-Butyl Phthalate	0.6 J	0.6 J	ug/L	13GW16-2	1/26	10 - 12	NA
132-64-9	Dibenzofuran	1 J	1 J	ug/L	LS4GW13MW1601	1/26	10 - 12	NA
206-44-0	Fluoranthene	2 J	2 J	ug/L	NESO11	1/26	10 - 12	NA
86-73-7	Fluorene	0.8 J	0.8 J	ug/L	LS4GW13MW1601	1/26	10 - 12	NA
193-39-5	Indeno(1,2,3-cd)pyrene	0.7 J	0.7 J	ug/L	NESO11	1/26	10 - 12	NA
91-20-3	Naphthalene	0.6 J	4 J	ug/L	LS4GW13MW1601	3/26	10 - 12	NA
85-01-8	Phenanthrene	0.6 J	1 J	ug/L	NESO11	2/26	10 - 12	NA
129-00-0	Pyrene	1 J	2 J	ug/L	NESO11	4/26	10 - 12	NA
Inorganics								
7429-90-5	Aluminum	18.2 J	40,800	ug/L	NESO11	5/35	10 - 178	3,560
7440-36-0	Antimony	5.6	9	ug/L	LS4GW00201	3/32	2.5 - 57.9	2.9
7440-38-2	Arsenic - Historic	1.3 J	29.6 J	ug/L	WE5	18/35	2 - 20	1.92
7440-38-2	Arsenic - PDI	0.24 J	3.49	ug/L	LS4-GW-13MW13-10-02	10/10	-	1.92
7440-39-3	Barium	3.6 J	283	ug/L	NESO11	30/35	10.9 - 37.6	227
7440-41-7	Beryllium	1.1 J	2.6 J	ug/L	NESO11	2/35	0.11 - 1	ND
7440-42-8	Boron	80.8	2,070 J	ug/L	13GW15-2	16/16	-	NA
7440-43-9	Cadmium	1.5 J	25.5 J	ug/L	012191-NESOMW10S	4/34	0.22 - 3	ND
7440-70-2	Calcium	22,400	246,000	ug/L	LS4GW13MW1501	35/35	-	188,000
15723-28-1	Chromium	1.4 J	116	ug/L	NESO11	3/35	0.68 - 5	49.9
7440-48-4	Cobalt	1.4 J	25.6 J	ug/L	NESO11	2/35	0.8 - 5	48.6
7440-50-8	Copper - Historic	1.7 J	649	ug/L	NESO11	10/34	1 - 17.2	107
7440-50-8	Copper - PDI	0.671	71	ug/L	LS4-GW-NESO11-10-02	10/10	-	107
7439-89-6	Iron	95.2 J	36,700	ug/L	NESO11	29/35	13 - 150	28,200

TABLE 5-14

FREQUENCY OF DETECTION FOR ALL ZONE 4 GROUNDWATER RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondects(2)	Background Concentrations(3)
7439-92-1	Lead - Historic	1.3 J	2,760 J	ug/L	NESO11	18/32	1.3 - 20	6.63
7439-92-1	Lead - PDI	0.542	72.6	ug/L	LS4-GW-NESO11-10-02	10/10	-	6.63
7439-95-4	Magnesium	2,230	861,000	ug/L	LS4GW13MW1501	35/35	-	191,000
7439-96-5	Manganese	3.4	1,980	ug/L	NESO11	32/35	11.9 - 99.9	11,700
7439-97-6	Mercury	0.47 J	0.47 J	ug/L	NESO11	1/35	0.01 - 0.2	ND
7440-02-0	Nickel	0.83 J	80	ug/L	NESO11	15/35	0.75 - 12	32.2
7440-09-7	Potassium	4,490	285,000	ug/L	LS4GW13MW1501	35/35	-	70,800
7782-49-2	Selenium	7.7	7.7	ug/L	011591-13MW14S	1/32	1 - 30	3.19
7440-22-4	Silver	1.5 J	4.1	ug/L	LS4GW13MW1501	3/35	1 - 7	ND
7440-23-5	Sodium	40,800 J	7,120,000	ug/L	LS4GW13MW1501	35/35	-	1,900,000
7440-28-0	Thallium	3.6 J	11.5 J	ug/L	012291-13MW15S-D	3/26	1 - 10	ND
7440-62-2	Vanadium	0.63 J	105	ug/L	NESO11	4/35	0.55 - 20	10.2
7440-66-6	Zinc	4.9 J	924	ug/L	NESO11	19/35	1.2 - 14.5	131
Inorganics, Filtered								
7429-90-5	Aluminum	11	11	ug/L	13GW16-2	1/26	10 - 85.7	64.4
7440-36-0	Antimony	0.24 J	2.84	ug/L	13GW14-2	5/26	2.5 - 22.3	2.01
7440-38-2	Arsenic - Historic	2.3 J	14.7	ug/L	LS4GW13MW1301	8/26	1 - 20	2.55
7440-38-2	Arsenic - PDI	0.24 J	2.84	ug/L	LS4-GW-13MW13-10-02	10/10	-	2.55
7440-39-3	Barium	6 J	452	ug/L	LS4GWNESO1001	23/26	9.6 - 39.1	124
7440-42-8	Boron	78.8 J	2,370	ug/L	13GW15-2	16/16	-	NA
7440-70-2	Calcium	24,500	251,000	ug/L	LS4GW13MW1501	26/26	-	152,000
7440-48-4	Cobalt	1.1 J	1.1 J	ug/L	LS4GW13MW1501	1/26	0.8 - 5	43.3
7440-50-8	Copper - Historic	1.6 J	20.4	ug/L	13GW16-2	8/25	1 - 7.5	39.4
7440-50-8	Copper - PDI	0.258	37.7	ug/L	LS4-GW-NESO11-10-01	10/10	-	39.4
7439-89-6	Iron	56.2	9,280	ug/L	LS4GW13MW1301	19/26	13 - 97	25,300
7439-92-1	Lead - Historic	1.4 J	14.1	ug/L	NES011-2	6/25	1 - 20	2.52
7439-92-1	Lead - PDI	0.034	16	ug/L	LS4-GW-NESO11-10-02	9/10	0.068	2.52
7439-95-4	Magnesium	2,180 J	878,000	ug/L	LS4GW13MW1501	26/26	-	150,000
7439-96-5	Manganese	6.1	611	ug/L	WE-5	23/26	10.9 - 89.4	9,400
7440-02-0	Nickel	1.2 J	1.2 J	ug/L	LS4GWNESO1001	1/26	2.6 - 11	15.3
7440-09-7	Potassium	6,950	291,000	ug/L	LS4GW13MW1501	26/26	-	60,000
7782-49-2	Selenium	2.1 J	2.1 J	ug/L	NES010-2	1/25	1.9 - 30	ND
7440-22-4	Silver	3.4	3.4	ug/L	LS4GWQW401	1/26	1.1 - 5.3	ND
7440-23-5	Sodium	56,200 J	7,260,000	ug/L	LS4GW13MW1501	24/26	142 - 142	15,800,000
7440-28-0	Thallium	6.8 J	6.8 J	ug/L	WE5-2	1/25	1 - 20	ND
7440-62-2	Vanadium	5.7	5.7	ug/L	13GW16-2	1/26	0.55 - 5	9.9
7440-66-6	Zinc	8.5 J	126 J	ug/L	LS4GWNESO1101	14/26	1.2 - 17.1	109
Miscellaneous Parameters								
14797-55-8	Nitrate	0.057 J	7.9 J	mg/L	LS4GW00201	10/10	-	NA
Petroleum Hydrocarbons								
--	Total Petroleum Hydrocarbons	500	5,400	ug/L	012391-13MW16S	4/35	500 - 3000	NA

TABLE 5-14

FREQUENCY OF DETECTION FOR ALL ZONE 4 GROUNDWATER RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondects(2)	Background Concentrations(3)

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - Basewide Groundwater Operable Unit Remedial Investigation Report, TtNUS, 2001.

Definitions:
J = Estimated value
NA = Not Applicable/Not Available
ND = Non Detect

Associated Samples

012191-13MW13S
13GW13
13GW13-2
LS4GW13MW1301
011591-13MW14S
13MW14
13GW14-2
LS4GW13MW1401
012291-13MW15S
012291-13MW15S-D
13GW15
13GW15-2
LS4GW13MW1501
012391-13MW16S
13MW16
13GW16-2
LS4GW13MW1601
LS4GW00101
LS4GW00201
012191-NESOMW10S
NESO10
NES010-2
LS4GWNESO1001
012191-NESO11
NESO11
NES011-2
LS4GWNESO1101
LS4GWQW401
012291-WEMW1S
WE-1
WE1-2
LS4GWWE101
012291-WEMW4S
012391-WEMW5S
WE-5
WE5-2
LS4-GW-13MW13-10-01
LS4-GW-13MW14-10-01
LS4-GW-MW1-4PDI-10-01
LS4-GW-NESO10-10-01
LS4-GW-NESO11-10-01
LS4-GW-13MW13-10-02
LS4-GW-13MW14-10-02
LS4-GW-MW1-4PDI-10-02
LS4-GW-NESO10-10-02
LS4-GW-NESO11-10-02

TABLE 5-15

SUMMARY OF DETECTED GROUNDWATER PDI RESULTS FOR ZONE 5, ROUND 1
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	19MW3 LS5-GW-19MW3-10-01 20100424	MW1-5PDI LS5-GW-MW1-5PDI-10-01 20100426
INORGANICS (UG/L)		
ARSENIC	1.43	3.2
COPPER	4.66	5.14
LEAD	0.803	2.15
INORGANICS, FILTERED (UG/L)		
ARSENIC	1.28	3.33
COPPER	2.51	0.871
LEAD	0.194	0.368
FIELD (C)		
TEMPERATURE	14.48	15.01
FIELD (MG/L)		
DISSOLVED OXYGEN	0.36	0.17
FIELD (MS/CM)		
SPECIFIC CONDUCTANCE	0.604	3.109
FIELD (NTU)		
TURBIDITY	2	3.8
FIELD (PPT)		
SALINITY	0.37	2.04
FIELD (S.U.)		
pH	6.21	6.37

TABLE 5-16

SUMMARY OF DETECTED GROUNDWATER PDI RESULTS FOR ZONE 5, ROUND 2
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	19MW3	MW1-5PDI	
	LS5-GW-19MW3-10-02	LS5-GW-MW1-5PDI-10-02	LS5-GW-MW1-5PDI-10-02-D
	20100826	20100826	20100826
INORGANICS (UG/L)			
ARSENIC	0.83	5.76	5.64
COPPER	1.98	1.18	1.18
LEAD	1.24	0.846	0.882
INORGANICS, FILTERED (UG/L)			
ARSENIC	0.91	5.59	5.88
COPPER	0.627	0.127	0.11
LEAD	0.258	0.051	0.056
FIELD (C)			
TEMPERATURE	24	24.97	NA
FIELD (MG/L)			
DISSOLVED OXYGEN	0.47	0.12	NA
FIELD (MS/CM)			
SPECIFIC CONDUCTANCE	0.448	1.425	NA
FIELD (MV)			
OXIDATION REDUCTION POTENTIAL	48.1	25.9	NA
FIELD (NTU)			
TURBIDITY	3	2.6	NA
FIELD (PPT)			
SALINITY	0.21	0.71	NA
FIELD (S.U.)			
pH	6.3	6.4	NA

TABLE 5-17

FREQUENCY OF DETECTION FOR ZONE 5, ROUND 1 GROUNDWATER PDI DATA
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Parameter	Frequency of Detection	Mimimum Concentration	Maximum Conentration	Sample with Maximum Concentration	Range of Non-Detects	Average of All Data
Inorganics (ug/L)							
7440-38-2	Arsenic	2/2	1.43	3.2	LS5-GW-MW1-5PDI-10-01	0	2.315
7440-50-8	Copper	2/2	4.66	5.14	LS5-GW-MW1-5PDI-10-01	0	4.900
7439-92-1	Lead	2/2	0.803	2.15	LS5-GW-MW1-5PDI-10-01	0	1.477
Inorganics, Filtered (ug/L)							
7440-38-2	Arsenic	2/2	1.28	3.33	LS5-GW-MW1-5PDI-10-01	0	2.305
7440-50-8	Copper	2/2	0.871	2.51	LS5-GW-19MW3-10-01	0	1.691
7439-92-1	Lead	2/2	0.194	0.368	LS5-GW-MW1-5PDI-10-01	0	0.281
Field Parameters							
TTNUS034	Dissolved Oxygen (mg/L)	2/2	170	360	LS5-GW-19MW3-10-01	0	265.000
TTNUS002	pH (S.U.)	2/2	6.21	6.37	LS5-GW-MW1-5PDI-10-01	0	6.290
TTNUS036	Salinity (ppt)	2/2	0.37	2.04	LS5-GW-MW1-5PDI-10-01	0	1.205
TTNUS038	Specific Conductance (ms/cm)	2/2	0.604	3.109	LS5-GW-MW1-5PDI-10-01	0	1.857
TTNUS047	Temperature (deg C)	2/2	14.48	15.01	LS5-GW-MW1-5PDI-10-01	0	14.745
TTNUS023	Turbidity (ntu)	2/2	2	3.8	LS5-GW-MW1-5PDI-10-01	0	2.900

Associated Samples:

LS5-GW-19MW3-10-01
LS5-GW-MW1-5PDI-10-01

TABLE 5-18

FREQUENCY OF DETECTION FOR ZONE 5, ROUND 2 GROUNDWATER PDI DATA
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Parameter	Frequency of Detection	Minimum Concentration	Maximum Conentration	Sample with Maximum Concentration	Range of Non-Detects	Average of All Data
Inorganics (ug/L)							
7440-38-2	Arsenic	2/2	0.83	5.76	LS5-GW-MW1-5PDI-10-02	0	3.265
7440-50-8	Copper	2/2	1.18	1.98	LS5-GW-19MW3-10-02	0	1.580
7439-92-1	Lead	2/2	0.846	1.24	LS5-GW-19MW3-10-02	0	1.052
Inorganics, Filtered (ug/L)							
7440-38-2	Arsenic	2/2	0.91	5.88	LS5-GW-MW1-5PDI-10-02-D	0	3.323
7440-50-8	Copper	2/2	0.11	0.627	LS5-GW-19MW3-10-02	0	0.373
7439-92-1	Lead	2/2	0.051	0.258	LS5-GW-19MW3-10-02	0	0.156
Field Parameters							
NA	Dissolved Oxygen (mg/L)	2/2	0.12	0.47	LS5-GW-19MW3-10-02	NA	0.295
NA	Oxidation Reduction (mV)	2/2	25.9	48.1	LS5-GW-19MW3-10-02	NA	37.000
NA	pH (S.U.)	2/2	6.3	6.4	LS5-GW-MW1-5PDI-10-02	NA	6.350
NA	Salinity (ppt)	2/2	0.21	0.71	LS5-GW-MW1-5PDI-10-02	NA	0.460
NA	Specific Conductance (ms/cm)	2/2	0.448	1.425	LS5-GW-MW1-5PDI-10-02	NA	0.937
NA	Temperature (deg C)	2/2	24	24.97	LS5-GW-MW1-5PDI-10-02	NA	24.485
NA	Turbidity (ntu)	2/2	2.6	3	LS5-GW-19MW3-10-02	NA	2.800

Associated Samples:

LS5-GW-19MW3-10-02
LS5-GW-MW1-5PDI-10-02
LS5-GW-MW1-5PDI-10-02-AVG
LS5-GW-MW1-5PDI-10-02-D

TABLE 5-19

FREQUENCY OF DETECTION FOR ALL ZONE 5 GROUNDWATER RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Minimum Concentration[1]	Maximum Concentration[1]	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondects[2]	Background Concentrations[3]
Volatile Organics								
100-41-4	Ethylbenzene	4	4	ug/L	19MW4 (93)	1/3	1 - 1	NA
108-88-3	Toluene	0.8 J	0.8 J	ug/L	19MW4 (93)	1/3	1 - 1	NA
1330-20-7	Total Xylenes	13	13	ug/L	19MW4 (93)	1/3	1 - 5	NA
Semivolatile Organics								
91-57-6	2-Methylnaphthalene	37	75	ug/L	19MW4 (93)	2/5	10 - 12	NA
83-32-9	Acenaphthene	2 J	3 J	ug/L	19GW3 (93)	2/5	10 - 12	NA
208-96-8	Acenaphthylene	2 J	2 J	ug/L	LS5GW19MW301	1/5	10 - 12	NA
84-74-2	di-n-Butyl Phthalate	0.6 J	0.6 J	ug/L	LS5GW19MW301	1/5	10 - 12	NA
132-64-9	Dibenzofuran	1 J	2 J	ug/L	19GW3 (93), 19MW4 (93)	3/5	10 - 12	NA
86-73-7	Fluorene	2 J	4 J	ug/L	19GW3 (93)	3/5	10 - 12	NA
91-20-3	Naphthalene	0.6 J	73	ug/L	19MW4 (93)	3/5	10 - 12	NA
85-01-8	Phenanthrene	1 J	2 J	ug/L	19MW4 (93)	2/5	10 - 12	NA
Inorganics								
7440-38-2	Arsenic - PDI	0.83	5.76	ug/L	LS5-GW-MW1-5PDI-10-02	4/4	-	2.55
7440-39-3	Barium	177	324	ug/L	LS5GW19MW201	2/5	43.7 - 72.8	227
7440-70-2	Calcium	22,700 J	182,000	ug/L	LS5GW19MW201	5/5	-	188,000
7440-48-4	Cobalt	11.5	11.5	ug/L	19MW4 (93)	1/5	2.9 - 3	48.6
7440-50-8	Copper - Historic	2.4 J	4.2	ug/L	LS5GW19MW201	2/5	3 - 3	107
7440-50-8	Copper - PDI	1.18	5.14	ug/L	LS5-GW-MW1-5PDI-10-01	4/4	-	107
7439-89-6	Iron	10,700 J	31,900 J	ug/L	19MW4 (93)	3/5	30.9 - 220	28,200
7439-92-1	Lead - Historic	1.3 J	1.3 J	ug/L	LS5GW19MW201	1/5	1.3 - 4.4	6.63
7439-92-1	Lead - PDI	0.803	2.15	ug/L	LS5-GW-MW1-5PDI-10-01	4/4	-	6.63
7439-95-4	Magnesium	3,360	391,000	ug/L	LS5GW19MW201	5/5	-	191,000
7439-96-5	Manganese	4.6 J	4,140 J	ug/L	19MW4 (93)	4/5	6.2 - 6.2	11,700
7439-97-6	Mercury	0.41	0.41	ug/L	LS5GW19MW301	1/5	0.04 - 0.18	ND
7440-09-7	Potassium	3,840	113,000	ug/L	LS5GW19MW201	5/5	-	70,800
7440-23-5	Sodium	21,900 J	3,090,000	ug/L	LS5GW19MW201	5/5	-	1,900,000
7440-66-6	Zinc	21.3 J	21.3 J	ug/L	LS5GW19MW201	1/5	3 - 15.7	131
Inorganics, Filtered								
7429-90-5	Aluminum	136 J	172 J	ug/L	19GW3 (93)	3/5	12.5 - 26.8	64.4
7440-38-2	Arsenic - Historic	34.3	34.3	ug/L	19MW4 (93)	1/5	2 - 2.5	2.55
7440-38-2	Arsenic - PDI	0.91	5.88	ug/L	LS5-GW-MW1-5PDI-10-02	4/4	-	2.55
7440-39-3	Barium	43.7 J	370	ug/L	LS5GW19MW301	5/5	-	124
7440-42-8	Boron	162	206	ug/L	19MW4 (93)	3/3	-	NA

TABLE 5-19

FREQUENCY OF DETECTION FOR ALL ZONE 5 GROUNDWATER RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondects(2)	Background Concentrations(3)
7440-70-2	Calcium	23,900	165,000	ug/L	LS5GW19MW201	5/5	-	152,000
7440-48-4	Cobalt	10.5 J	10.5 J	ug/L	19MW4 (93)	1/5	2.9 - 3	43.3
7440-50-8	Copper - Historic	3.2	11.4	ug/L	LS5GW19MW301	2/5	3 - 3	39.4
7440-50-8	Copper - PDI	0.11	2.51	ug/L	LS5-GW-19MW3-10-01	4/4	-	39.4
7439-89-6	Iron	42.5 J	31,100	ug/L	19MW4 (93)	4/5	22.2 - 22.2	25,300
7439-92-1	Lead - Historic	1.4 J	2.2 J	ug/L	19MW3 (93)	2/5	1 - 1.3	2.52
7439-92-1	Lead - PDI	0.051	0.368	ug/L	LS5-GW-MW1-5PDI-10-01	4/4	-	2.52
7439-95-4	Magnesium	3,410 J	351,000	ug/L	LS5GW19MW201	5/5	-	150,000
7439-96-5	Manganese	7.6 J	4,090	ug/L	19MW4 (93)	4/5	1.6 - 1.6	9,400
7440-09-7	Potassium	4,030 J	100,000	ug/L	LS5GW19MW201	5/5	-	60,000
7440-23-5	Sodium	21,600	2,770,000	ug/L	LS5GW19MW201	5/5	-	1,580,000
7440-62-2	Vanadium	3 J	3 J	ug/L	LS5GW19MW301	1/5	2.9 - 5	9.9
7440-66-6	Zinc	3.3 J	185 J	ug/L	LS5GW19MW201	4/5	11 - 11	109
Miscellaneous Parameters								
NA	Nitrate	1.2	1.2	mg/L	LS5GW19MW201	1/2	0.05 - 0.05	NA

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - Basewide Groundwater Operable Unit Remedial Investigation Report, TtNUS, 2001.

Associated Samples

19GW2 (93)	LS5-GW-19MW3-10-02
LS5GW19MW201	LS5-GW-MW1-5PDI-10-02
19GW3 (93)	LS5-GW-19MW3-10-01
LS5GW19MW301	LS5-GW-MW1-5PDI-10-01
19MW4 (93)	LS5-GW-MW1-5PDI-10-02-D

Definitions:
J = Estimated value
NA = Not Applicable/Not Available
ND = Non Detect

TABLE 5-20

SUMMARY OF DETECTED GROUNDWATER PDI RESULTS FOR ZONE 7, ROUND 1
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	MW1-7PDI	MW3-7RI		MW4-7RI
	LS7-GW-MW1-7PDI-10-01	LS7-GW-MW3-7RI-10-01	LS7-GW-MW3-7RI-10-01-D	LS7-GW-MW4-7RI-10-01
	20100430	20100424	20100424	20100424
INORGANICS (UG/L)				
ARSENIC	0.76	0.23 J	0.21 J	1.12
COPPER	0.208	0.417	0.404	0.433
LEAD	0.074	0.092	0.062	0.031
INORGANICS, FILTERED (UG/L)				
ARSENIC	0.78	0.16 J	0.17 J	1.1
COPPER	0.089 J	0.369	0.41	0.34
LEAD	0.025	0.018 J	0.051	0.019 J
FIELD (C)				
TEMPERATURE	12.63	14.29	NA	17.81
FIELD (MG/L)				
DISSOLVED OXYGEN	0.65	1.25	NA	0.83
FIELD (MS/CM)				
SPECIFIC CONDUCTANCE	0.191	1.586	NA	1.789
FIELD (NTU)				
TURBIDITY	3.8	2	NA	3.9
FIELD (PPT)				
SALINITY	0.12	1.01	NA	1.07
FIELD (S.U.)				
pH	7.22	6.94	NA	7.15

TABLE 5-21

SUMMARY OF DETECTED GROUNDWATER PDI RESULTS FOR ZONE 7, ROUND 2
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

PARAMETER	MW1-7PDI	MW3-7RI		MW4-7RI
	LS7-GW-MW1-7PDI-10-02	LS7-GW-MW3-7RI-10-02	LS7-GW-MW3-7RI-10-02-D	LS7-GW-MW4-7RI-10-02
	20100828	20100828	20100828	20100829
INORGANICS (UG/L)				
ARSENIC	1.56	0.22 J	0.23 J	15
COPPER	0.389	0.814	0.755	0.249
LEAD	0.184 U	0.266	0.057 U	0.106 U
INORGANICS, FILTERED (UG/L)				
ARSENIC	1.47	0.18 J	0.21 J	15.1
COPPER	0.046 J	0.81	0.766	0.075 J
LEAD	0.017 U	0.018 J	0.023 U	0.018 U
FIELD (C)				
TEMPERATURE	24.7	25.83	NA	23.75
FIELD (MG/L)				
DISSOLVED OXYGEN	0.32	1.23	NA	0.38
FIELD (MS/CM)				
SPECIFIC CONDUCTANCE	0.494	1.763	NA	0.924
FIELD (MV)				
OXIDATION REDUCTION POTENTIAL	-12.6	166.4	NA	-39.8
FIELD (NTU)				
TURBIDITY	3.2	0	NA	1.1
FIELD (PPT)				
SALINITY	0.24	0.89	NA	0.45
FIELD (S.U.)				
pH	6.97	6.7	NA	7.07

TABLE 5-22

FREQUENCY OF DETECTION FOR ZONE 7, ROUND 1 GROUNDWATER PDI DATA
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Parameter	Frequency of Detection	Mimimum Concentration		Maximum Concentration	Sample with Maximum Concentration	Range of Non-Detects	Average of All Data
Inorganics (ug/L)								
7440-38-2	Arsenic	3/3	0.21	J	1.12	LS7-GW-MW4-7RI-10-01	0	0.700
7440-50-8	Copper	3/3	0.208		0.433	LS7-GW-MW4-7RI-10-01	0	0.351
7439-92-1	Lead	3/3	0.031		0.092	LS7-GW-MW3-7RI-10-01	0	0.061
Inorganics, Filtered (ug/L)								
7440-38-2	Arsenic	3/3	0.16	J	1.1	LS7-GW-MW4-7RI-10-01	0	0.682
7440-50-8	Copper	3/3	0.089	J	0.41	LS7-GW-MW3-7RI-10-01-D	0	0.273
7439-92-1	Lead	3/3	0.018	J	0.051	LS7-GW-MW3-7RI-10-01-D	0	0.026
Field Parameters								
TTNUS034	Dissolved Oxygen (mg/L)	3/3	0.65		1.25	LS7-GW-MW3-7RI-10-01	0	740.000
TTNUS002	pH (S.U.)	3/3	6.94		7.22	LS7-GW-MW1-7PDI-10-01	0	7.185
TTNUS036	Salinity (ppt)	3/3	0.12		1.07	LS7-GW-MW4-7RI-10-01	0	0.595
TTNUS038	Specific Conductance (ms/cm)	3/3	0.191		1.789	LS7-GW-MW4-7RI-10-01	0	0.990
TTNUS047	Temperature (deg C)	3/3	12.63		17.81	LS7-GW-MW4-7RI-10-01	0	15.220
TTNUS023	Turbidity (ntu)	3/3	2		3.9	LS7-GW-MW4-7RI-10-01	0	3.850

Associated Samples:

LS7-GW-MW1-7PDI-10-01
LS7-GW-MW3-7RI-10-01
LS7-GW-MW3-7RI-10-01-AVG
LS7-GW-MW3-7RI-10-01-D
LS7-GW-MW4-7RI-10-01

TABLE 5-23

FREQUENCY OF DETECTION FOR ZONE 7, ROUND 2 GROUNDWATER PDI DATA
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Parameter	Frequency of Detection	Minimum Concnetration	Maximum Concentration	Sample with Maximum Concentration	Range of Non-Detects	Average of Positive Hits Data	Average of All Data
Inorganics (ug/L)								
7440-38-2	Arsenic	3/3	0.22 J	15	LS7-GW-MW4-7RI-10-02	0	5.595	5.595
7440-50-8	Copper	3/3	0.249	0.814	LS7-GW-MW3-7RI-10-02	0	0.474	0.474
7439-92-1	Lead	1/3	0.266	0.266	LS7-GW-MW3-7RI-10-02	0.057 - 0.184	0.147	0.097
Inorganics, Filtered (ug/L)								
7440-38-2	Arsenic	3/3	0.18 J	15.1	LS7-GW-MW4-7RI-10-02	0	5.588	5.588
7440-50-8	Copper	3/3	0.046 J	0.81	LS7-GW-MW3-7RI-10-02	0	0.303	0.303
7439-92-1	Lead	1/3	0.018 J	0.018 J	LS7-GW-MW3-7RI-10-02	0.017 - 0.023	0.018	0.012
Field Parameters								
NA	Dissolved Oxygen (mg/L)	3/3	0.32	1.23	LS7-GW-MW3-7RI-10-02	NA	0.643	0.643
NA	Oxidation Reduction (mV)	3/3	-39.8	166.4	LS7-GW-MW3-7RI-10-02	NA	38.000	38.000
NA	pH (S.U.)	3/3	6.7	7.07	LS7-GW-MW4-7RI-10-02	NA	6.913	6.913
NA	Salinity (ppt)	3/3	0.24	0.89	LS7-GW-MW3-7RI-10-02	NA	0.527	0.527
NA	Specific Conductance (ms/cm)	3/3	0.494	1.763	LS7-GW-MW3-7RI-10-02	NA	1.060	1.060
NA	Temperature (deg C)	3/3	23.75	25.83	LS7-GW-MW3-7RI-10-02	NA	24.760	24.760
NA	Turbidity (ntu)	3/3	0	3.2	LS7-GW-MW1-7PDI-10-02	NA	1.433	1.433

Associated Samples:

LS7-GW-MW1-7PDI-10-02
LS7-GW-MW3-7RI-10-02
LS7-GW-MW3-7RI-10-02-AVG
LS7-GW-MW3-7RI-10-02-D
LS7-GW-MW4-7RI-10-02

TABLE 5-24

FREQUENCY OF DETECTION FOR ALL ZONE 7 GROUNDWATER RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondects(2)	Background Concentrations(4)
Volatile Organics								
71-55-6	1,1,1-Trichloroethane	0.6 J	0.6 J	ug/L	20MW6 (93)	1/6	1 - 1	NA
67-66-3	Chloroform	2	2	ug/L	20MW4 (93)	1/6	1 - 1	NA
79-01-6	Trichloroethene	0.6 J	0.6 J	ug/L	20MW6 (93)	1/6	1 - 1	NA
Semivolatile Organics								
91-57-6	2-Methylnaphthalene	1 J	3 J	ug/L	20GW7 (93)	2/17	11 - 13	NA
83-32-9	Acenaphthene	0.6 J	10 J	ug/L	20MW3 (93)	7/17	11 - 13	NA
208-96-8	Acenaphthylene	1 J	1 J	ug/L	20MW3 (93), 20MW4 (93)	2/17	10 - 13	NA
120-12-7	Anthracene	2 J	2 J	ug/L	LS7GW00401	1/17	10 - 13	NA
86-74-8	Carbazole	1 J	1 J	ug/L	LS7GW00401	1/17	10 - 13	NA
218-01-9	Chrysene	0.9 J	0.9 J	ug/L	LS7GW00401	1/17	10 - 13	NA
132-64-9	Dibenzofuran	1 J	1 J	ug/L	LS7GW00401	1/17	10 - 13	NA
206-44-0	Fluoranthene	1 J	5 J	ug/L	LS7GW00401	2/16	10 - 13	NA
86-73-7	Fluorene	2 J	3 J	ug/L	LS7GW00401, LS7GW20MW701	3/17	10 - 13	NA
91-20-3	Naphthalene	0.7 J	0.7 J	ug/L	LS7GW00401	1/17	10 - 13	NA
85-01-8	Phenanthrene	1 J	9 J	ug/L	LS7GW00401	2/17	10 - 13	NA
129-00-0	Pyrene	1 J	5 J	ug/L	LS7GW00401	2/17	10 - 13	NA
Inorganics								
7429-90-5	Aluminum	339	339	ug/L	LS7GW20MW301	1/17	10 - 225	3,560
7440-36-0	Antimony	9.3	15.7	ug/L	LS7GW20MW601-D	3/17	2.5 - 30	2.9
7440-38-2	Arsenic - Historic	2.8 J	18.8	ug/L	LS7GW20MW701	8/17	2.5 - 4.9	1.92
7440-38-2	Arsenic - PDI	0.21 J	15	ug/L	LS7-GW-MW4-7RI-10-02	6/6	-	1.92
7440-39-3	Barium	7.9 J	966	ug/L	LS7GW20MW501	13/17	27.3 - 72.8	227
7440-70-2	Calcium	3740 J	89200 J	ug/L	20GW7 (93)	17/17	-	188,000
15723-28-1	Chromium	2.9	2.9	ug/L	LS7GW20MW301	1/17	0.68 - 4	49.9
7440-48-4	Cobalt	0.249	4.4 J	ug/L	20MW2 (93)	4/17	0.8 - 3	48.6
7440-50-8	Copper - Historic	22.7 J	24.4 J	ug/L	20MW6 (93)	2/17	0.74 - 11.4	107
7440-50-8	Copper - PDI	0.208	0.814	ug/L	LS7-GW-MW3-7RI-10-02	6/6	-	107
7439-89-6	Iron	375 J	22600	ug/L	LS7GW001001	11/17	44.3 - 1910	28,200
7439-92-1	Lead - Historic	6	117 J	ug/L	20MW6 (93)	7/17	1 - 2.2	6.63
7439-92-1	Lead - PDI	0.031	0.266	ug/L	LS7-GW-MW3-7RI-10-02	4/6	0.057 - 0.184	6.63
7439-95-4	Magnesium	1280 J	27000 J	ug/L	20MW3 (93)	17/17	-	191,000
7439-96-5	Manganese	28 J	3490 J	ug/L	20MW2 (93)	14/17	11.9 - 156	11,700

TABLE 5-24

FREQUENCY OF DETECTION FOR ALL ZONE 7 GROUNDWATER RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondects(2)	Background Concentrations(4)
7440-02-0	Nickel	0.78 J	13.2	ug/L	LS7GW001001, LS7GW001001-D	5/17	0.75 - 9	32.2
7440-09-7	Potassium	3780 J	21400 J	ug/L	20MW2 (93)	16/17	2780 - 2780	70,800
7782-49-2	Selenium	1.3 J	56.1 J	ug/L	LS7GW20MW701	3/17	1 - 3.1	3.19
7440-23-5	Sodium	11400 J	156000 J	ug/L	20MW3 (93)	17/17	-	1,900,000
7440-62-2	Vanadium	2.3	2.3	ug/L	LS7GW20MW301	1/17	0.55 - 5	10.2
7440-66-6	Zinc	26.6	816	ug/L	20MW6 (93)	5/17	3.2 - 14.4	131
Inorganics, Filtered								
7429-90-5	Aluminum	133 J	163 J	ug/L	20GW5 (93)	5/17	10 - 169	64.4
7440-36-0	Antimony	4.5 J	10.7	ug/L	LS7GW001001-D	2/17	2.5 - 30	2.01
7440-38-2	Arsenic - Historic	2.7 J	20	ug/L	LS7GW20MW701	11/17	2 - 4.9	2.55
7440-38-2	Arsenic - PDI	0.16 J	15.1	ug/L	LS7-GW-MW4-7RI-10-01	6/6	-	2.55
7440-39-3	Barium	6.9 J	1200	ug/L	LS7GW20MW501	16/17	72.8 - 72.8	124
7440-42-8	Boron	241	939	ug/L	20MW4 (93)	5/6	261 - 261	NA
7440-43-9	Cadmium	3.1 J	3.1 J	ug/L	20MW2 (93)	1/17	0.22 - 2	ND
7440-70-2	Calcium	3740	92300 J	ug/L	20GW7 (93)	17/17	-	152,000
7440-48-4	Cobalt	0.83 J	3.1 J	ug/L	20MW2 (93)	4/17	0.8 - 3	43.3
7440-50-8	Copper - Historic	21.1 J	21.1 J	ug/L	20MW6 (93)	1/17	1.5 - 7.8	39.4
7440-50-8	Copper - PDI	0.046 J	0.81	ug/L	LS7-GW-MW3-7RI-10-02	6/6	-	39.4
7439-89-6	Iron	28.3 J	20100	ug/L	LS7GW001001-D	14/17	13 - 256	25,300
7439-92-1	Lead - Historic	1.5 J	97.5	ug/L	20MW6 (93)	6/17	1.3 - 1.6	2.52
7439-92-1	Lead - PDI	0.018 J	0.051	ug/L	LS7-GW-MW3-7RI-10-01-D	4/6	0.017 - 0.023	2.52
7439-95-4	Magnesium	1390 J	24800	ug/L	20MW3 (93)	17/17	-	150,000
7439-96-5	Manganese	16.9	3600	ug/L	20MW2 (93)	15/17	11.4 - 152	9,400
7440-02-0	Nickel	0.93 J	16.1	ug/L	LS7GW001001-D	5/17	0.75 - 9	15.3
7440-09-7	Potassium	2910	22100	ug/L	20MW2 (93)	17/17	-	60,000
7782-49-2	Selenium	1.2 J	1.2 J	ug/L	20MW6 (93)	1/17	1 - 1.9	ND
7440-23-5	Sodium	18600	148000	ug/L	20MW2 (93)	17/17	-	1,580,000
7440-28-0	Thallium	1.2 J	2 J	ug/L	20MW4 (93)	4/17	1 - 4.8	ND
7440-62-2	Vanadium	1.8	1.8	ug/L	LS7GW20MW301	1/17	0.55 - 5	9.9
7440-66-6	Zinc	3.5 J	780	ug/L	20MW6 (93)	13/17	3 - 15.5	109

Footnotes:
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - Basewide Groundwater Operable Unit Remedial Investigation Report, TtNUS, 2001.

TABLE 5-24

FREQUENCY OF DETECTION FOR ALL ZONE 7 GROUNDWATER RESULTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Associated Samples

20GW5 (93)
20GW7 (93)
20MW2 (93)
20MW3 (93)
20MW4 (93)
20MW6 (93)
LS7GW001001
LS7GW001001-D
LS7GW00301
LS7GW00401
LS7GW00701
LS7GW00901
LS7GW20MW201
LS7GW20MW301
LS7GW20MW401
LS7GW20MW501
LS7GW20MW601
LS7GW20MW601-D
LS7GW20MW701
LS7-GW-MW1-7PDI-10-01
LS7-GW-MW3-7RI-10-01
LS7-GW-MW3-7RI-10-01-D
LS7-GW-MW4-7RI-10-01
LS7-GW-MW1-7PDI-10-02
LS7-GW-MW3-7RI-10-02
LS7-GW-MW3-7RI-10-02-D
LS7-GW-MW4-7RI-10-02

Definitions:

J = Estimated value
NA = Not Applicable/Not Available
ND = Non Detect

TABLE 5-25

MONITORING WELL CONSTRUCTION INFORMATION AND 2010 FIELD MEASUREMENTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

			Field Verified								Well Log Documentation					
Zone	Site	Well Number	Northing (NAD 83)	Easting (NAD 83)	Hole Dia. (in)	Casing Material	Well Outer Casing	2010 Depth to Water (ft)	2007 or 2010 Depth of Well (ft RP)	2010 Depth to Free Product (ft RP)	Log Total Depth (ft RP)	Ground Surface Elevation (NAVD 88)	Top Of Casing Elevation (NAVD 88)	Top Of Riser Elevation (NAVD 88)	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)
IRP Wells																
1	10	13MW1	705452.60	1180818.10	2	PVC	8" Diameter	NM	17.15	NA	17	11.34	--	10.97	7.49	17.49
1	10	13MW2	705419.90	1180831.20	2	PVC	8" Diameter	9.24	17.30	NA	17	10.84	--	10.41	7.67	17.67
1	10	13MW3	705396.10	1180734.50	2	PVC	12" Diameter	9.36	17.30	NA	17	10.76	--	10.50	7.36	17.36
1	10	FOMW13	705491.00	1180757.20	2	PVC	12" Diameter	8.95	9.93	NA	10	10.80	--	10.11	3.50	10.50
1	10	FOMW14	705477.50	1180721.10	2	PVC	12" Diameter	9.12	10.02	NA	10	10.56	--	10.29	3.20	10.20
1	10	FOMW15	705514.10	1180739.10	2	PVC	12" Diameter	9.14	10.02	NA	10	10.94	--	10.29	3.40	10.40
1	10	FOMW16	705499.40	1180712.00	2	PVC	12" Diameter	9.08	9.50	NA	10	10.50	--	10.23	2.90	9.90
1	11	13MW4	705490.90	1180555.20	2	PVC	--	--	--	--	15	7.90	--	7.75	4.95	14.95
1	11	13MW5	705235.90	1180680.10	2	PVC	--	--	--	--	17	9.33	--	8.74	7.92	17.12
1	11	13MW7	705377.10	1180452.60	2	PVC	--	--	--	--	14	5.80	--	5.46	4.34	14.34
1	11	MW1-1PDI	705393.44	1180442.31	2	PVC	8" Diameter	4.38	14[1]	--	14	5.90	5.89	5.46	4.00	14.00
1	11	13MW8	705272.80	1180456.70	2	PVC	--	--	--	--	13	5.41	--	4.95	3.71	13.71
1	11	13MW9	705117.00	1180533.30	2	PVC	--	--	--	--	14	5.18	--	4.52	4.78	14.78
1	11	USTPW-01	4' N of 13MW18		2	PVC	8" Diameter	NM	NM	8.9	--	--	--	--	--	--
1	11	13MW19	705449.90	1180513.80	2	PVC	8" Diameter	4.4	14.62	NA	15	5.95	5.95	5.66	5.00	15.00
1	11	13MW20	705513.30	1180578.40	2	PVC	8" Diameter	6.89	14.60	NA	13	8.32	8.32	8.06	3.00	13.00
1	11	13MW21	705485.90	1180525.60	2	PVC	8" Diameter	5.09	12.60	NA	15	6.64	6.64	6.31	5.00	15.00
1	11	NESO4	705074.20	1180604.00	2	PVC	--	--	--	--	8	6.12	--	5.83	2.90	7.90
2	11	13MW6	705084.80	1180924.60	2	PVC	8" Diameter	18.29	24.68	NA	27	19.45	--	19.08	17.82	27.82
2	11	13MW10	704891.90	1180694.30	2	PVC	10" Diameter	5.28	15.05	NA	15	6.34	--	6.05	5.00	15.00
2	11	13MW17	704842.90	1180689.10	2	PVC	--	--	--	--	13	5.32	--	5.08	3.50	13.50
2	11	MW-6	704954.89	1180677.67	2	PVC	--	--	--	--	10	19.91	--	19.50	3.00	10.00
2	11	NESO6	704938.30	1180675.60	2	PVC	--	--	--	--	6	6.50	--	6.28	1.40	6.40
3	17	13MW11	704684.80	1180772.80	2	PVC	10" Diameter	NM	NM	NA	14	5.84	--	5.44	4.00	14.00
3	13	13MW12	704523.90	1180979.20	2	PVC	10" Diameter	5.97	15.21	NA	15	7.16	--	6.82	5.30	15.30
3	17	MW2-3RI	704591.18	1180804.46	2	PVC	8" Diameter	NM	NM	NA	8	5.88	5.88	5.39	3.00	8.00
4	13	13MW13	704363.70	1181030.60	2	PVC	10" Diameter	5.07	14.33	NA	14	6.55	--	6.11	4.60	14.60
4	13	13MW14	704343.40	1180927.20	2	PVC	8" Diameter	4.98	14.15	NA	14	6.09	--	5.59	4.80	14.80
4	13	13MW15	704310.30	1180916.90	2	PVC	--	--	--	--	12	5.31	--	4.86	2.60	12.60
4	13	MW1-4PDI	704303.21	1180917.20	2	PVC	8" Diameter	6.26	14[1]	--	14	5.60	5.61	5.06	3.00	13.00
4	13	13MW16	704357.10	1180897.60	2	PVC	--	--	--	--	13	5.25	--	4.91	3.50	13.50
4	13	MW1-4RI	704130.15	1181062.30	2	PVC	--	--	--	--	9	5.88	5.88	5.56	4.00	9.50
4	13	NESO10	704284.40	1180956.40	**3**	Other	10" Diameter	5.19	9.25	NA	9	6.03	--	5.71	4.30	9.30
4	13	NESO11	704286.80	1181077.60	2	PVC	10" Diameter	NM	8.77	NA	8	6.50	--	6.39	3.60	8.60
4	13	QW-1	704375.60	1180888.40	**6**	STEEL	12" Diameter	5.47	unknown	NA	11	5.47	5.47	5.07	6.50	11.00
4	13	QW-2	704422.50	1180871.00	4	PVC	12" Diameter	6.73	8.94	NA	13	5.55	5.55	5.19	6.00	13.00
4	13	QW-3	704284.10	1180930.60	4	Other	12" Diameter	5.55	--	NA	10	5.47	5.47	5.17	7.00	10.00
4	13	QW-4	704233.40	1180952.80	6	--	--	--	--	--	9	5.41	5.41	4.28	7.50	10.50
4	13	QW-5	704108.10	1181007.50	4	--	--	5.11	--	NA	10	5.45	5.45	5.26	7.50	10.00
4	13	WE1	704427.10	1181035.10	2	PVC	Circular	NM	15.41	NA	15	7.23	--	7.03	5.30	15.30
4	13	WE4	704387.30	1180999.70	2	PVC	Circular	5.16	6.61	NA	13	6.32	--	6.22	3.40	13.40
4	13	WE5	704425.30	1180911.30	2	None	Circular	NM	--	NA	14	5.98	--	5.86	4.00	14.00
4	19	MW2-4RI	704205.24	1181147.56	2	PVC	8" Diameter	4.81	9.53	NA	8	6.96	6.96	6.46	3.00	8.00
5	22	19MW2	708546.10	1180159.40	2	PVC	6" Diameter	3.49	5.68	NA	5	4.89	--	4.59	1.78	5.78
5	22	19MW3	708438.10	1180160.40	2	PVC	6" Diameter	3.53	5.22	NA	6	4.79	--	4.50	2.30	6.30
5	22	19MW4	708333.00	1180178.20	2	PVC	--	--	--	--	5	4.94	--	4.70	1.70	5.70
5	22	MW1-5PDI	708330.13	1180166.32	2	PVC	8" Diameter	3.61	6[1]	--	6	5.10	5.05	4.68	1.00	6.00
6	24	MW1-6RI	707646.62	1180333.04	2	PVC	8" Diameter	26.85	34.35	NA	35	28.36	28.36	27.99	25.00	35.00
6	24	MW2-6RI	707554.52	1180197.96	2	PVC	8" Diameter	NM	7.96	NA	8	4.10	4.10	3.63	3.00	8.00

TABLE 5-25

MONITORING WELL CONSTRUCTION INFORMATION AND 2010 FIELD MEASUREMENTS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

			Field Verified								Well Log Documentation					
Zone	Site	Well Number	Northing (NAD 83)	Easting (NAD 83)	Hole Dia. (in)	Casing Material	Well Outer Casing	2010 Depth to Water (ft)	2007 or 2010 Depth of Well (ft RP)	2010 Depth to Free Product (ft RP)	Log Total Depth (ft RP)	Ground Surface Elevation (NAVD 88)	Top Of Casing Elevation (NAVD 88)	Top Of Riser Elevation (NAVD 88)	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)
6	24	MW3-6RI	707614.64	1180172.82	2	PVC	8" Diameter	2.62	7.84	NA	8	4.38	4.38	3.92	3.00	8.00
6	24	MW4-6RI	707712.67	1180171.17	2	PVC	8" Diameter	3.33	7.88	NA	8	4.95	4.95	4.51	3.00	8.00
6	24	MW5-6RI	707798.01	1180170.65	2	PVC	8" Diameter	3.45	7.86	NA	8	5.24	5.24	4.83	3.00	8.00
7	21	20MW2	706174.70	1180251.60	2	PVC	6" Diameter	4.19	12.40	NA	12	5.57		5.35	2.50	12.50
7	21	20MW3	706326.90	1180212.90	2	PVC	--	--	--	--	12	4.44	--	4.27	2.50	12.50
7	21	20MW6	706614.90	1180371.90	2	PVC	6" Diameter	6	13.90	NA	14	7.80		7.63	4.00	14.00
7	21	MW1-7RI	706203.78	1180331.32	2	PVC	8" Diameter	4.44	9.31	NA	9	6.13	6.13	5.72	5.00	9.00
7	21	MW2-7RI	706342.54	1180271.12	2	PVC	8" Diameter	4.28	9.38	NA	9	5.81	5.81	5.43	4.50	9.50
7	21	MW3-7RI	706602.50	1180250.84	2	PVC	8" Diameter	2.92	8.35	NA	8	4.67	4.67	4.27	3.00	8.00
7	21	MW4-7RI	706758.13	1180277.23	2	PVC	8" Diameter	4.25	9.90	NA	8	6.03	6.03	5.67	3.00	8.00
7	21	MW5-7RI	706370.02	1180460.40	2	PVC	--	--	--	--	9	6.94	6.94	6.48	4.50	9.50
7	25	20MW7	706694.80	1180254.90	2	PVC	--	--	--	--	12	3.79	--	3.57	2.50	12.50
7	25	MW1-7PDI	706684.82	1180243.45	2	PVC	8" Diameter	2.45	13[1]	--	14	4.10	4.16	3.84	3.00	13.00

1 - Depth of well measured in 2010.
bgs - below ground surface
ft - feet
in - inch
NA - Not applicable
NAD - North American Datum
NAVD - North American Vertical Datum
NM - Not measured
PVC - Polyvinyl Chloride
RP - Reference Point
All Lower Subase wells listed are flush mount

White on Black	Well not found during 2007 inventory.
White on Blue	Well found in 2007 but not found in August 2010.

TABLE 5-26

SUMMARY OF WELL CONDITIONS FOUND DURING 2010 SURVEY
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Zone	Site	Well ID	Able to Open Well/ Open	Not Deficient	Unable to Determine	Not Usable	Damaged - Usable	Not Found	Abandoned	Organic Vapor Reading (ppm)
1	10	13MW1			●					NA
1	10	13MW2	●	●						ND
1	10	13MW3	●	●						ND
1	10	FOMW13	●	●						ND
1	10	FOMW14	●	●						ND
1	10	FOMW15	●	●						ND
1	10	FOMW16	●	●						ND
1	11	13MW4						●		NA
1	11	13MW5						●		NA
1	11	13MW7						●		NA
1	11	MW1-1PDI	●	●						ND
1	11	13MW8						●		NA
1	11	13MW9						●		NA
1	11	USTPW-01	●	●						ND
1	11	13MW19	●	●						ND
1	11	13MW20	●	●						ND
1	11	13MW21	●	●						ND
1	11	NESO4						●		NA
2	11	13MW6	●	●						ND
2	11	13MW10	●	●						ND
2	11	13MW17						●		NA
2	11	MW-6						●		NA
2	11	NESO6						●		NA
3	17	13MW11	●	●						ND
3	13	13MW12	●	●						ND
3	17	MW2-3RI			●					NA
4	13	13MW13	●	●						ND
4	13	13MW14	●	●						ND
4	13	13MW15						●		NA
4	13	MW1-4PDI	●	●						ND
4	13	13MW16						●		NA
4	13	MW1-4RI						●		NA

TABLE 5-26

SUMMARY OF WELL CONDITIONS FOUND DURING 2010 SURVEY
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Zone	Site	Well ID	Able to Open Well/ Open	Not Deficient	Unable to Determine	Not Usable	Damaged - Usable	Not Found	Abandoned	Organic Vapor Reading (ppm)
4	13	NESO10	●	●						ND
4	13	NESO11	●	●						ND
4	13	QW-1	●	●						ND
4	13	QW-2				●				NA
4	13	QW-3	●	●						0.5
4	13	QW-4						●		NA
4	13	QW-5	●	●						ND
4	13	WE1						●		NA
4	13	WE4	●				●			ND
4	13	WE5						●		NA
4	19	MW2-4RI	●	●						ND
5	22	19MW2	●	●						ND
5	22	19MW3	●	●						ND
5	22	19MW4						●		NA
5	22	MW1-5PDI	●	●						ND
6	24	MW1-6RI	●	●						ND
6	24	MW2-6RI						●		NA
6	24	MW3-6RI	●	●						ND
6	24	MW4-6RI	●	●						ND
6	24	MW5-6RI	●	●						ND
7	21	20MW2	●	●						ND
7	21	20MW3						●		NA
7	21	20MW6	●	●						ND
7	21	MW1-7RI	●	●						ND
7	21	MW2-7RI	●	●						ND
7	21	MW3-7RI	●	●						ND
7	21	MW4-7RI	●	●						ND
7	21	MW5-7RI						●		NA
7	25	20MW7						●		NA
7	25	MW1-7PDI	●	●						ND

NOTES:
NA - Not analyzed
ND - Not detected
ppm - parts per million

TABLE 5-27

RECOMMENDED MAINTENANCE BASED ON 2010 MONITORING WELL CONDITION SURVEY
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Zone	Site	Well ID	Evaluation Year	Action Recommended Casing	Well Sampling Equipment	Well Cap Type	Well Cap Condition	Action Recommended Cap	Well Cap Comment	Action Recommended Surface	Surface Comment
1	10	13MW1	2010	Install new protective casing and concrete pad	None	Flush mount cover - center bolt	Other	Install new flush mount cover	Cover cracked	No action needed	---
1	10	13MW2	2010	No action needed	None	Flush mount cover - center bolt	Outer cover/plug present with bolt(s) and riser plug/cover present	No action needed	---	No action needed	---
1	10	13MW3	2010	No action needed	None	Flush mount cover - no bolt-type covering original flushmount lid with center bolt	Outer cover/plug present but not secure and riser plug/cover present	No action needed	---	No action needed	---
1	10	FOMW13	2010	Raise flush-mount vault	None	Flush mount cover - 2 bolts	Outer cover/plug present with bolt(s) and riser plug/cover present	Install new flush mount cover	---	Install new concrete pad and raise flush mount vault.	Vault floods - build up slightly above grade
1	10	FOMW14	2010	Vault bolt tabs need re-threaded	None	Flush mount cover - 2 bolts	Outer cover/plug present with bolt(s) and riser plug/cover present	No action needed	Hinged riser cap	No action needed	---
1	10	FOMW15	2010	No action needed	None	Flush mount cover - 2 bolts	Outer cover/plug present with bolt(s) and riser plug/cover present	No action needed	Hinged riser cap	No action needed	---
1	10	FOMW16	2010	Install new protective casing and concrete pad	None	Flush mount cover - no bolts	Outer cover/plug present but not secure and riser plug/cover present	Install new flush mount cover	Hinged riser cap. Flush mount cover flanges broken - bolts will not tighten	No action needed	---
1	11	USTWP-01 (N of 13MW18)	2010	No action needed	None	Flush mount - 9/16" bolts	Outer cover/plug present with bolt(s) and riser plug/cover present	No action needed	---	No action needed	Recent installation, new concrete pad, white cover lid
1	11	13MW19	2010	No action needed	None	Flush mount cover - 2 bolts	Outer cover/plug present with bolt(s) and riser plug/cover present	No action needed	---	No action needed	---
1	11	13MW20	2010	Raise flush-mount vault, replace missing bolt	Tubing only	Flush mount cover - 1 bolt missing	Outer cover/plug present with 1 bolt missing and riser plug/cover present	No action needed	---	Install new concrete pad	Well in low spot - elevate vault and place new pad
1	11	13MW21	2010	Bolts need replaced	Tubing only	Flush mount cover - 2 missing bolts	Outer cover/plug present without bolt(s) and riser plug/cover present	No action needed	---	Install new concrete pad	---
2	11	13MW6	2010	No action needed	None	Flush mount cover - center bolt	Outer cover/plug present with bolt(s) and riser plug/cover present	No action needed	---	No action needed	Pad cracked
2	11	13MW10	2010	No action needed	None	Flush mount cover - center bolt	Outer cover/plug present with bolt(s) and riser plug/cover present	No action needed	---	Install new concrete pad	well located in sidewalk area
3	17	13MW11	2010	No action needed	None	Flush mount cover - center bolt	Outer cover/plug present with bolt(s) and riser plug/cover present	No action needed	---	Install new concrete pad	Install new concrete pad
3	13	13MW12	2010	No action needed	None	Flush mount cover - center bolt	Outer cover/plug present with bolt(s) and riser plug/cover present	No action needed	---	No action needed	---
3	17	MW2-3RI	2010	Covered in asphalt	---	---	---	---	---	Install new concrete pad	Install new concrete pad
4	13	13MW13	2010	No action needed	None	Flush mount cover - center bolt	Outer cover/plug present with bolt(s) and riser plug/cover present	No action needed	---	No action needed	pad old but not cracked and ok condition for now
4	13	13MW14	2010	Under jersey barrier, but still accessible if barrier is moved	None	---	---	---	---	---	---
4	13	NESO10	2010	No action needed	None	Flush mount cover - center bolt	Outer cover/plug present with bolt(s) and riser plug/cover missing	Install new inner cap	3" riser plug missing - put temp plastic over riser	No action needed	---
4	13	NESO11	2010	No action needed	None	Flush mount cover - center bolt	Outer cover/plug present with bolt(s) and riser plug/cover present	Install new inner cap	no riser plug - 3" riser covered with temp plastic bag	Install new concrete pad	Install new concrete pad
4	13	QW-1	2010	Remove 5-gal plastic bucket previously placed over well to support protective casing. Three vault bolt tabs need re-threaded.	None	Flush mount cover - 3 bolts, all dog ears stripped	Outer cover present with bolt(s) and riser plug/cover missing	Install new inner cap	no 6" riser plugs availabe - put temp plastic bag over riser	No action needed	---
4	13	QW-2	2010	Well is filled with grout / abandoned	---	---	---	---	---	---	---
4	13	QW-3	2010	Install new protective casing and concrete pad	None	Flush mount cover - missing 4 bolts	Outer cover present but not secure and riser plug/cover present	Install new flush mount cover	modified steel plate cover missing 4 bolts	Install new concrete pad	Install new concrete pad
4	13	QW-5	2010	Install new protective casing and concrete pad	none	1/2" steel plate	Outer steel plate cover present but not secure and riser plug/cover present	Install new flush mount cover	Steel cover should be removed and vault replaced with new bolted cover	Install new concrete pad	Install new concrete pad

TABLE 5-27

RECOMMENDED MAINTENANCE BASED ON 2010 MONITORING WELL CONDITION SURVEY
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Zone	Site	Well ID	Evaluation Year	Well Label Type	Well Label Location	Well Tag	Action Taken ID	Action Recommended ID	Notes
1	10	13MW1	2010	Stamped metal plate with well name/number	On pad	Legible	No action taken	Upgrade existing well tag to permanent client-specified well tag	---
1	10	13MW2	2010	Stamped metal plate with well name/number	On pad	Legible	No action taken	Upgrade existing well tag to permanent client-specified well tag	---
1	10	13MW3	2010	Temporary painted well name/number	On pad	Missing	---	---	---
1	10	FOMW13	2010	Temporary painted well name/number	On vault lid	Missing	No action taken	Install permanent client-specified well tag	Vault floods - build up slightly above grade
1	10	FOMW14	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	---	---	---
1	10	FOMW15	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	---
1	10	FOMW16	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	---
1	11	USTWP-01 (N of 13MW18)	2010	None	NA	Missing	---	--	Very thick black product, almost like tar, interface probe too coated to get accurate readings
1	11	13MW19	2010	Temporary marker well name/number	On back of well cap/cover	Missing	No action taken	Install permanent client-specified well tag	---
1	11	13MW20	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	No action taken	Install permanent client-specified well tag	Well in low spot - elevate vault and place new pad
1	11	13MW21	2010	Temporary marker well name/number	On back of well cap/cover	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	---
2	11	13MW6	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	No action taken	Install permanent client-specified well tag	---
2	11	13MW10	2010	Stamped metal plate with well name/number	On pad	Legible	No action taken	Upgrade existing well tag to permanent client-specified well tag	---
3	17	13MW11	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	---
3	13	13MW12	2010	Stamped metal plate with well name/number	On pad	Legible	No action taken	Upgrade existing well tag to permanent client-specified well tag	---
3	17	MW2-3RI	2010	---	---	---	---	---	Covered in asphalt, raise protective casing
4	13	13MW13	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	---
4	13	13MW14	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	---	Install permanent client-specified well tag	Under jersey barrier. Well is accessible, but need to have barrier moved to complete inspection.
4	13	NESO10	2010	Stamped metal plate with well name/number	On pad	Legible	No action taken	Upgrade existing well tag to permanent client-specified well tag	---
4	13	NESO11	2010	Stamped metal plate with well name/number	On pad	Legible	No action taken	Upgrade existing well tag to permanent client-specified well tag	---
4	13	QW-1	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	Cut a hole in the plastc bucket to access well.
4	13	QW-2	2010	---	---	---	---	---	Well is filled with grout / abandoned
4	13	QW-3	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	Replace protective casing
4	13	QW-5	2010	Temporary painted well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	Replace protective casing and pad

TABLE 5-27

RECOMMENDED MAINTENANCE BASED ON 2010 MONITORING WELL CONDITION SURVEY
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Zone	Site	Well ID	Evaluation Year	Action Recommended Casing	Well Sampling Equipment	Well Cap Type	Well Cap Condition	Action Recommended Cap	Well Cap Comment	Action Recommended Surface	Surface Comment
4	13	WE1	2010	Not located, in area of new asphalt	---	---	---	---	---	---	---
4	13	WE4	2010	---	---	---	---	---	---	---	---
4	13	WE5	2010	Not located, in area of new asphalt	---	---	---	---	---	---	---
4	19	MW2-4RI	2010	Install new protective casing and concrete pad	None	Flush mount cover - 2 stripped and 1 broken dog ear	Outer cover/plug present with 2 stripped bolt(s) and riser plug/cover present	Install new flush mount cover	---	Install new concrete pad	Install new concrete pad
5	22	19MW2	2010	Replace stripped bolt	None	Flush mount cover - 2 bolts, 1 bolt stripped	Outer cover/plug present with bolt(s) and riser plug/cover present	Replace stripped bolts	---	No action needed	Location in pavement
5	22	19MW3	2010	Replace custom aluminum outer cap	None	Flush mount cover - custom fabrication, aluminum	Outer cover/plug present and riser plug/cover present	Install new flush mount cover	Outer cover temporary aluminum plate	No action needed	---
6	24	MW1-6RI	2010	No action needed	None	Flush mount cover - 3 bolts	Outer cover/plug present with bolt(s) and riser plug/cover present and locked	No action needed	---	Install new concrete pad	Well sits in low spot in grass
6	24	MW2-6RI	2010	Location was not accessible, covered by heavy machinery	---	---	---	---	---	---	---
6	24	MW3-6RI	2010	No action needed	None	Flush mount cover - 3 bolts	Outer cover/plug present with bolt(s) and riser plug/cover present	No action needed	---	No action needed	---
6	24	MW4-6RI	2010	No action needed	None	Flush mount cover - 3 bolts	Outer cover/plug present with bolt(s) and riser plug/cover present	No action needed	---	No action needed	---
6	24	MW5-6RI	2010	Install new protective casing and concrete pad	None	Flush mount cover - 2 of 3 bolts present	Outer cover/plug present with bolt(s), 1 broken dog ear, and riser plug/cover present	Replace protective casing	---	Install new concrete pad	Install new concrete pad
7	21	20MW2	2010	Bolts need replaced	None	Flush mount cover - 2 bolts	Outer cover/plug present with bolt(s) and riser plug/cover present	No action needed	---	Install new concrete pad	Install new concrete pad
7	21	20MW6	2010	No action needed	None	Flush mount cover - 3 bolts	Outer cover/plug present with bolts and riser plug/cover present	No action needed	---	No action needed	New asphalt, casing and lid in low spot
7	21	MW1-7RI	2010	Install new protective casing and concrete pad	None	Broken flush mount casing	Outer cover/plug present but broken and riser plug/cover present	Install new flush mount cover	Replace	Install new concrete pad	Install new concrete pad
7	21	MW2-7RI	2010	Replace one bolt that is stripped	None	Flush mount cover - 3 bolts, 1 bolt stripped	Outer cover/plug present with bolt(s) and riser plug/cover present	No action needed	---	No action needed	---
7	21	MW3-7RI	2010	Install new protective casing and concrete pad	None	Flush mount cover - 3 bolts, 1 broken dog ear	Outer cover/plug present with bolt(s) and riser plug/cover present	Install new flush mount cover	Install new flush mount cover	Install new concrete pad	Install new concrete pad
7	21	MW4-7RI	2010	No action needed	Tubing only	Flush mount cover - 3 bolts	Outer cover/plug present with bolt(s) and riser plug/cover present	No action needed	---	Install new concrete pad	Install new concrete pad

TABLE 5-27

RECOMMENDED MAINTENANCE BASED ON 2010 MONITORING WELL CONDITION SURVEY
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Zone	Site	Well ID	Evaluation Year	Well Label Type	Well Label Location	Well Tag	Action Taken ID	Action Recommended ID	Notes
4	13	WE1	2010	---	---	---	---	---	---
4	13	WE4	2010	Temporary painted well name/number	Asphalt	Missing	Marked well ID with temporary label	---	Not usable for sampling, proper abandonment recommended
4	13	WE5	2010	---	---	---	---	---	---
4	19	MW2-4RI	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	---
5	22	19MW2	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	Replace stripped bolt
5	22	19MW3	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	Temporary aluminum protective casing cover
6	24	MW1-6RI	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	No action taken	Install permanent client-specified well tag	New expandable J-plug placed in riser
6	24	MW2-6RI	2010	---	---	---	---	---	---
6	24	MW3-6RI	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	---
6	24	MW4-6RI	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	---
6	24	MW5-6RI	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	---
7	21	20MW2	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	---
7	21	20MW6	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	---
7	21	MW1-7RI	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	---
7	21	MW2-7RI	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	---
7	21	MW3-7RI	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	---
7	21	MW4-7RI	2010	Temporary marker well name/number	On protective casing cover/lid	Missing	Marked well ID with temporary label	Install permanent client-specified well tag	---

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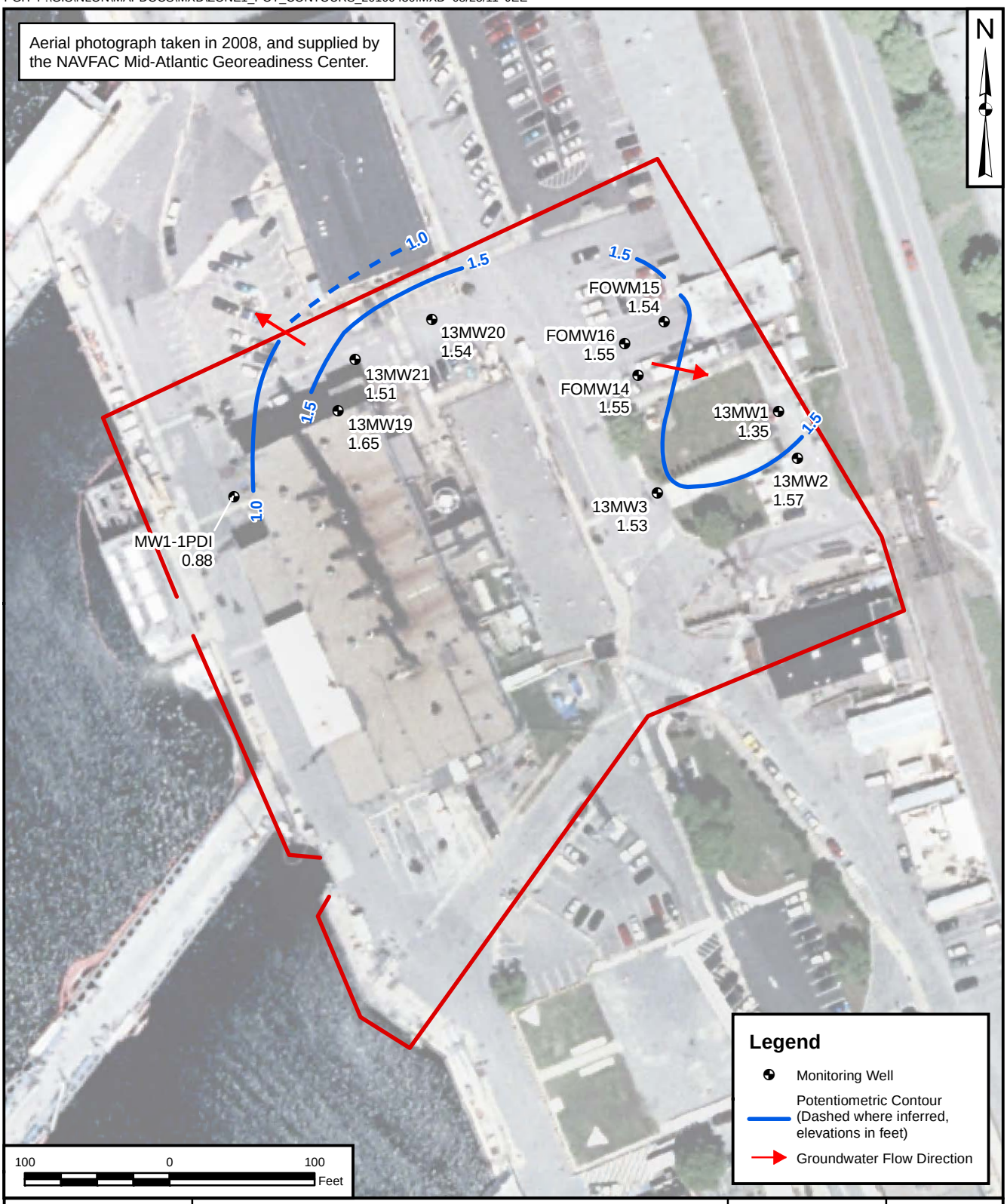

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CHECKED BY N. BALSAMO	DATE 08/25/11	POTENTIOMETRIC SURFACE MAP ZONE 1, LOW TIDE - APRIL 30, 2010 LOWER SUBASE SOIL AND GROUDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR	DATE 08/25/11
REVISED BY	DATE		APPROVED BY NJB	DATE 08/25/11
SCALE AS NOTED			FIGURE NO. FIGURE 5-1	REV 0

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DRAWN BY J. ENGLISH	DATE 07/14/10	TETRA TECH	CONTRACT NUMBER 3271	CTO NUMBER WE67
CHECKED BY N. BALSAMO	DATE 08/25/11	POTENTIOMETRIC SURFACE MAP ZONE 1, LOW TIDE - AUGUST 25, 2010 LOWER SUBASE SOIL AND GROUDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR	DATE 08/25/11
REVISED BY	DATE		APPROVED BY NJB	DATE 08/25/11
SCALE AS NOTED			FIGURE NO. FIGURE 5-2	REV 0

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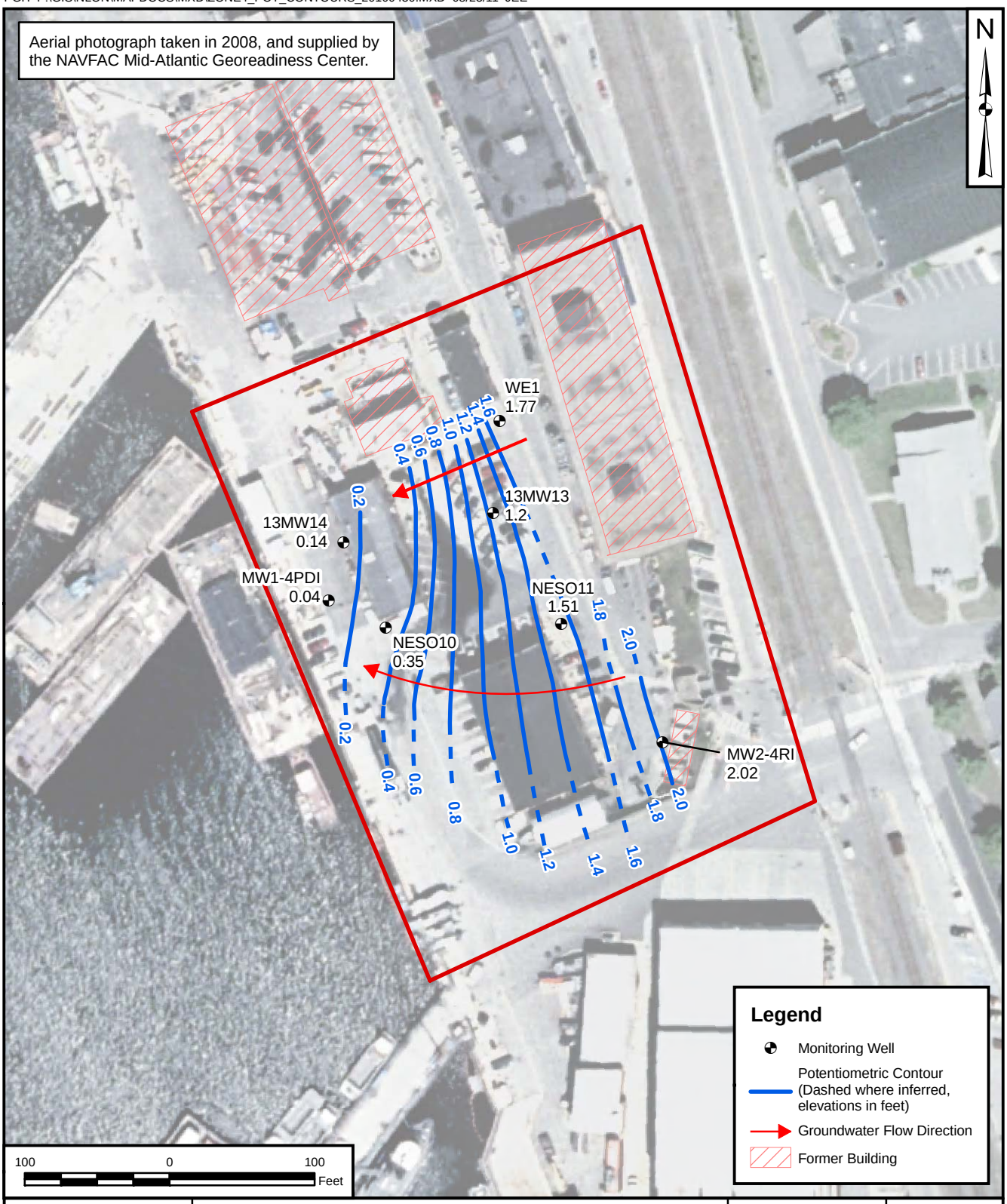

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J. ENGLISH	08/10/11		3271	WE57
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N. BALSAMO	08/23/11		CAR	08/18/11
REVISED BY	DATE		APPROVED BY	DATE
SCALE			FIGURE NO.	REV
AS NOTED			FIGURE 5-3	0

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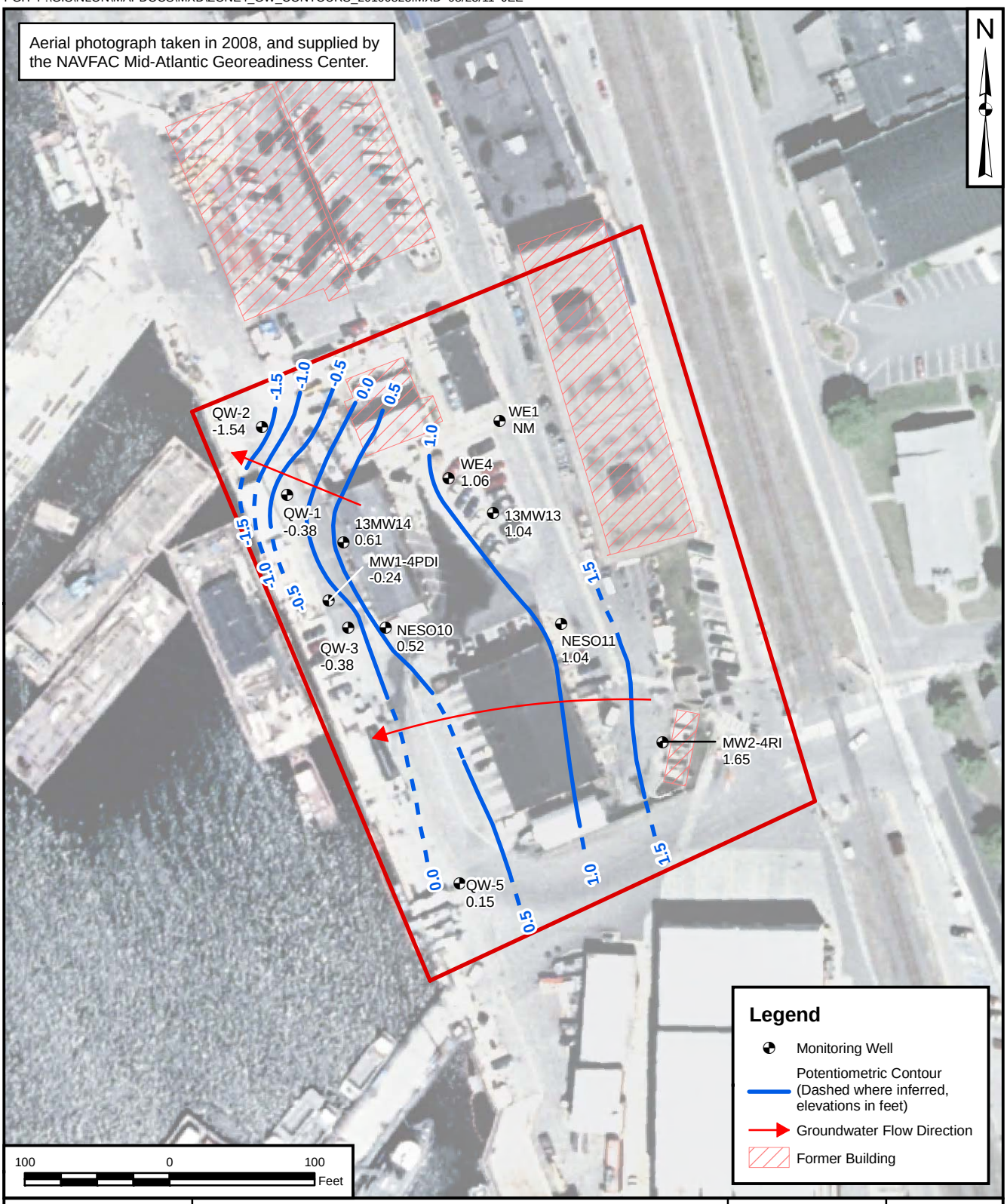

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J. ENGLISH	08/10/11		3271	WE57
CHECKED BY	DATE	POTENTIOMETRIC SURFACE MAP ZONE 4, LOW TIDE - AUGUST 25, 2010 LOWER SUBASE SOIL AND GROUDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY	DATE
N. BALSAMO	08/23/11		CAR	08/11/11
REVISED BY	DATE		APPROVED BY	DATE
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SCALE			FIGURE NO.	REV
AS NOTED			FIGURE 5-4	0

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DRAWN BY J. ENGLISH	DATE 08/17/11	TETRA TECH	CONTRACT NUMBER 3271	CTO NUMBER WE67
CHECKED BY N. BALSAMO	DATE 08/17/11	POTENTIOMETRIC CONTOURS ZONE 5, LOW TIDE - APRIL 30, 2010 LOWER SUBASE SOIL AND GROUDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR	DATE 08/17/11
REVISED BY ___	DATE ___		APPROVED BY ___	DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 5-5	REV 0

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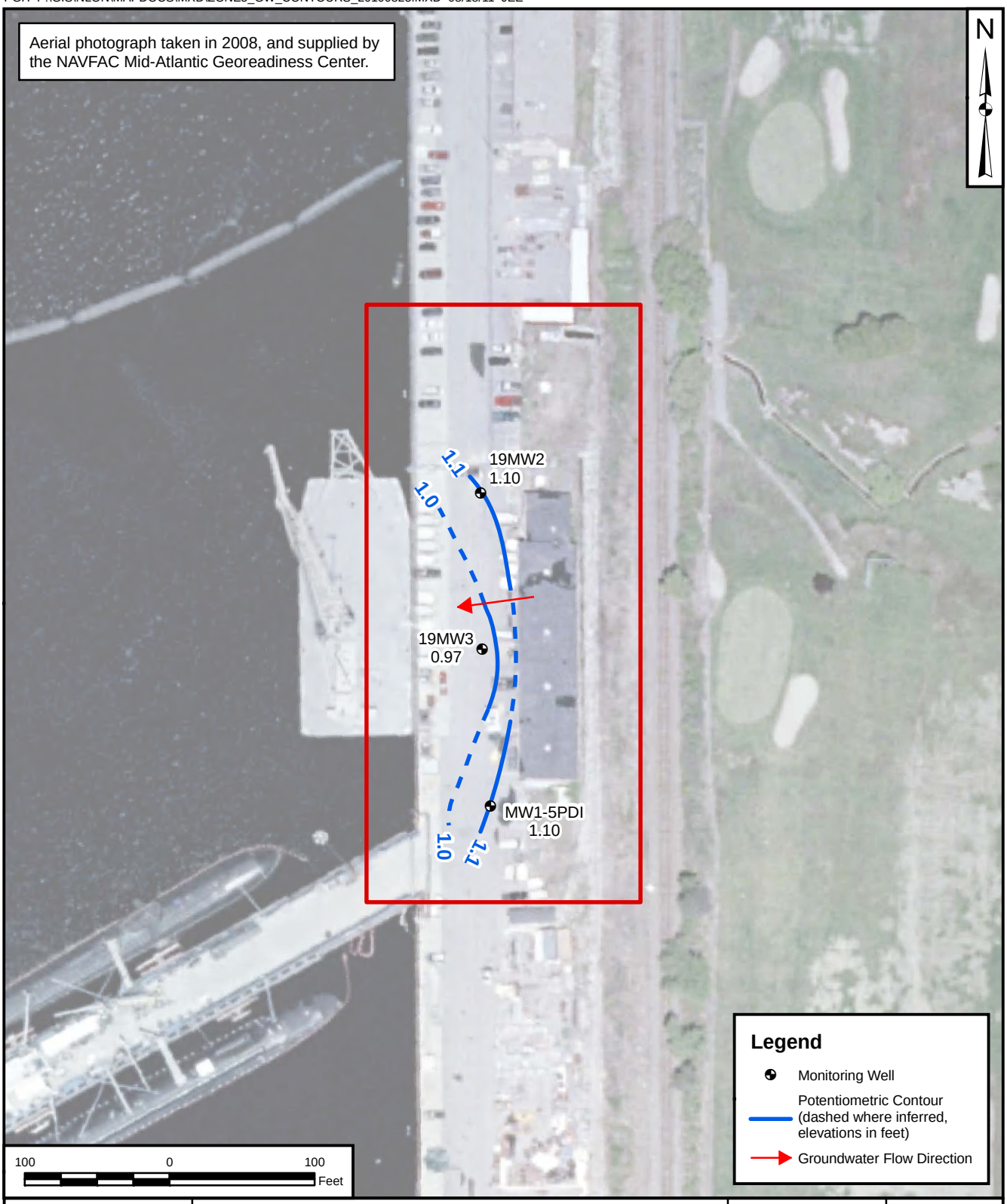

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REVISED BY ___	DATE ___		APPROVED BY ___	DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 5-6	REV 0

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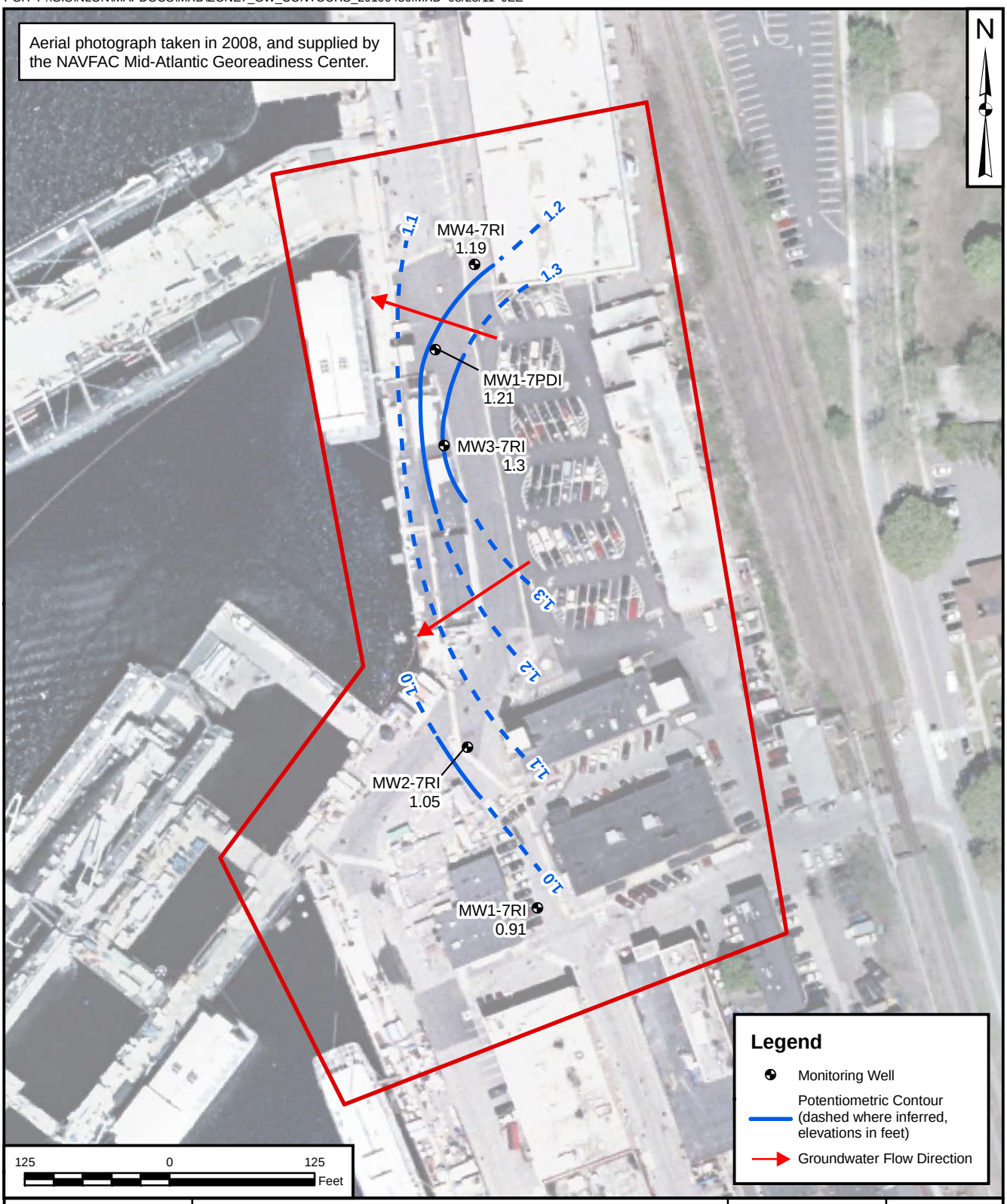

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J. ENGLISH	08/18/11		3271	WE67
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N. BALSAMO	08/23/11		___	___
REVISED BY	DATE		APPROVED BY	DATE
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SCALE			FIGURE NO.	REV
AS NOTED			FIGURE 5-7	0

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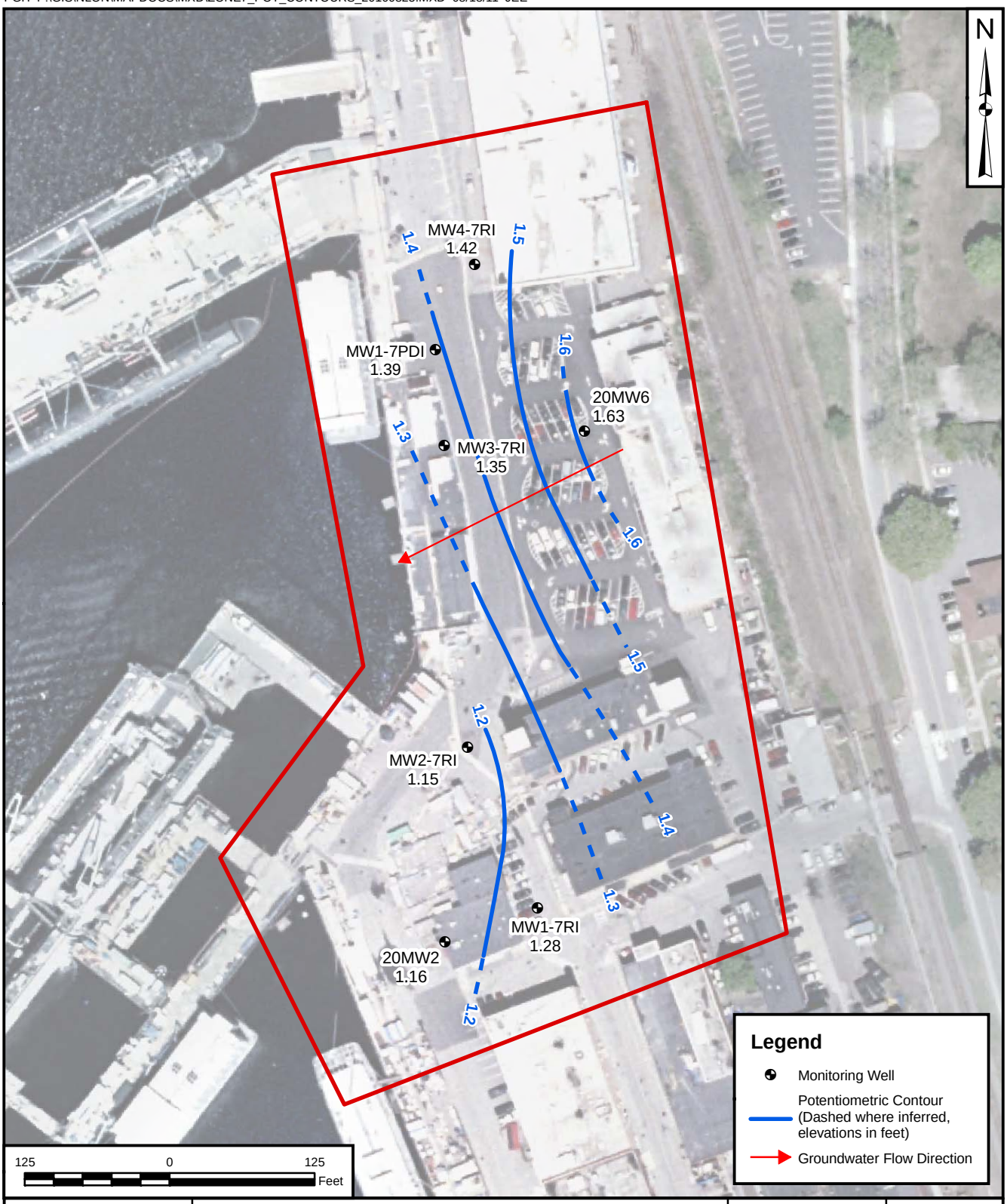

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CHECKED BY N. BALSAMO	DATE 08/18/11	POTENTIOMETRIC SURFACE MAP ZONE 7, LOW TIDE - AUGUST 25, 2010 LOWER SUBASE SOIL AND GROUDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY ___	DATE ___
REVISED BY ___	DATE ___		APPROVED BY ___	DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 5-8	REV 0

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DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	08/11/11		3271	WE57
CHECKED BY	DATE	ZONE 1 2010 WELL INVENTORY MAP LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY	DATE
N. BALSAMO	12/9/11		CAR	08/17/11
REVISED BY	DATE		APPROVED BY	DATE
___	___		___	___
SCALE			FIGURE NO.	REV
AS NOTED			FIGURE 5-9	0

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DRAWN BY J. ENGLISH	DATE 08/11/11	TETRA TECH	CONTRACT NUMBER 3271	CTO NUMBER WE57
CHECKED BY N. BALSAMO	DATE 01/10/12	ZONE 2 2010 WELL INVENTORY MAP LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR	DATE 08/11/11
REVISED BY S. PAXTON	DATE 01/10/12		APPROVED BY ___	DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 5-10	REV 0

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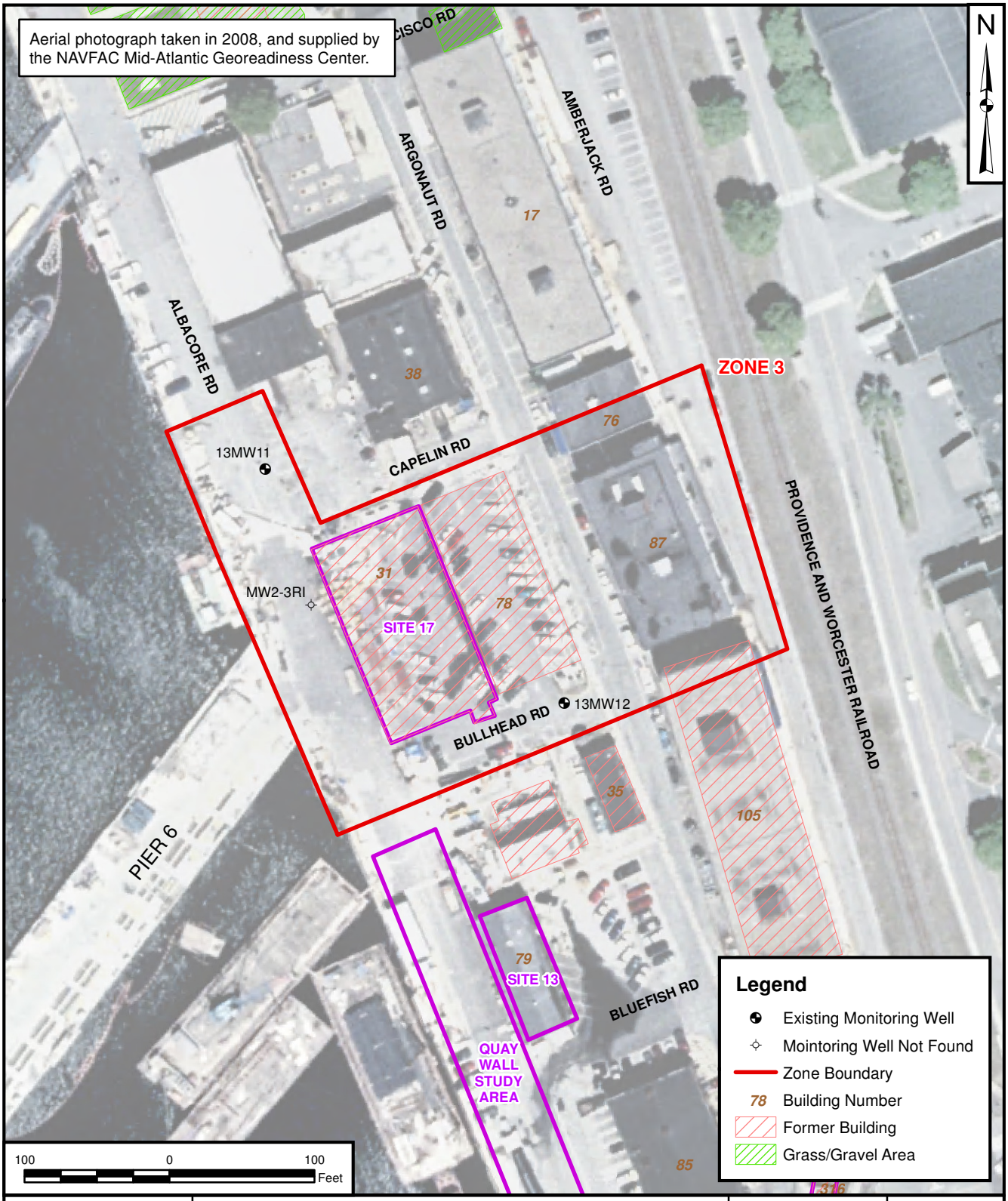

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J. ENGLISH	08/11/11		3271	WE57
CHECKED BY	DATE	ZONE 3 2010 WELL INVENTORY MAP	APPROVED BY	DATE
N. BALSAMO	01/10/12	LOWER SUBASE SOIL AND GROUNDWATER	CAR	08/17/11
REVISED BY	DATE	PDI COMPLETION REPORT AND FS ADDENDUM	APPROVED BY	DATE
S. PAXTON	01/10/12		___	___
SCALE		NSB-NLON, GROTON, CONNECTICUT	FIGURE NO.	REV
AS NOTED			FIGURE 5-11	0

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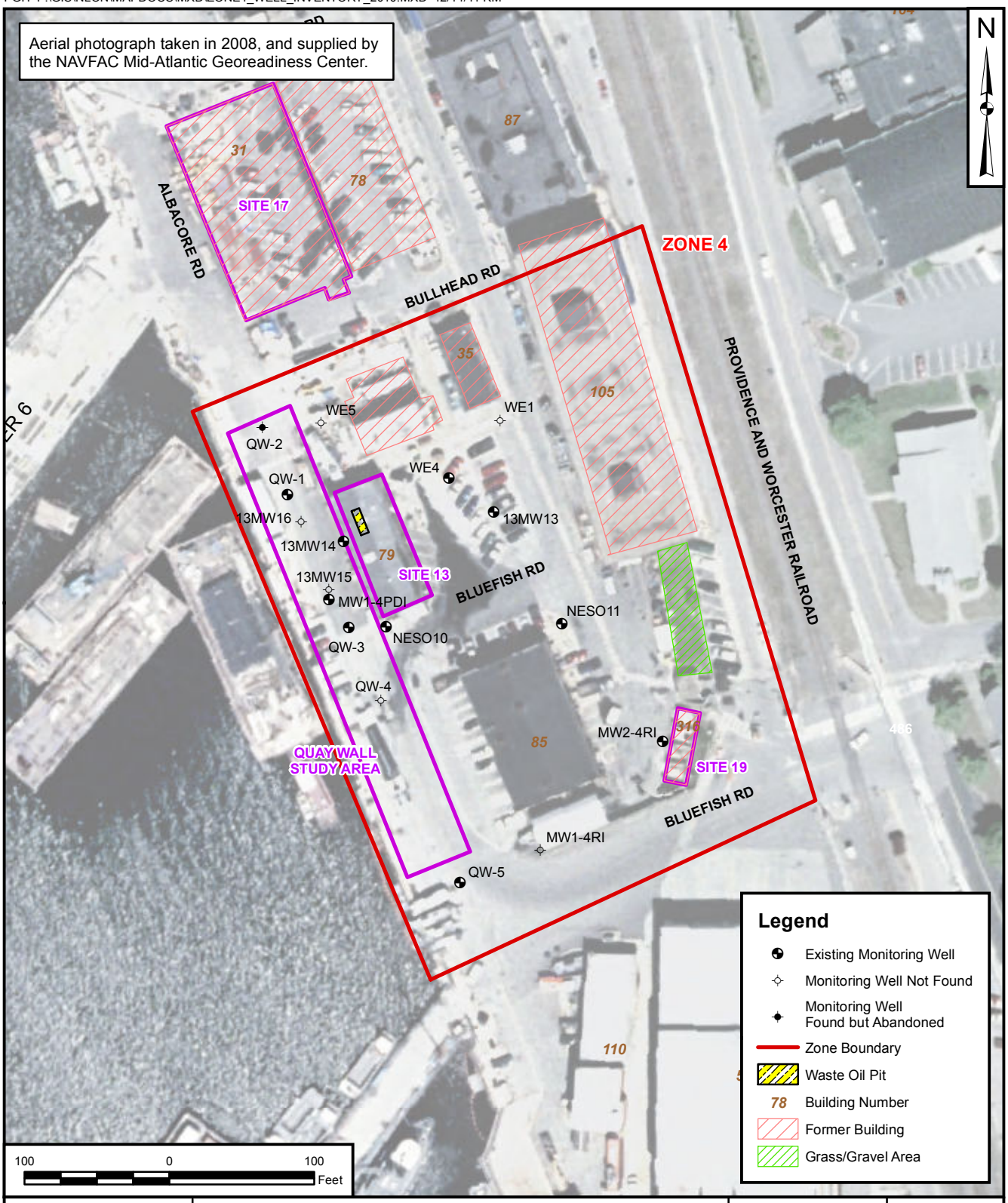

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J. ENGLISH	08/11/11		3271	WE57
CHECKED BY	DATE	ZONE 4 2010 WELL INVENTORY MAP	APPROVED BY	DATE
N. BALSAMO	12/14/11	LOWER SUBASE SOIL AND GROUNDWATER	CAR	08/17/11
REVISED BY	DATE	PDI COMPLETION REPORT AND FS ADDENDUM	APPROVED BY	DATE
K. MOORE	12/14/11	NSB-NLON, GROTON, CONNECTICUT	—	—
SCALE			FIGURE NO.	REV
AS NOTED			FIGURE 5-12	0

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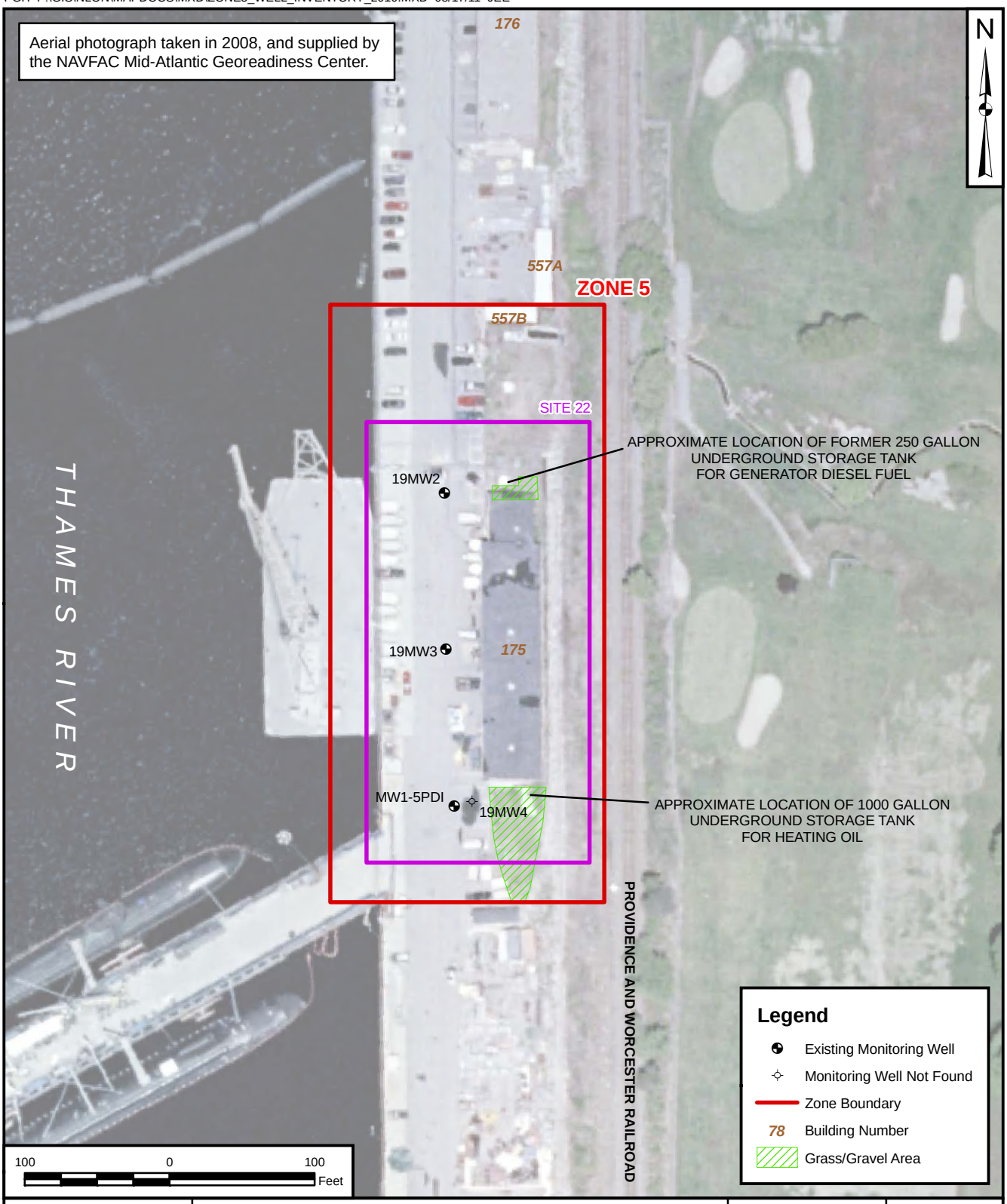

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J. ENGLISH	08/11/11		3271	WE57
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N. BALSAMO	08/17/11		CAR	08/17/11
REVISED BY	DATE		APPROVED BY	DATE
___	___		___	___
SCALE			FIGURE NO.	REV
AS NOTED			FIGURE 5-13	0

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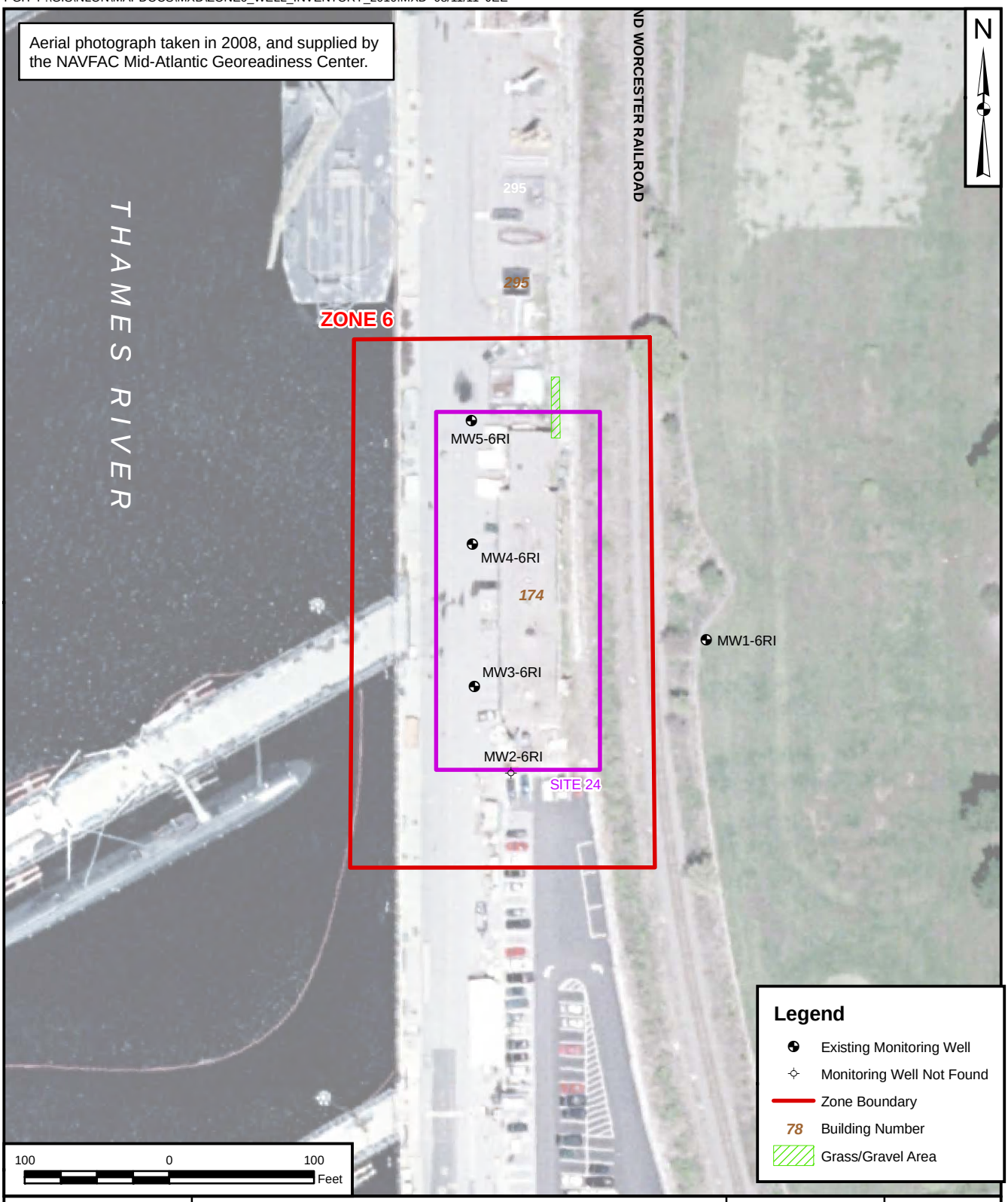

DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	08/11/11		3271	WE54
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N. BALSAMO	08/11/11	LOWER SUBASE SOIL AND GROUNDWATER	CAR	08/11/11
REVISED BY	DATE	PDI COMPLETION REPORT AND FS ADDENDUM	APPROVED BY	DATE
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SCALE		NSB-NLON, GROTON, CONNECTICUT	FIGURE NO.	REV
AS NOTED			FIGURE 5-14	0

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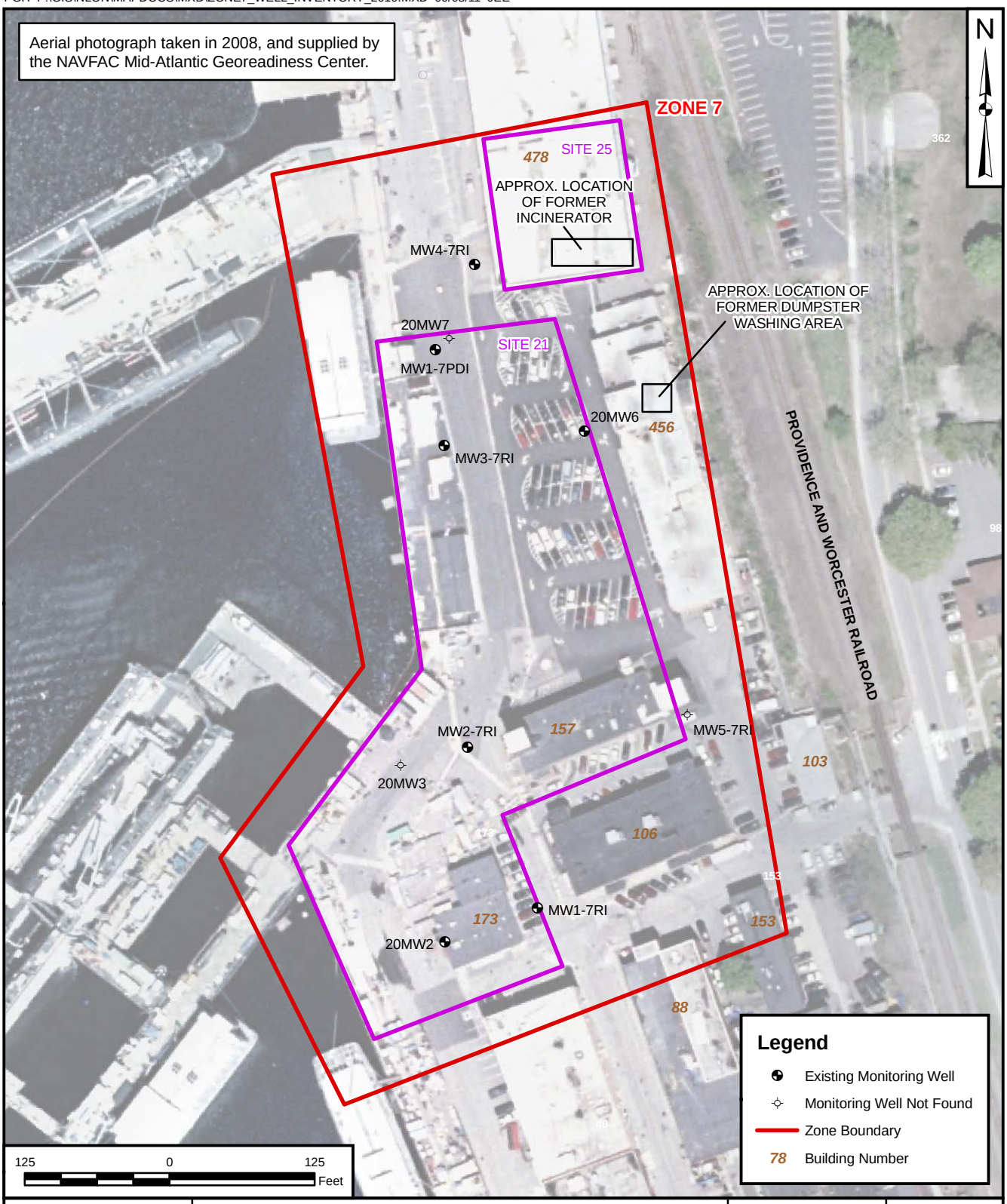

DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	08/11/11		3271	WE57
CHECKED BY	DATE	ZONE 7 2010 WELL INVENTORY MAP LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY	DATE
N. BALSAMO	09/08/11		CAR	08/17/11
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SCALE			FIGURE NO.	REV
AS NOTED			FIGURE 5-15	0

6.0 FEASIBILITY STUDY ADDENDUM

This section provides updates to the primary sections of the Lower Subase FS (Tetra Tech, 2010d). Information from the RAOs and General Response Actions (GRAs) [i.e., HHRA, Media of Concern, Preliminary Remediation Goals (PRGs) and COCs, and volumes of contaminated media] and remedial alternative analysis sections of the FS were updated to incorporate information collected during the Soil and Groundwater PDIs discussed in Sections 2 through 5 of this report. Although no new information was collected, the sediment alternatives were re-evaluated in this report so that only CERCLA-contaminated sediments, versus all sediments to meet operational depth concerns, are addressed by the remedial alternatives. The information provided in this section supersedes information provided in the Lower Subase FS and will be used as the basis for the preparing the Proposed Plan and Record of Decision for the Lower Subase IR sites.

6.1 RAO AND GRA UPDATE

Updated RAO and GRA information is provided for each zone in the following subsections. New soil and groundwater data were used to complete the updates. No new sediment data was collected during the PDIs, but sediment updates are provided because of the change in approach for sediments discussed above.

6.1.1 Zone 1

6.1.1.1 HHRA Update

The updated Zone 1 HHRA is provided in Appendix F. Table 6-1 summarizes the updated carcinogenic and noncarcinogenic risks associated with exposure to Zone 1 media under the Reasonable Maximum Exposure (RME) scenario (i.e., principal scenario recommended for evaluating potential risks at CERCLA sites). Table 6-2 summarizes the risk-based COCs determined using USEPA's risk assessment methodology. Hazard Indices (HIs) for construction workers, full-time employees, and hypothetical adult residents under the RME scenario were less than or equal to unity (1), indicating that adverse non-carcinogenic effects are not anticipated for these receptors under the defined exposure conditions. The HI for hypothetical child residents exposed to surface/subsurface soil (HI = 4) exceeded the acceptable level of 1. Mercury [Hazard Quotient (HQ) = 4] was the major contributor to the elevated HI for hypothetical child residents. Incremental Life-time Cancer Risks (ILCRs) for construction workers, current full-time employees, and future full-time employees were less than USEPA's target risk range of 10^{-4} to 10^{-6}. The ILCR for hypothetical adult residents (1×10^{-4}) was equal to the upper bound of USEPA's target range, and the ILCRs for hypothetical child residents (7×10^{-4}) and hypothetical lifetime residents (8×10^{-4}) exceeded USEPA's target range. Carcinogenic PAHs in surface/subsurface soil were the major

contributors to the unacceptable ILCRs for the hypothetical future child and lifetime residents. Arsenic was a minor contributor to unacceptable cancer risk estimates for hypothetical future child and lifetime residents; risk associated with arsenic alone (1×10^{-5}) is within EPA's acceptable risk range.

Risks for hypothetical residents exposed to chemicals (benzene and ethylbenzene) that have volatilized from groundwater and migrated through building foundations into the indoor air of a structure were evaluated using USEPA's Johnson and Ettinger vapor intrusion model (2003b). For hypothetical residents, the cumulative HI was less unity and the ILCR was within USEPA's target risk range of 10^{-4} to 10^{-6}, indicating that adverse non-carcinogenic and carcinogenic effects are not anticipated. HIs and ILCRs for industrial workers would also be expected to be within acceptable levels because these receptors would be exposed to volatiles in indoor air on a less frequent basis than residential receptors.

Issues contributing uncertainty to the HHRA include the following:

- Soil samples were collected from locations that are currently under pavement; therefore, actual exposures under current site conditions are less than exposures assumed in the HHRA.

- Potential exposures for future full-time employees and hypothetical residents assume that substantial excavation occurs at the site and that excavated subsurface soil is mixed with surface soil. If in the future the site is redeveloped without subsurface excavation, then the exposures to future receptors will be less than those estimated in this HHRA.

- Exposures to TPH and LNAPL in subsurface soil and groundwater were not evaluated in the HHRA because there are no toxicity criteria available for TPH or LNAPL. Further evaluation of these non-CERCLA contaminants is warranted outside of this FS Addendum.

The final results of the HHRA for Zone 1 are captured in Tables 6-3 and 6-4. Table 6-3 summarizes the risk-based direct exposure COCs retained for Zone 1 as wells as the other Lower Subase zones. Table 6-4 provides a range of potential PRGs for all COCs and receptors evaluated in the HHRA. Similar to Table 6-3, Table 6-4 includes COCs for all of the Lower Subase zones that were evaluated. The potential PRGs were developed from the HHRA considering carcinogenic risks (USEPA's target risk range of 10^{-4} to 10^{-6}), noncarcinogenic risks (HI = 1), lead modeling, and other criteria (CTDEEP RSRs and OSWER screening levels). The potential PRGs were evaluated further in Appendix G and the final PRGs selected for Zone 1 are discussed below in Section 6.1.1.3.

The focus of the FS Addendum is on evaluation of the most likely scenario to be considered for remediation [i.e., the I/C scenario] and on changes that resulted because of the new data collected during

the PDIs. By comparison of the FS Addendum HHRA to the FS HHRA, it was determined that the same USEPA soil COCs for the residential scenario were identified in the FS Addendum as in the FS (Tetra Tech, 2010d); therefore, further evaluation of residential soil COCs was not completed in this Addendum. These COCs remain a concern and will need to be addressed.

The FS Addendum HHRA indicated that risks to I/C receptors were acceptable in Zone 1; however, because there is a CERCLA risk for the zone (i.e., potential unacceptable risks to residential receptors), additional evaluation of Zone 1 was completed using CTDEEP RSRs because they would be ARARs. Table 6-5 summarizes the chemicals of potential concern (COPCs) that were identified by directly comparing analytical data to CTDEEP RSRs applicable to the I/C scenario. Under CTDEEP RSRs, only benzo(a)pyrene was determined to be a COPC for direct exposure to surface soil (less than 2 feet bgs in paved areas). Further evaluation of this COPC was completed in Appendix G.1. As allowed by the CTDEEP RSRs, an Alternative DEC for benzo(a)pyrene (10 mg/kg) was developed using the results of the HHRA for the I/C scenario. By using the Alternative DEC, benzo(a)pyrene was screened out as a COC, and therefore, no chemicals remain direct exposure COCs for Zone 1 soil under an I/C scenario. The chemicals that pose potential migration issues [i.e., soil to groundwater (I/C scenario only) or groundwater to surface water] were also further evaluated in Appendices G.1 and G.2, respectively. Alternative PMC for the I/C scenario and alternative SWPC were developed for the respective evaluations. The additional evaluations showed that none of the potential soil-to-groundwater migration COPCs poses an actual migration concern under the I/C scenario and that none of the groundwater-to-surface water migration COPCs poses an actual migration concern under the I/C scenario. It should also be noted that LNAPL was previously identified in Zone 1, and the estimated extent of LNAPL was updated using information collected during the Soil PDI. CTDEEP indicated that Alternative PMC may not be used where LNAPL is present. The extent of LNAPL is shown on Figure 6-1. Based on this information, it was determined that LNAPL was not present where the concentrations of CERCLA pollutant mobility COPCs were elevated; therefore, it was acceptable to develop Alternative PMC and use them for evaluation of Zone 1 COPCs discussed above.

The only exception regarding migration concerns is TPH, which was detected in soil at concentrations greater than the CTDEEP RSR related to soil-to-groundwater migration concerns (i.e., GB PMC = 2,500 mg/kg) and in groundwater at a concentration greater than a surrogate CTDEEP criteria for migration of groundwater-to-surface water concerns (i.e., 2,500 µg/L which is based on General Permit for the Discharge of Stormwater Associated with Industrial Activity). TPH is not a CERCLA contaminant and therefore will not be further evaluated in this FS Addendum. Additional evaluation of TPH will be completed under a CTDEEP regulatory program.

6.1.1.2 Media of Concern

The nature and extent of soil contamination in Zone 1 was defined in Section 4.2.2. The updated HHRA showed that there are USEPA direct exposure COCs for soil under the residential scenario but no USEPA direct exposure COCs for soil (Table 6-3) under the I/C scenario. Additional evaluation of soil data with respect to CTDEEP RSRs indicated that benzo(a)pyrene in surface soil in paved areas may be a concern under the I/C scenario for Zone 1, but this chemical was subsequently screened out as a concern through development of an Alternative DEC. Comparison of Zone 1 soil data to CTDEEP RSRs and applicable Alternative PMC determined that there were no I/C pollutant mobility COCs for soil. Because of the potential unacceptable human health risks under the residential scenario, both surface and subsurface soil were retained as media of CERCLA concern for Zone 1. However, there are no unacceptable human health risks under the I/C scenario.

The nature and extent of groundwater contamination in Zone 1 was defined in Section 5.2.1. No contaminants were detected in Zone 1 groundwater that present unacceptable risks considering the current exposure scenario or present potential migration to surface water concerns. Therefore, groundwater was not retained as a medium of concern for CERCLA.

TPH and LNAPL are present in subsurface soil in Zone 1 at concentrations that exceed CTDEEP RSRs. In addition, TPH is potentially present in groundwater at concentrations above CTDEEP RSRs. TPH is not a CTDEEP concern under the I/C scenario, and it is not commingled with CERCLA COCs under the I/C scenario. The TPH in both media and LNAPL in soil will be addressed under a separate CTDEEP regulatory program. However, the extent and volume of LNAPL in Zone 1 was further developed in this FS Addendum because, per CTDEEP RSRs, the use of Alternative PMCs is limited to those areas where LNAPL is not present.

6.1.1.3 PRGs and COCs

PRGs were selected for those soil contaminants identified as CERCLA direct exposure risk-based COCs through the quantitative HHRA. No soil pollutant mobility COCs were identified. The PRG development and selection process is summarized in Appendices F and G, and the resulting Zone 1 PRGs are summarized in Table 6-6. Because there were no unacceptable risks for Zone 1 soil under the I/C scenario, no COCs were retained and no PRGs were selected for this scenario. Although the residential soil COCs were not re-evaluated in this Addendum, the residential soil COCs and PRGs from the FS are presented to provide a complete summary.

No groundwater COCs were identified for Zone 1; therefore, no groundwater PRGs were necessary.

6.1.1.4 Volumes of Contaminated Media

No calculations were required to determine the volume of contaminated soil with COC concentrations greater than I/C PRGs in Zone 1 because there were no I/C COCs identified.

Calculations were performed to determine the volume of LNAPL in soil in Zone 1. As estimated in the calculations provided in Appendices H.1 and H.2 and as shown on Figure 6-1, there are approximately 580 cubic yards (cy) of soil below the water table in Zone 1 with concentrations of TPH greater than 22,500 mg/kg (i.e., the concentration above which LNAPL release occurs in saturated soil). It was estimated that 1,100 gallons [7,900 pounds (lbs)] of TPH are present as LNAPL in the 580 cy of contaminated soil.

6.1.2 <u>Zone 2</u>

6.1.2.1 HHRA Update

The updated Zone 2 HHRA is provided in Appendix F. Table 6-7 summarizes the updated carcinogenic and noncarcinogenic risks associated with exposure to Zone 2 media under the RME scenario. HIs for all receptors under the RME scenario were less than or equal to unity (1), indicating that adverse non-carcinogenic effects are not anticipated for these receptors under the defined exposure conditions. ILCRs for all receptors were less than or within USEPA's target risk range of 10^{-4} to 10^{-6}.

Risks for hypothetical residents exposed to chemicals (chloroform and tetrachloroethene) that have volatilized from groundwater and migrated through building foundations into the indoor air of a structure were evaluated using USEPA's Johnson and Ettinger vapor intrusion model (2003b). For hypothetical residents, the HI (HI = 0.003) was less than unity and the ILCR (ILCR = 2×10^{-6}) was within USEPA's target risk range of 10^{-4} to 10^{-6}, indicating that adverse non-carcinogenic and carcinogenic effects are not anticipated. HIs and ILCRs for industrial workers would also be expected to be within acceptable levels because these receptors would be exposed to volatiles in indoor air on a less frequent basis than residential receptors.

As summarized in Table 6-3, the HHRA determined that there are no risk-based COCs for Zone 2.

Issues contributing uncertainty to the HHRA include the following:

- Arsenic was identified as a COPC in subsurface soil. The detected concentrations of arsenic were within background levels for metals in soil; consequently, arsenic may be naturally occurring at Zone 2 and may not be present as a result of site operations.

- Exposures to TPH in subsurface soil and groundwater were not evaluated in the HHRA because there are no toxicity criteria available for TPH. Further evaluation of this non-CERCLA contaminant is warranted outside of this FS Addendum.

Because the FS Addendum HHRA results indicated that there were no unacceptable CERCLA risks under either the residential or I/C scenarios, additional evaluation of Zone 2 using CTDEEP RSRs was not completed because they would not be ARARs. As indicated above, TPH was detected at concentrations greater than CTDEEP RSRs and poses potential direct exposure and soil-to-groundwater pollutant mobility concerns. Additional evaluation of TPH will be completed under a CTDEEP regulatory program.

6.1.2.2 Media of Concern

Based on the HHRA, there are no CERCLA media of concern for Zone 2.

6.1.2.3 PRGs and COCs

Based on the HHRA, there are no CERCLA COCs for Zone 2; therefore, no PRGs required development.

6.1.2.4 Volumes of Contaminated Media

Because there were no CERCLA media of concern or COCs identified for Zone 2, no calculations were required for the volumes of contaminated media.

6.1.3 Zone 3

6.1.3.1 HHRA Update

The updated Zone 3 HHRA is provided in Appendix F. Table 6-8 summarizes the updated carcinogenic and noncarcinogenic risks associated with exposure to Zone 3 media under the RME scenario. Table 6-9 summarizes the risk-based COCs determined using USEPA's risk assessment methodology. HIs for all receptors on a target organ basis under the RME scenario were less than or equal to unity (1), indicating that adverse non-carcinogenic effects are not anticipated for these receptors under the defined exposure conditions. ILCRs for all receptors under the RME scenario were less than or within USEPA's target risk range.

Lead was identified as a COPC in surface and subsurface soil at Zone 3. Hypothetical residential exposures to lead in surface/subsurface soil were evaluated using the IEUBK lead model (Version 1.1,

Build 11). The average lead concentration of 269 mg/kg in surface/subsurface soil was used as the Zone 3 EPC, and the model predicted that 1.0 percent of future on-site child residents would have a blood lead level greater than 10 µg/dL and that the geometric mean blood lead level would be 3.3 µg/dL. This value is less than the USEPA goal of no more than 5 percent of children exceeding a 10 µg/dL blood lead level.

Exposures to lead in surface soil by full-time employees and in surface/subsurface soil by construction workers and full-time employees were evaluated using a slope-factor approach developed by the USEPA TRW for Lead (2003a and 2009a). The average lead concentration of 301 mg/kg was used as the EPC for full-time employees exposed to surface soil, and the average lead concentration of 269 mg/kg was used as the EPC for construction workers and full-time employees exposed to surface/subsurface soil. For full-time employees exposed to surface soil, the model predicts that 0.03 percent of the receptors (fetuses) would have a blood lead level greater than 10.0 µg/dL and that the geometric mean blood lead level would be 1.4 µg/dL. For construction workers exposed to surface/subsurface soil, the model predicts that 0.04 percent of the receptors (fetuses) would have a blood lead level greater than 10 µg/dL and that the geometric mean blood lead level would be 1.6 µg/dL. For full-time employees exposed to surface/subsurface soil, the model predicts that 0.02 percent of the receptors (fetuses) would have a blood lead level greater than 10.0 µg/dL and that the geometric mean blood lead level would be 1.4 µg/dL. These results do not exceed the USEPA goal of no more than 5 percent of children (fetuses of exposed women) exceeding a 10 µg/dL blood lead level.

Although the results of the IEUBK and TRW lead models are within USEPA acceptable levels, concentrations of lead in several samples exceeded the OSWER screening level by an order of magnitude or more. Also, concentrations of lead in six surface soil samples and ten subsurface soil samples exceeded the CTDEEP residential RSR of 400 mg/kg, and concentrations of lead in two surface soil samples and five subsurface soil samples exceeded the CTDEEP I/C RSR of 1,000 mg/kg. Therefore, because the lead concentrations may pose potential acute risks, lead was retained as a COC at Zone 3.

In addition, a time-critical soil removal action occurred at Zone 3 in 1995 to address lead-contaminated soil. Soil beneath the floor of former Building 31 with lead concentrations exceeding 500 mg/kg was excavated, stabilized with Portland cement, and placed back into the excavation. After stabilization, lead concentrations in the TCLP extracts from the treated soil were less than the residential CTDEEP PMC. However, although the mobility of lead was reduced by stabilization, the total lead concentration was not changed. The lead evaluation performed in the HHRA did not use lead data from the stabilized soil. Lead concentrations in the stabilized soil were generally much greater than the lead concentrations in the remaining soil surrounding Building 31. The IEUBK and adult lead models evaluate exposures to soil, and the stabilized material no longer has the physical properties of soil. Also, although the total lead

concentration has not changed, the stabilization process most likely reduced the bioavailability of the lead in the soil. The Navy continues to maintain the concrete floor slab and asphalt over the area formerly covered by Building 31. By doing this, the soil continues to be considered inaccessible under CTDEEP RSRs.

Issues contributing uncertainty to the Zone 3 HHRA include the following:

- Soil samples were collected from locations that are currently under pavement; therefore, actual exposures under current site conditions are less than the exposure that is assumed in the HHRA.

- Arsenic was identified as a COPC in surface and subsurface soil. The detected concentrations of arsenic in surface soil were within background levels; consequently, arsenic in surface soil may be naturally occurring at Zone 3, and may not be present as a result of site operations.

- Lead is the primary COC at Zone 3, but only one surface soil sample was analyzed for VOCs, SVOCs, and inorganics. One sample provides limited information regarding the nature and extent of contamination and results in uncertainty when estimating risks.

The final results of the HHRA for Zone 3 are captured in Tables 6-3 and 6-4. Table 6-3 summarizes the risk-based COC retained for Zone 3 (lead) as wells as the COCs retained for the other Lower Subase zones. Table 6-4 provides a range of potential PRGs for lead and the receptors evaluated in the HHRA. Table 6-4 also includes the COCs and potential PRGs identified for all of the Lower Subase zones that were evaluated. The potential PRGs were developed from the HHRA considering carcinogenic risks (USEPA's target risk range of 10^{-4} to 10^{-6}), noncarcinogenic risks (HI = 1), lead modeling, and other criteria (CTDEEP RSRs and OSWER screening levels). The potential PRGs were evaluated further in Appendix G and the final PRGs selected for Zone 3 are discussed below in Section 6.1.3.3.

As mentioned previously, the focus of the FS Addendum is on evaluating the most likely scenario to be considered for remediation (i.e., the I/C scenario) and on changes that resulted because of the new data collected during the PDIs. By comparison of the FS Addendum HHRA to the FS HHRA, it was determined that the same USEPA soil COC for the residential scenario (lead) was identified in the FS Addendum as in the FS (Tetra Tech, 2010d); therefore, further evaluation of the residential soil COC was not completed in this Addendum. Lead remains a concern under the residential scenario and will need to be addressed.

The FS Addendum HHRA indicated that risks to I/C receptors are potentially unacceptable in Zone 3; therefore, because there is a CERCLA risk for the zone, additional evaluation of Zone 3 was completed

using CTDEEP RSRs because they would be ARARs. Table 6-10 summarizes the COPCs that were identified by directly screening analytical data against the CTDEEP RSRs applicable to the I/C scenario. Based on these comparisons, only lead was determined to be a COPC for direct exposure to surface soil (less than 2 feet bgs in paved areas). Further evaluation of this COPC was completed in Appendix G.1, and lead was retained as a direct contact COC. The chemicals that pose potential migration issues [i.e., soil to groundwater (I/C scenario only)] were also further evaluated in Appendix G.1. Alternative PMC for the I/C scenario were developed for the evaluation. The additional evaluation showed that one of the potential soil-to-groundwater migration COPCs (lead) poses an actual migration concern under the I/C scenario and it was retained as a migration COC.

In addition to lead, TPH was identified as a soil-to-groundwater migration concern in Zone 3 by comparison to CTDEEP RSRs (i.e., GB PMC = 2,500 mg/kg). TPH was detected in soil at concentrations greater than the criteria and poses a potential migration concern to groundwater. TPH is not a CERCLA contaminant and therefore will not be further evaluated in this FS Addendum. Additional evaluation of TPH will be completed under a CTDEEP regulatory program.

6.1.3.2 Media of Concern

The nature and extent of soil contamination in Zone 3 was defined in Section 4.2.4. The updated HHRA showed that there is one USEPA direct exposure COC for soil (lead) under the residential and I/C scenarios (Table 6-3). Additional evaluation of soil data with respect to CTDEEP RSRs also indicated that lead in surface soil in paved areas remains a direct exposure concern under the I/C scenario for Zone 3. Comparison of Zone 3 soil data to CTDEEP RSRs and applicable Alternative PMC determined that lead is an I/C pollutant mobility COC for soil. Because of the potential unacceptable human health risks under the residential and I/C scenarios and the pollutant mobility concern, both surface and subsurface soil were retained as media of CERCLA concern for Zone 3.

Because no new data were collected in Zone 3 during the groundwater PDI, the nature and extent of groundwater contamination in Zone 3 was defined in the Lower Subase FS. With the exclusion of suspect data from temporary drive-point wells from the groundwater database, no contaminants were detected in Zone 3 groundwater that present unacceptable risks considering the current exposure scenario or present potential migration to surface water concerns. Therefore, groundwater was not retained as a medium of CERCLA concern.

6.1.3.3 PRGs and COCs

PRGs were selected for lead, which was identified as a CERCLA direct contact risk-based COC through the quantitative HHRA and as a soil pollutant mobility COC. The PRG development and selection

process is summarized in Appendices F and G, and the resulting Zone 3 PRGs are presented in Table 6-6. Figure 6-2 shows the distribution of lead in Zone 3 soil exceeding I/C scenario PRGs. Although the residential soil COCs were not re-evaluated in this Addendum, the residential soil COCs and PRGs from the FS are presented in Table 6-6 to provide a summary of both I/C and residential scenarios.

No groundwater COCs were identified for Zone 3; therefore, no PRGs were necessary.

6.1.3.4 Volumes of Contaminated Media

The contaminated medium in Zone 3 consist of 610 cy of contaminated soil with lead concentrations exceeding I/C DEC or PMC PRGs, including 240 cy of contaminated surface soil and 370 cy of contaminated subsurface soil. Computations of contaminated soil volumes are provided in Appendix H.3. As shown in Appendix H.4, the estimated mass of lead in Zone 3 soil that exceeds I/C PRGs is 5,120 lbs.

6.1.4 Zone 4

6.1.4.1 HHRA Update

The updated Zone 4 HHRA is provided in Appendix F. Table 6-11 summarizes the updated carcinogenic and noncarcinogenic risks associated with exposure to Zone 4 media under the RME scenario. Table 6-12 summarizes the risk-based COCs determined using USEPA's risk assessment methodology. HIs for all receptors under the RME scenario were less than or equal to unity (1), indicating that adverse non-carcinogenic effects are not anticipated for these receptors under the defined exposure conditions. ILCRs for all receptors with the exception of the hypothetical child and lifetime residents were within USEPA's target risk range of 10^{-4} to 10^{-6}. The ILCRs for hypothetical child resident (3×10^{-4}) and hypothetical lifelong residents (3×10^{-4}) exceeded USEPA's target range. Carcinogenic PAHs in surface/subsurface soil were the major contributors to the unacceptable ILCRs for the hypothetical future child and lifetime residents. Arsenic was a minor contributor to unacceptable cancer risk estimates for hypothetical future child and lifetime residents; risk associated with arsenic alone (1×10^{-5}) is within EPA's acceptable risk range.

Lead was identified as a COPC in surface and subsurface soil at Zone 4. Hypothetical residential exposures to lead in surface/subsurface soil were evaluated using the most recent version of the IEUBK lead model (Version 1.1, Build 11). The average lead concentration of 1,256 mg/kg in surface/subsurface soil was used as the Zone 4 EPC and the model predicted that 55 percent of future on-site child residents would have a blood lead level greater than 10 µg/dL and that the resulting geometric mean blood lead level would be 10.6 µg/dL. This value exceeds the USEPA goal of no more than 5 percent of children with blood lead levels exceeding 10 µg/dL.

Exposures to lead in surface soil by full-time employees and in surface/subsurface soil by construction workers and full-time employees were evaluated using a slope-factor approach developed by the USEPA TRW for Lead (2003a and 2009a). The average lead concentration of 1,840 mg/kg was used as the EPC for full-time employees exposed to surface soil, and the average lead concentration of 1,256 mg/kg was used as the EPC for construction workers and full-time employees exposed to surface/subsurface soil. For full-time employees exposed to surface soil, the model predicted that 2.9 percent of the receptors (fetuses) would have a blood lead level greater than 10.0 µg/dL and that the geometric mean blood lead level would be 3.6 µg/dL. For construction workers exposed to surface/subsurface soil, the model predicted that 3.0 percent of the receptors (fetuses) would have a blood lead level greater than 10 µg/dL and that the geometric mean blood lead level would be 3.7 µg/dL. For full-time employees exposed to surface/subsurface soil, the model predicts that 1.0 percent of the receptors (fetuses) would have a blood lead level greater than 10.0 µg/dL and that the geometric mean blood lead level would be 2.8 µg/dL. These results do not exceed the USEPA goal of no more than 5 percent of children (fetuses of exposed women) having a blood lead level exceeding 10 µg/dL.

Although the results of the IEUBK and TRW lead models are within USEPA acceptable levels, concentrations of lead in several samples exceeded the OSWER screening level by an order of magnitude or more. Also, concentrations of lead in six surface soil samples and five subsurface soil samples exceeded the CTDEEP residential RSR of 400 mg/kg. In addition, the concentrations of lead in three surface soil samples and five subsurface soil samples exceeded the CTDEEP I/C RSR of 1,000 mg/kg. Therefore, lead was retained as a COC at Zone 4.

Risks for hypothetical residents exposed to chemicals (ethylbenzene and vinyl chloride) that have volatilized from groundwater and migrated through building foundations into the indoor air of a structure were evaluated using USEPA's Johnson and Ettinger vapor intrusion model (2003b). For hypothetical residents, the HI (0.1) was less unity and the ILCR (4×10^{-5}) was within USEPA's target risk range of 10^{-4} to 10^{-6}, indicating that adverse non-carcinogenic and carcinogenic effects are not anticipated. HIs and ILCRs for industrial workers would also be expected to be within acceptable levels because these receptors would be exposed to volatiles in indoor air on a less frequent basis than residential receptors.

Issues contributing uncertainty to the Zone 4 HHRA include the following:

- Soil samples were collected from locations that are currently under pavement; therefore, actual exposures under current site conditions are less than the exposure that is assumed in the HHRA.

- Exposures to TPH in subsurface soil and groundwater were not evaluated in the HHRA because there are no toxicity criteria available for TPH. Further evaluation of this non-CERCLA contaminant is warranted outside of this FS Addendum.

The final results of the HHRA for Zone 4 are captured in Tables 6-3 and 6-4. Table 6-3 summarizes the risk-based direct exposure COCs retained for Zone 4 as wells as the other Lower Subase zones. Table 6-4 provides a range of potential PRGs for all COCs and receptors evaluated in the HHRA. Similar to Table 6-3, Table 6-4 includes COCs for all of the Lower Subase zones that were evaluated. The potential PRGs were developed from the HHRA considering carcinogenic risks (USEPA's target risk range of 10^{-4} to 10^{-6}), noncarcinogenic risks (HI = 1), lead modeling, and other criteria (CTDEEP RSRs and OSWER screening levels). The potential PRGs were evaluated further in Appendix G and the final PRGs selected for Zone 4 are discussed below in Section 6.1.4.3.

As mentioned previously, the focus of the FS Addendum is on evaluating the most likely scenario to be considered for remediation (i.e., the I/C scenario) and on changes that resulted because of the new data collected during the PDIs. By comparison of the FS Addendum HHRA to the FS HHRA, it was determined that the same USEPA soil COCs for the residential scenario were identified in the FS Addendum as in the FS (Tetra Tech, 2010d); therefore, further evaluation of the residential soil COCs were not completed in this Addendum. The residential COCs remain a concern and will need to be addressed.

The FS Addendum HHRA indicated that risks to I/C receptors are potentially unacceptable in Zone 4; therefore, because there is a CERCLA risk for the zone, additional evaluation of Zone 4 was completed using CTDEEP RSRs because they would be ARARs. Table 6-13 summarizes the COPCs that were identified by directly comparing analytical data to CTDEEP RSRs applicable to the I/C scenario. Further evaluation of the soil COPCs [benzo(a)pyrene, dibenzo(a,h)anthracene, and lead] was completed in Appendix G.1. As allowed by the CTDEEP RSRs, Alternative DEC for benzo(a)pyrene (10 mg/kg) and dibenzo(a,h)anthracene (8 mg/kg) were developed using the results of the HHRA for the I/C scenario. By using the Alternative DECs, benzo(a)pyrene and dibenzo(a,h)anthracene were screened out as COCs. However, lead was retained as a direct exposure COC. The chemicals detected in soil that pose potential migration issues [i.e., soil to groundwater (I/C scenario only)] were also further evaluated in Appendix G.1. Alternative PMC for the I/C scenario were developed for the evaluation. The additional evaluation showed that one of the potential soil-to-groundwater migration COPCs (lead) poses an actual migration concern under the I/C scenario. Evaluation of soil pollutant mobility issues in the unpaved area to the south of former Building 105 was not warranted because no contaminant source(s) were known to be present in this area, the PDI soil sample collected adjacent to the area did not show contaminant concentrations greater than GB PMC, and the area makes up a very small fraction of Zone 4 and would

have minimal impact on pollutant mobility issues. As shown in Appendix G.2, Alternative SWPC were developed and used to further evaluate the groundwater-to-surface water COPCs. None of the COPCs were detected at concentrations exceeding the Alternative SWPC.

In addition to lead, TPH was identified as a contaminant with potential migration concerns. TPH was detected in soil at concentrations that pose potential soil-to-groundwater migration concerns based on comparison to CTDEEP RSRs (i.e., GB PMC = 2,500 mg/kg). TPH is not a CERCLA contaminant, but it is commingled with soil contaminated with lead in a limited area of Zone 4. Therefore, the commingled TPH-contaminated soil will be further evaluated in this FS Addendum. Additional evaluation of non-commingled TPH-contaminated soil in other areas of Zone 4 will be completed under a CTDEEP regulatory program. TPH was also detected in groundwater at a concentration greater than a surrogate CTDEEP criteria for migration of groundwater-to-surface water concerns (i.e., 2,500 µg/L which is based on General Permit for the Discharge of Stormwater Associated with Industrial Activity).

6.1.4.2 Media of Concern

The nature and extent of soil contamination in Zone 4 was defined in Section 4.2.5. The updated HHRA showed that there are USEPA direct exposure COCs for soil under residential and I/C scenarios (Table 6-12). Additional evaluation of soil data with respect to CTDEEP RSRs indicated that lead in surface soil in paved areas remains a concern under the I/C scenario for Zone 4. Comparison of Zone 4 soil data to CTDEEP RSRs and applicable Alternative PMC determined that lead is the only I/C pollutant mobility COC for soil. Because of the potential unacceptable human health risks under the residential and I/C scenarios and the pollutant mobility concerns, both surface and subsurface soil were retained as media of CERCLA concern for Zone 4.

The nature and extent of groundwater contamination in Zone 4 was defined in Section 5.2.2. No contaminants were detected in Zone 4 groundwater that present unacceptable risks considering the current exposure scenario or present potential migration to surface water concerns. Therefore, groundwater was not retained as a medium of CERCLA concern.

A small amount of TPH-contaminated soil is commingled with the CERCLA lead-contaminated soil under the I/C scenario. The commingled soil will be addressed under CERCLA.

6.1.4.3 PRGs and COCs

PRGs were selected for lead, which was identified as a CERCLA direct contact risk-based COC through the quantitative HHRA and as a soil pollutant mobility COC. In addition, TPH is commingled with the lead

contaminated soil. The lead contaminated soil cannot effectively be addressed separately from the TPH. Therefore, although the TPH is not identified as a concern for health and ecological risk, cleanup will address the lead and commingled TPH. If encountered, non-commingled TPH would be addressed under a separate State-lead program to meet CTDEP RSRs (e.g., TPH I/C DEC = 2,500 mg/kg, TPH Residential DEC = 500 mg/kg, TPH PMC for GB Groundwater = 2,500 mg/kg). The PRG development and selection process is summarized in Appendices F and G. The resulting Zone 4 PRGs are presented in Table 6-6. Figure 6-3 shows the distribution of lead and TPH in Zone 4 soil exceeding the I/C scenario PRGs. Although the residential soil COCs were not re-evaluated under CTDEEP RSRs in this Addendum, the residential soil COCs and PRGs from the FS are presented in Table 6-6 to provide a summary of both I/C and residential scenarios.

No groundwater COCs were identified for Zone 4; therefore, no PRGs were necessary.

6.1.4.4 Volumes of Contaminated Media

The contaminated medium in Zone 4 consist of 1,780 cy of contaminated soil with lead concentrations exceeding the I/C DEC or PMC PRGs, including 730 cy of contaminated surface soil and 1,050 cy of contaminated subsurface soil. A total of 20 cy of the lead-contaminated soil is also contaminated with TPH, which would increase the disposal cost. Computations of contaminated soil volumes are provided in Appendix H.3. The mass of lead in Zone 4 soil with concentrations that are greater than I/C PRGs was estimated in Appendix H.4 at 7,450 lbs.

6.1.5 <u>Zone 5</u>

6.1.5.1 HHRA Update

The updated Zone 5 HHRA is provided in Appendix F. Table 6-14 summarizes the updated carcinogenic and noncarcinogenic risks associated with exposure to Zone 5 media under the RME scenario. HIs for all receptors under the RME scenario were less than or equal to unity (1), indicating that adverse non-carcinogenic effects are not anticipated for these receptors under the defined exposure conditions. ILCRs for all receptors under the RME scenario were less than or within USEPA's target risk range of 10^{-4} to 10^{-6}.

Risks for hypothetical residents exposed to chemicals (ethylbenzene) that have volatilized from groundwater and migrated through building foundations into the indoor air of a structure were evaluated using USEPA's Johnson and Ettinger vapor intrusion model (2003b). For hypothetical residents, the HI (0.0006) was less than unity and the ILCR (7×10^{-7}) was less than USEPA's target risk range of 10^{-4} to 10^{-6}, indicating that adverse non-carcinogenic and carcinogenic effects are not anticipated. HIs and

ILCRs for industrial workers would also be expected to be within acceptable levels because these receptors would be exposed to volatiles in indoor air on a less frequent basis than residential receptors.

As summarized in Table 6-3, the HHRA determined that there are no risk-based COCs for Zone 5.

Issues contributing uncertainty to the Zone 5 HHRA include the following:

- Soil samples were collected from locations that are currently under pavement; therefore, actual exposures under current site conditions are less than the exposure that is assumed in the HHRA.

- Potential exposures for future full-time employees and hypothetical residents assume that substantial excavation occurs at the site and that excavated subsurface soil is mixed with surface soil. If in the future the site is redeveloped without subsurface excavation, the exposures to future receptors will be less than those estimated in the HHRA.

- Arsenic and vanadium were identified as soil COPCs, but their detected concentrations were within background levels. Consequently, arsenic and vanadium in surface and subsurface soil may be naturally occurring at Zone 5 and may not be present as a result of site operations.

- Exposures to TPH in subsurface soil and groundwater were not evaluated in the HHRA because there are no toxicity criteria available for TPH. Further evaluation of this non-CERCLA contaminant is warranted outside of this FS Addendum.

Because the FS Addendum HHRA results indicated that there were no unacceptable CERCLA risks under either the residential or I/C scenarios, additional evaluation of Zone 5 using CTDEEP RSRs was not completed because they would not be ARARs. As indicated above, TPH remains a concern under CTDEEP RSRs because of potential direct exposure and soil-to-groundwater pollutant mobility concerns. Additional evaluation of TPH will be completed under a CTDEEP regulatory program.

6.1.5.2 Media of Concern

Based on the HHRA, there are no CERCLA media of concern for Zone 5.

6.1.5.3 PRGs and COCs

Based on the HHRA, there are no CERCLA COCs for Zone 5; therefore, no PRGs required development.

6.1.5.4 Volumes of Contaminated Media

Because there were no CERCLA media of concern or COCs identified for Zone 5, no calculations were required for the volumes of contaminated media.

6.1.6 Zone 6

6.1.6.1 HHRA Update

The updated Zone 6 HHRA is provided in Appendix F. Table 6-15 summarizes the updated carcinogenic and noncarcinogenic risks associated with exposure to Zone 6 media under the RME scenario. HIs for all receptors under the RME scenario were less than or equal to unity (1), indicating that adverse non-carcinogenic effects are not anticipated for these receptors under the defined exposure conditions. ILCRs for all receptors under the RME scenario were less than or within USEPA's target risk range.

Risks for hypothetical residents exposed to chemicals (chloroform) that have volatilized from groundwater and migrated through building foundations into the indoor air of a structure were evaluated using USEPA's Johnson and Ettinger vapor intrusion model (2003b). For hypothetical residents, the HI (HI = 0.01) was less unity and the ILCR (ILCR = 1×10^{-5}) was less than USEPA's target risk range of 10^{-4} to 10^{-6}, indicating that adverse non-carcinogenic and carcinogenic effects are not anticipated. HIs and ILCRs for industrial workers would also be expected to be within acceptable levels because these receptors would be exposed to volatiles in indoor air on a less frequent basis than residential receptors.

As summarized in Table 6-3, the HHRA determined that there are no risk-based COCs for Zone 6.

Issues contributing uncertainty to the Zone 6 HHRA include the following:

- Soil samples were collected from locations that are currently under pavement; therefore, actual exposures under current site conditions are less than the exposure that is assumed in the HHRA.

- Arsenic was identified as a COPC in surface and subsurface soil. The detected concentrations of arsenic in surface and subsurface soil were within background levels; consequently, arsenic in surface and subsurface soil may be naturally occurring at Zone 6 and may not be present as a result of site operations.

- Exposures to TPH in subsurface soil and groundwater were not evaluated in the HHRA because there are no toxicity criteria available for TPH.

Because the FS Addendum HHRA results indicated that there were no unacceptable CERCLA risks under either the residential or I/C scenarios, additional evaluation of Zone 6 using CTDEEP RSRs was not completed because they would not be ARARs. As indicated above, TPH remains a concern under CTDEEP RSRs because of potential direct exposure and soil-to-groundwater pollutant mobility concerns. Additional evaluation of TPH will be completed under a CTDEEP regulatory program.

6.1.6.2 Media of concern

Based on the HHRA, there are no CERCLA media of concern for Zone 6.

6.1.6.3 PRGs and COCs

Based on the HHRA, there are no CERCLA COCs for Zone 6; therefore, no PRGs required development.

6.1.6.4 Volumes of Contaminated Media

Because there were no CERCLA media of concern or COCs identified for Zone 6, no calculations were required for the volumes of contaminated media.

6.1.7 Zone 7

6.1.7.1 HHRA Update

The updated Zone 7 HHRA is provided in Appendix F. Table 6-16 summarizes the updated carcinogenic and noncarcinogenic risks associated with exposure to Zone 7 media under the RME scenario. Table 6-17 summarizes the risk-based COCs determined using USEPA's risk assessment methodology. HIs for construction workers exposed to groundwater and full-time employees exposed to surface soil under the RME scenario were less than or equal to unity (1), indicating that adverse non-carcinogenic effects are not anticipated for these receptors under the defined exposure conditions. HIs for exposures to surface/subsurface soil by full-time employees (2) and hypothetical adult residents (2) were greater than the acceptable level of 1; however, as shown in Appendix F, HIs for individual target organs were all less than or equal to 1. HIs for exposure to surface/subsurface soil by construction workers (2) and hypothetical child residents (14) exceeded the acceptable level of 1. Antimony was the major contributor to the HI for all receptors. ILCRs for all receptors with the exception of the hypothetical child and lifetime residents were within USEPA's target risk range of 10^{-4} to 10^{-6}. ILCRs for hypothetical child residents (2×10^{-4}) and hypothetical lifelong residents (3×10^{-4}) exceeded USEPA's target range. Carcinogenic PAHs and arsenic were the major contributors to the ILCRs.

Lead was identified as a COPC in surface soil and subsurface soil at Zone 7. Hypothetical residential exposures to lead in surface/subsurface soil were evaluated using the IEUBK lead model (Version 1.1, Build 11). The average lead concentration (5,370 mg/kg) in surface/subsurface soil was used as the Zone 7 EPC in the model. The model predicted that 99 percent of future on-site child residents would have a blood lead level greater than 10 µg/dL and that the resulting geometric mean blood lead level would be 27.8 µg/dL. This result exceeds the USEPA goal of no more than 5 percent of children with blood lead levels exceeding 10 µg/dL.

Exposures to lead in surface soil by full-time employees and in surface/subsurface soil by construction workers and full-time employees were evaluated using a slope-factor approach developed by USEPA TRW for Lead (2003a and 2009a). The average lead concentration (2,444 mg/kg) in surface soil was used as the EPC for current full-time employees, and the average lead concentration (5,370 mg/kg) surface/subsurface soil was used as the EPC for construction workers and future full-time employees. For full-time employees, the model predicted that exposure to surface soil would result in 6.3 percent of the receptors (fetuses) having a blood lead level greater than 10.0 µg/dL and a geometric mean blood lead level of 4.5 µg/dL. For construction workers, the model predicted that exposure to surface/subsurface soil would result in 58 percent of the receptors (fetuses) having a blood lead level greater than 10 µg/dL and a geometric mean blood lead level of 12.5 µg/dL. For full-time employees exposed to surface/subsurface soil, the model predicted that 34 percent of the receptors (fetuses) having a blood lead level greater than 10.0 µg/dL and a geometric mean blood lead level of 8.7 µg/dL. All of these results exceed the USEPA goal of no more than 5 percent of children (fetuses of exposed women) with blood lead levels exceeding 10 µg/dL.

Risks for hypothetical residents exposed to chemicals (chloroform and trichloroethene) that have volatilized from groundwater and migrated through building foundations into the indoor air of a structure were evaluated using USEPA's Johnson and Ettinger vapor intrusion model (2003b). For hypothetical residents, the HI (0.01) was less unity and the ILCR (1×10^{-6}) was within the USEPA's target risk range of 10^{-4} to 10^{-6}, indicating that adverse non-carcinogenic and carcinogenic effects are not anticipated. HIs and ILCRs for industrial workers would also be expected to be within acceptable levels because these receptors would be exposed to volatiles in indoor air on a less frequent basis than residential receptors.

Issues contributing uncertainty to the Zone 7 HHRA include the following:

- Soil samples were collected from locations that are currently under pavement; therefore, actual exposures under current site conditions are less than the exposure that is assumed in the HHRA.

- Arsenic was identified as COPCs in surface and subsurface soil. The detected concentrations of arsenic in surface soil were within background levels; consequently, arsenic in surface soil may be naturally occurring at Zone 7 and may not be present as a result of site operations.

- Antimony in one subsurface soil sample (20TB4) from 14 to 16 feet bgs contributed significantly to the HI of 2 for the construction worker. This sample was collected from 8 to 10 feet below the water table. It is unlikely that a construction worker would be exposed to soil at this depth below the water table. Therefore, the actual noncarcinogenic risks for construction workers are expected to be significantly less than those estimated in the HHRA.

- Exposures to TPH in subsurface soil and groundwater were not evaluated in the HHRA because there are no toxicity criteria available for TPH.

- Soil samples were collected in the vicinity of Site 25 during the Pier 33 and Berth 16/Former Incinerator Site Investigation (Atlantic, 1995) and analyzed for dioxins. The results of the investigation were evaluated in the Lower Subase RI (Tetra Tech, 1999). Dioxin was detected in one sample from location 20MW6 (2 to 4 feet bgs) at a 2,3,7,8-TCDD equivalent concentration of 0.49 ng/kg. This concentration is less than the USEPA residential RSL (4.5 ng/kg), OSWER action level (1 µg/kg) for residential exposures (USEPA, 1998), and OSWER's proposed residential PRG of 72 ng/kg (USEPA, 2009b); therefore, the data indicates that dioxins are not a concern for Zone 7.

The final results of the HHRA for Zone 7 are captured in Tables 6-3 and 6-4. Table 6-3 summarizes the risk-based direct exposure COCs retained for Zone 7 as wells as the other Lower Subase zones. Table 6-4 provides a range of potential PRGs for all COCs and receptors evaluated in the HHRA. Similar to Table 6-3, Table 6-4 includes COCs for all of the Lower Subase zones that were evaluated. The potential PRGs were developed from the HHRA considering carcinogenic risks (USEPA's target risk range of 10^{-4} to 10^{-6}), noncarcinogenic risks (HI = 1), lead modeling, and other criteria (CTDEEP RSRs and OSWER screening levels). The potential PRGs were evaluated further in Appendix G and the final PRGs selected for Zone 7 are discussed below in Section 6.1.7.3.

As mentioned above, the focus of the FS Addendum is on evaluating the most likely scenario to be considered for remediation (i.e., the I/C scenario) and on changes that resulted because of the new data collected during the PDIs. By comparison of the FS Addendum HHRA to the FS HHRA, it was determined that a majority of the same USEPA soil COCs for the residential scenario were identified in the FS Addendum (8 of 10) as in the FS (Tetra Tech, 2010d). The exceptions were benzo(k)fluoranthene and hexavalent chromium. Benzo(k)fluoranthene was eliminated as a COC and hexavalent chromium was added as a COC based on the new data collected during the PDI. The elimination/inclusion of these

residential COCs does not significantly change alternatives developed under the residential scenario. Therefore, further evaluation of the residential soil COCs was not completed in this FS Addendum. It is understood that the residential soil COCs remain a concern and will need to be addressed.

The FS Addendum HHRA indicated that risks to I/C receptors are potentially unacceptable in Zone 7; therefore, because there is a CERCLA risk for the zone, additional evaluation of Zone 7 was completed using CTDEEP RSRs because they would be ARARs. Table 6-18 summarizes the COPCs that were identified by directly comparing analytical data to CTDEEP RSRs applicable to the I/C scenario. Further evaluation of the soil COPCs [benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and lead] was completed in Appendix G.1. Benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene were screened out as COCs using the 95 percent UCL concentration for each chemical. As allowed by CTDEEP RSRs, Alternative DECs for benzo(a)pyrene (10 mg/kg) and dibenzo(a,h)anthracene (8 mg/kg) were developed using the results of the HHRA for the I/C scenario. By using the Alternative DECs, benzo(a)pyrene and dibenzo(a,h)anthracene were screened out as COCs. Lead was retained as a direct exposure COC. The chemicals detected in soil that pose potential migration issues [i.e., soil to groundwater (I/C scenario only)] were also further evaluated in Appendix G.1. Alternative PMC for the I/C scenario were developed for the evaluation. The additional evaluation showed that two of the potential soil-to-groundwater migration COPCs (antimony and lead) pose actual migration concerns under the I/C scenario. As shown in Appendix G.2, Alternative SWPC were developed and used to further evaluate the groundwater-to-surface water COPCs. Of the COPCs, only arsenic was detected at a concentration greater than the Alternative SWPC. Based on the frequency of detection, frequency of exceedance, average concentration, and further evaluation in Appendix G.2 (p.-4 of 4), arsenic was not retained as a COC.

6.1.7.2 Media of Concern

The nature and extent of soil contamination in Zone 7 was defined in Section 4.2.8. The updated HHRA showed that there are USEPA direct exposure COCs for soil under the residential and I/C scenarios (Table 6-17). Additional evaluation of soil data with respect to CTDEEP RSRs also indicated that lead in surface soil in paved areas is a concern under the I/C scenario for Zone 7. Comparison of Zone 7 soil data to CTDEEP RSRs and applicable Alternative PMC determined that antimony, arsenic, and lead are I/C pollutant mobility COCs for soil. Because of the potential unacceptable human health risks under the residential and I/C scenarios and the pollutant mobility concerns, both surface and subsurface soil were retained as media of CERCLA concern for Zone 7.

The nature and extent of groundwater contamination in Zone 7 was detailed in Section 5.2.4. No contaminants were detected in Zone 7 groundwater that present unacceptable risks considering the

current exposure scenario or present potential migration to surface water concerns. Therefore, groundwater was not retained as a CERCLA medium of concern.

6.1.7.3 PRGs and COCs

PRGs were selected for the CERCLA direct contact risk-based COCs identified through the quantitative HHRA (lead) and for soil pollutant mobility COCs (antimony and lead). Antimony was initially identified as an I/C DEC COC through the HHRA; however, it was subsequently eliminated based on the depth of the sample (14 to 16 feet bgs) contributing to the risk and the unlikely exposure to the construction worker. The PRG development and selection process is summarized in Appendices F and G. The resulting Zone 7 PRGs are presented in Table 6-6. Figure 6-4 shows the distribution of antimony and lead in Zone 7 soil exceeding the I/C scenario PRGs.

Although the residential soil COCs were not re-evaluated in this Addendum, the residential soil COCs and PRGs from the FS are presented to provide a summary of both residential and I/C scenarios.

No groundwater COCs were identified for Zone 7; therefore, no PRGs were necessary.

6.1.7.4 Volumes of Contaminated Media

The contaminated medium in Zone 7 consists of 2,720 cy of contaminated soil with lead concentrations greater than the I/C DEC and/or PMC PRGs and/or antimony concentrations greater than the I/C PMC PRG, including 990 cy of contaminated surface soil and 1,730 cy of contaminated subsurface soil. Computations of contaminated soil volumes are provided in Appendix H.3. The mass of lead in Zone 7 soil that exceeds I/C PRGs was estimated in Appendix H.4 at 43,880 lbs. The mass of antimony in the soil was not estimated because it is a minor COC compared to lead in Zone 7, and it is commingled with the lead-contaminated soil.

6.1.8 Zone 4 and Outer Pier 1 Sediment

6.1.8.1 Ecological Risk Assessment

No changes were made to the baseline ecological risk assessment described in the Lower Subase FS (Tetra Tech, 2010) and the information contained in the assessment is still valid.

6.1.8.2 Media of Concern

The nature and extent of sediment contamination in Zone 4 and Outer Pier 1 was defined in the Lower Subase FS. Figure 6-16 depicts the extent of contaminated sediments in these areas. Contaminated

sediments extend to at least 6 feet below the sediment surface. The depth from the water surface to the sediment surface in Zone 4 is also shown on Figure 6-16. The depths vary from 16 feet to 41 feet because of the slope of the sediments along the quay wall and previous maintenance dredging activities. A sediment mound (depth to sediment surface of 24 feet) exists in the central part of Zone 4 and is probably in the location of a previous pier.

6.1.8.3 PRGs and COCs

Sediment PRGs and COCs identified through the ecological risk assessment and New London Partnering Team consensus include Total Effects Range Median-Quotient (ERM-Q) of 1.17 and PCB congener of 1 mg/kg. The chemicals included in the calculation of the ERM-Q and the specific PCB congeners to be included in the PCB concentration calculation are identified in the Lower Subase FS.

6.1.8.4 Volumes of Contaminated Media

Based on calculations provided in Appendix H.5, there are approximately 10,400 cy of sediment in Zone 4 and 1,000 cy of sediment in Outer Pier 1 with contaminant concentrations exceeding the sediment PRGs. The extent of the contaminated sediments are shown on Figures 6-16 and 6-21.

6.1.9 Media-Specific Summaries

The following summaries were developed from the information provided above in Subsections 6.1.1 through 6.1.8:

- Contaminants are present in Zones 1, 3, 4, and 7 soil at concentrations that pose potentially unacceptable human health risks under residential and/or I/C exposure scenarios and that pose potential pollutant mobility concerns. Because of these CERCLA risks and mobility concerns, the soil remedial alternatives developed for Zones 1, 3, 4, and 7 in the Lower Subase FS (Tetra Tech, 2010d) should be re-evaluated in this FS Addendum. The re-evaluation should focus on I/C scenario alternatives because they are the most likely to be implemented. Under the I/C scenario, the primary soil COC is lead.

- Contaminants were not detected in Zones 2, 5, or 6 soil at concentrations that pose potentially unacceptable human health risks under residential or I/C exposure scenarios. Because no unacceptable CERCLA risks were identified, the soil remedial alternatives developed for Zones 2, 5, and 6 in the Lower Subase FS do not need to be re-evaluated in this FS Addendum. TPH, a non-CERCLA contaminant, is present in soil in these zones at concentrations greater than the CTDEEP

RSRs. Further evaluation of the TPH-contaminated soil in these zones should be completed under a regulatory program other than CERCLA.

- Contaminants were not detected in the groundwater of Zones 1 through 7 at concentrations that pose potentially unacceptable risks under the I/C exposure scenario or pollutant mobility concerns. A residential exposure scenario was not evaluated for groundwater because the groundwater is brackish, it is classified as GB, and potable water is available. Because no unacceptable CERCLA risks were identified, the groundwater remedial alternatives developed for Zones 1, 4, and 7 in the Lower Subase FS (Tetra Tech, 2010d) do not need to be re-evaluated in this FS Addendum. TPH, a non-CERCLA contaminant, may be present in groundwater in Zones 1 and 4 at concentrations greater than CTDEEP RSRs. Historic data showed exceedances, but no data has been collected recently to confirm the exceedances. Further evaluation of the TPH-contaminated groundwater in these zones should be completed under a regulatory program other than CERCLA.

- No new sediment data were collected and site conditions remained generally unchanged; therefore, the remedial alternatives developed in the Lower Subase FS are generally still valid, but some changes are required. This statement is contingent on the success of the second phase of the Non-Time Critical Removal Action (NTCRA) for Inner Pier 1 that is currently being planned. It is anticipated that the new technology to be implemented during the second phase of the NTCRA (hydraulic dredging) will successfully meet the remedial goals for Inner Pier 1 and that Inner Pier 1 sediment will not need to be included with the Zone 4 and Outer Pier 1 sediment alternatives. Initiation of the second phase of the NTRCA is planned for early 2012. Re-evaluation of the sediment alternatives are required in this FS Addendum to address the volume changes associated with the exclusion of the sediment associated with operational depth concerns, to include the most recent discount rate in the cost estimates, and to add another alternative (SD-8) for dealing with the contaminated sediment.

- LNAPL (TPH) is present in subsurface soil below the water table in Zone 1. The additional data collected during the Soil PDI refined the extent and volume of LNAPL and allowed for a more accurate evaluation of soil pollutant mobility concerns using CTDEEP RSRs. Based on input from the regulators, the LNAPL alternatives developed in the Lower Subase FS are not updated in this FS Addendum. They will be further evaluated under a regulatory program other than CERCLA because the primary LNAPL component is TPH, a non-CERCLA contaminant..

6.1.10 LUC Boundaries

The LUC boundaries for Zones 1, 3, 4, and 7 were determined by overlying the 2010 kriging from ground surface to a depth of 15 feet below ground surface (bgs) for Residential DEC values for lead and BaPEQ

for CERCLA LUCs and TPH for non-CERCLA LUCs. Because the residential scenario was not re-evaluated in detail, 2010 kriging figures below MHW were not included in the FS Addendum Appendix E. However, 2010 kriging was performed to 15 feet bgs and was used to generate the LUC boundaries. On Figure 6-5, areas with CERCLA LUCs for Zones 1, 3, and 4 are shown in pink and areas expected to have non-CERCLA LUCs are shown in green. Similarly, Zone 7 areas with LUCs are shown on Figure 6-12. For Zone 7, LUC boundaries were extended beyond the zone boundary to the limits of kriging to the south, and to the Providence and Worcester Railroad embankment to the east.

6.2 REMEDIAL ALTERNATIVE AND COMPARATIVE ANALYSIS UPDATE

The remedial alternatives for Zones 1, 3, 4 and 7 soil, Zone 4 and Outer Pier 1 sediment, and Zone 1 LNAPL from the Lower Subase FS are updated in this section. A new set of excavation remedial alternatives was developed and included for Zones 3, 4, and 7 soil and one new alternative was also developed for Zone 4 and Outer Pier 1 sediment. Based on the available information, the RAOs, remedial technologies, and process options developed for the remedial alternatives in the Lower Subase FS did not need to be re-evaluated or updated in this FS Addendum. However, the ARARs for the alternatives were reviewed and updated as necessary in this FS Addendum. Because detailed remedial alternative analyses were completed in the Lower Subase FS, the updates included in this FS Addendum focused on revised alternative descriptions, ARAR evaluations, comparative analyses, and remedial costs.

6.2.1 Soil Remedial Alternatives - Zones 1, 3, 4, and 7

The soil remedial alternatives developed for Zones 1, 3, 4, and 7 under the I/C scenario were re-evaluated in this FS Addendum. For Zones 3, 4, and 7, two excavation alternatives (A and B) are included in the FS Addendum. Excavation Alternative B is the same alternative that was included in the Lower Subase FS and includes excavation to the water table to address both direct exposure and pollutant mobility issues. Excavation Alternative A is new and includes excavation to only 2 feet bgs to address direct exposure issues and addresses pollutant mobility issues with the existing asphalt. No updates were made to the soil remedial alternatives developed for these zones under the residential scenario.

6.2.1.1 Zone 1

The soil remedial alternatives retained for Zone 1 under the I/C scenario are described below. For all Zone 1 alternatives, there are no soil COCs as long as the I/C scenario assumptions apply.

Alternative S-1.1: No Action

The No Action alternative is required by CERCLA as a baseline for comparison to other alternatives and would not include any new environmental action, and any existing administrative and/or engineering environmental controls would not be an enforceable part of a CERCLA remedy. The only action for these alternatives would be the performance of CERCLA-mandated five-year reviews to periodically evaluate site status. A No Action alternative cannot be chosen because contamination remains on site.

Alternative S-1.2: LUCs (Engineering and Institutional Controls) and Monitoring

Alternative S-1.2 would consist of two major components: (1) LUCs with engineering and institutional controls and (2) monitoring. The estimated time to implement the LUCs is 3 months.

Component 1: LUCs with Engineering and Institutional Controls

LUCs for Zone 1 that are protective will be established and implemented in accordance with a post-ROD LUC Remedial Design (RD). The LUC will both restrict residential land use and maintain a protective cover layer that meets CTDEEP RSR standards to be protective under industrial/commercial use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil, maintain the I/C site use conditions, and to prevent residential development of Zone 1. Engineering controls to be specified in the LUC RD would include the existing pavement and buildings that already cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. Unpaved areas in Zone 1 are outside of the CERCLA LUC area. Pavement maintenance would be needed over the 24,400 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would also be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-5 shows the proposed areas in Zone 1 where LUCs would be required. The areas are differentiated by CERCLA and potential non-CERCLA concerns. The total area requiring CERCLA LUCs covers approximately 44,760 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, environmental land use restrictions (ELURs), meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 2: Monitoring

A groundwater monitoring program would be developed and implemented because contaminated soil with an unacceptable residential risk is to remain in place. For the purpose of this report, it was assumed that four groundwater samples would be regularly collected from wells installed in strategic locations to be identified in the monitoring plan and that the collected samples would be analyzed for PAHs. It was assumed for this report that the monitoring frequency would be quarterly for the first 2 years, semi-annually for the next 2 years, annually the fifth year, and every 5 years thereafter.

Monitoring of compliance with LUCs would occur at least annually. The monitoring will confirm that regular maintenance of building foundations is being performed.

Reviews would be performed every 5 years to evaluate site status, assess the continued adequacy of remedial activities, and determine whether further action is necessary. Five-year reviews are required because the soil that remains presents an unacceptable residential risk.

<u>Other Alternatives</u>

Alternatives S-1.3: In-Situ Treatment (Enhanced Bioremediation) to Meet I/C DECs and PMCs, LUCs (Engineering and Institutional Controls), and Monitoring and Alternative S-1.4: Excavation to Meet I/C DECs and PMCs, Off-Site Disposal [Low-Temperature Thermal Desorption (LTTD) and Landfilling], LUCs (Engineering and Institutional Controls), and Monitoring, which were included in the Lower Subase FS, are not required in this FS Addendum. The additional data collected during the Soil PDI and the associated re-evaluation of risks and pollutant mobility concerns indicated that these alternatives are no longer required.

Alternative Evaluation

Detailed evaluations of Alternatives S-1.1 and S-1.2 can be found in the Lower Subase FS Report (Tetra Tech, 2010d). Generally, no changes have been made to these alternatives except for estimated volumes and costs. The discount rate used to estimate the net present worth of Alternative 1.2 and all other alternatives requiring a net present worth cost was changed from 7 percent to 2.3 percent based on Appendix C of the Office of Management and Budget Circular A-94 (Revision - December 2010).

Chemical-specific ARARs for Alternative S-1.1 are summarized and evaluated in Table 6-19. The chemical-, location-, and action-specific ARARs for Alternative S-1.2 are summarized and evaluated in Tables 6-20, 6-21, and 6-22, respectively.

Table 6-23 provides a comparative analysis of Zone 1 soil remedial alternatives. Remedial cost estimates are provided in Appendix K. The remedial alternatives for the I/C scenario must consider the potential residential concerns that need to be addressed.

6.2.1.2 Zone 3

The soil remedial alternatives retained for Zone 3 under the I/C scenario are described below. For all Zone 3 I/C alternatives, the COC is lead, the I/C direct exposure PRG for lead is 1,090 mg/kg, and the I/C pollutant mobility PRG for lead is 0.47 mg/L.

Alternative S-3.1: No Action

This would be the same CERCLA-mandated alternative as Alternative S-1.1.

Alternative S-3.2: LUCs (Engineering and Institutional Controls) and Monitoring

Alternative S-3.2 would consist of two major components: (1) LUCs with engineering and institutional controls and (2) monitoring. The estimated time to implement the LUCs is 3 months.

Component 1: LUCs with Engineering and Institutional Controls

LUCs for Zone 3 that are protective will be established and implemented in accordance with a post-ROD LUC RD. The LUC will both restrict residential land use and maintain a protective cover layer that meets CTDEEP RSR standards to be protective under I/C use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil, maintain the I/C site use conditions, and to prevent residential development of Zone 3. Engineering controls to be specified in the LUC RD would include the existing pavement and buildings that already cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. No unpaved areas exist in Zone 3. Pavement maintenance would be needed over the 6,200 square foot area where soil lead concentrations are greater than the I/C lead direct exposure and/or pollutant mobility PRGs; for costing purposes, it was assumed that 10 percent of that area would be repaved annually. Pavement maintenance would also be needed over the 42,560 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-5 shows the proposed areas in Zone 3 where LUCs would be required. The areas are differentiated by CERCLA and potential non-CERCLA concerns. The total area requiring CERCLA LUCs covers approximately 52,720 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, ELURs, meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 2: Monitoring

A groundwater monitoring program would be developed and implemented to evaluate potential migration of lead from soil to groundwater. For the purpose of this report, it was assumed that four groundwater samples would be regularly collected from wells installed in strategic locations to be identified in the monitoring plan and that the collected samples would be analyzed for lead. It was assumed for this report

that the monitoring frequency would be quarterly for the first 2 years, semi-annually for the next 2 years, annually the fifth year, and every 5 years thereafter.

Monitoring of compliance with LUCs would occur at least annually. The monitoring will confirm that regular pavement and building foundation maintenance are being performed.

Reviews would be performed every 5 years to evaluate site status, assess the continued adequacy of remedial activities, and determine whether further action is necessary. These site reviews are required because this alternative would allow lead to remain in soil at concentrations that prevent unrestricted use of the site.

Alternative S-3.3: Capping to Allow I/C Site Use and Prevent Leaching, LUCs (Engineering and Institutional Controls), and Monitoring

Alternative S-3.3 would consist of four major components: (1) capping to allow I/C site use and prevent leaching, (2) off-site disposal of excavated material, (3) LUCs with engineering and institutional controls, and (4) monitoring. The estimated times for implementation of the LUCs and cap for this alternative are 3 months and 1 month, respectively.

Component 1: Capping to Allow I/C Site Use and Prevent Leaching

Soil would be excavated to a depth of 2 feet bgs (paved area) to allow installation of the cap. Areas of soil with lead concentrations greater than the I/C direct exposure PRG to a depth of 2 feet bgs (paved areas) would be removed during excavation. Soil with SPLP/TCLP concentrations of lead greater than the I/C pollutant mobility PRG at depths greater than 2 feet bgs but above the mean high water table would be capped with an impervious cover system to prevent potential migration of lead from soil to groundwater. Capping would also address potential future unacceptable CERCLA risks under the I/C exposure scenario. Additional data collected during the soil PDI were used to update the estimated extent of contaminated soil. Figure 6-6 shows the proposed areas to be capped under this alternative.

For the purpose of this alternative, it is assumed that the foundation of former Building 31 already provides a suitable cap in this area. This foundation consists of a 2-foot-thick concrete slab over which has been added a 4-inch layer of asphalt to allow use of the area as a parking lot. In addition, much of the lead-contaminated soil beneath former Building 31 has been treated by in-situ chemical stabilization/solidification to the water table as part of a previous remedial action (HNUS, 1995). Therefore, no further capping of this area would be required.

The area to be excavated to allow installation of the cap is located along Albacore Road, west of former Building 31, and extends over an estimated total area of 6,200 square feet. Beneath that area, at 2 feet bgs, the area that exceeds the pollutant mobility PRG for I/C site use is estimated to extend over approximately 4,830 square feet; therefore, an impervious membrane liner would be placed at the bottom of the 6,200 square foot excavation over a 4,830 square foot area.

During construction activities, water sprinkling and perimeter air quality monitoring would be implemented to ensure that fugitive dust emissions are kept to an acceptable minimum. Appropriate controls such as silt curtains, sediment traps, and hay bales would also be used to minimize erosion and sedimentation. The excavated areas would be backfilled or capped as soon as possible, and on-site staging and stockpiling of excavated soil would be kept to a minimum. Any on-site stockpiles of excavated soil would be covered with an impervious synthetic liner at the end of each day's work.

Following excavation, confirmation samples would be collected from the walls of the excavated area to verify that soil with concentrations greater than the direct exposure PRG has been removed. After confirmation sampling is complete and the geomembrane is installed, the excavated area would be backfilled with clean soil and site pavement would be restored. The pavement system would consist of a separation geotextile, 6-inch layer of base course aggregate, 2-inch asphalt binder course, and 1-inch asphalt topping layer.

Component 2: Off-Site Disposal

Asphalt pavement debris generated during excavation activities would be segregated and recycled or, if required, disposed of at an off-site construction material landfill. PDI borings indicate that Zone 3 asphalt has an average thickness of 9 inches; therefore, it is estimated that 170 cy of asphalt debris would be removed from Zone 3.

Because soil would be excavated from above the water table, it is assumed that the excavated soil would contain minimal free water and would not have to be pretreated by on-site dewatering prior to off-site transportation and disposal.

To determine the proper method of disposal of the 290 cy of excavated soil, composite samples would be collected and analyzed for mass lead and TCLP lead. Based on current soil characterization data, it is anticipated that the results of these analyses would show that mass lead concentrations would be greater than the I/C direct exposure PRG and/or TCLP concentrations of lead in all of the excavated soil would be greater than the RCRA toxicity characteristic for lead (5 mg/L). Therefore, it is anticipated that the 240 cy of excavated soil would be identified as "high lead" (potential characteristic hazardous waste) and disposed of at an off-site treatment, storage and disposal facility (TSDF) where it would undergo

treatment by chemical stabilization/solidification prior to landfilling and 50 cy would be disposed as non-hazardous material. Volume computations are provided in Appendix H.3.

During off-site transportation of contaminated soil, appropriate spill prevention and control measures would be implemented, and DOT regulations would be followed.

Component 3: LUCs with Engineering and Institutional Controls

LUCs for Zone 3 that are protective will be established and implemented in accordance with a post-ROD LUC RD. The LUC will both restrict residential land use and maintain a protective cover layer that meets CTDEEP RSR standards to be protective under I/C use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil, maintain the I/C site use conditions, and to prevent residential development of Zone 3. Engineering controls to be specified in the LUC RD would include the cap, pavement and buildings that cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. No unpaved areas exist in Zone 3. Pavement maintenance would be required over a 4,830 square foot capped area; for costing purposes, it was assumed that 10 percent of that area would be repaved annually. Pavement maintenance would also be needed over the additional 43,930 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-5 shows the proposed areas in Zone 3 where LUCs would be required. The areas are differentiated by CERCLA and potential non-CERCLA concerns. The total area requiring CERCLA LUCs covers approximately 52,720 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, ELURs, meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may

transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 4: Monitoring

Long-term groundwater monitoring would be conducted to confirm that soil contaminants are not mobilizing and migrating to groundwater at unacceptable concentrations. In addition, LUC monitoring and 5-year reviews would be required for this alternative. The monitoring requirements for this alternative would be identical to Alternative S-3.2.

Alternative S-3.4: In-Situ Treatment (Stabilization/Solidification) to Allow I/C Site Use and Meet I/C PMCs, LUCs (Engineering and Institutional Controls), and Monitoring

Alternative S-3.4 would consist of three major components: (1) in-situ treatment to allow I/C site use and meet PMCs for I/C site use, (2) off-site disposal of excavated material, (3) LUCs with engineering and institutional controls, and (4) monitoring. The estimated times for implementation of the LUCs and in-situ treatment for this alternative are 3 months and 1 month, respectively.

Component 1: In-Situ Treatment to Allow I/C Site Use and Meet PMCs for I/C Site Use

Areas of soil with SPLP/TCLP concentrations of lead greater than its Zone 3 pollutant mobility PRG in the unsaturated zone would be treated using in-situ chemical stabilization/solidification to address pollutant mobility concerns. The area of soil with lead concentrations greater than the direct exposure PRG was estimated to also be the area of soil with concentrations greater than the pollutant mobility PRG. The in-situ chemical stabilization/solidification process would change the soil characteristics and reduce potential exposure to the contaminated soil, thereby reducing the direct exposure CERCLA risks associated with the soil. Additional data collected during the soil PDI were used to update the estimated extent of contaminated soil. Figure 6-7 shows the proposed area to be treated in-situ with chemical stabilization/solidification under this alternative.

For the purpose of this alternative, it is assumed that areas of soil known to have lead concentrations exceeding the pollutant mobility PRG but that are located beneath the former Building 31 foundation (now used as a parking area) would be classified as environmentally isolated and would not require in-situ treatment. In addition, much of the lead-contaminated soil beneath former Building 31 has already been treated by in-situ chemical stabilization/solidification to the water table as part of a previous remedial action (HNUS, 1995).

The area to be treated under this alternative is located along Albacore Road, west of former Building 31, and extends over an estimated total 6,200 square feet to a depth of 4 feet bgs, as shown on Figure 6-7.

Blending of contaminated soil with stabilization materials would be performed with a large-diameter auger (LDA). An LDA is typically 6 to 10 feet in diameter and would be used to blend the contaminated soil with controlled amounts of a pozzolanic reagent such as Portland cement and water to chemically stabilize the lead within the soil matrix. Each application of the LDA would generate a column of treated soil approximately 6 to 10 feet in diameter, and this would be repeated with a slight column-to-column overlap until all areas of contaminated soil have been treated. Soil would be treated by blending in Portland cement and water at the rate of approximately 5 percent (by weight) and 2 percent (by weight), respectively, for a total estimated use of approximately 60 tons of Portland cement and 5,870 gallons of water. It was estimated that approximately 240 LDA passes would be required to treat all of the contaminated soil above the water table. In-situ stabilization with Portland cement is regulated under Connecticut standards as a discharge to the waters of the state. Therefore, the activity will be conducted in compliance with the substantive standards under the CTDEEP Water Pollution Control regulations.

Prior to treatment, treatability testing would be performed to confirm that the ratio of Portland cement and water mentioned above is appropriate to achieve properly stabilized soil. Also prior to treatment, a detailed survey would be made of underground obstacles (e.g., underground pipes or cables) in the area to be treated and, when practical, these obstacles would be moved. If obstacles prevent the use of a blending auger in certain areas and if moving of these obstacles is not practical, the Portland cement and water would be manually worked into the soil to be treated using hand tools such as shovels, provided that the areas to be so treated are relatively small in size. Accordingly, it is assumed for costing purposes that underground obstacles would not actually prevent the implementation of in-situ chemical stabilization/solidification.

Following treatment, confirmation samples would be collected beneath and around the treated area to verify that all contaminated soil has been treated. Additional confirmation samples would also be collected from the treated area within approximately 1 month and tested for SPLP concentrations of lead to verify that treated soil meets the Zone 3 I/C pollutant mobility PRG for lead.

After treatment, any disturbed utilities and site pavement would be restored. The pavement system would consist of a separation geotextile, 6-inch layer of base course aggregate, 2-inch asphalt binder course and 1-inch asphalt topping layer.

Component 2: Off-Site Disposal

Asphalt pavement would be excavated prior to treatment of the soil and the resulting asphalt debris would be recycled or, if required, disposed of at an off-site construction material landfill. PDI borings indicate that Zone 3 asphalt has an average thickness of 9 inches; therefore, it is estimated that 170 cy of asphalt debris would be removed from Zone 3.

The blending action and addition of Portland cement would result in an increase in the volume of treated soil of approximately 75 cy. Because the soil would be treated, it could be disposed of offsite at a municipal solid waste landfill after testing confirmed that it was nonhazardous solid waste.

Component 3: LUCs with Engineering and Institutional Controls

LUCs for Zone 3 that are protective will be established and implemented in accordance with a post-ROD LUC RD. The LUC will both restrict residential land use and maintain a protective cover layer that meets CTDEEP RSR standards to be protective under I/C use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil, maintain the I/C site use conditions, and to prevent residential development of Zone 3. Engineering controls to be specified in the LUC RD would include the pavement and buildings that cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. No unpaved areas exist in Zone 3. Pavement maintenance would also be needed over the 48,760 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-5 shows the proposed areas in Zone 3 where LUCs would be required. The areas are differentiated by CERCLA and potential non-CERCLA concerns. The total area requiring CERCLA LUCs covers approximately 52,720 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware

of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, ELURs, meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 4: Monitoring

Long-term groundwater monitoring would be conducted to confirm that soil contaminants are not mobilizing and migrating to groundwater at unacceptable concentrations. In addition, LUC monitoring and 5-year reviews would be required for this alternative. The monitoring requirements for this alternative would be identical to Alternative S-3.2.

Alternative S-3.5A: Excavation to Meet I/C DECs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring

Alternative S-3.5A would consist of four major components: (1) excavation to meet direct exposure I/C PRGs, (2) off-site disposal of excavated material, (3) LUCs with engineering and institutional controls, and (4) monitoring. The estimated times for implementation of the LUCs and excavation for this alternative are 3 months and 1 month, respectively.

Component 1: Excavation to Meet the Direct Exposure I/C PRGs

Areas of soil with mass concentrations of lead greater than its I/C direct exposure PRG to a depth of 2 feet bgs (paved area) would excavated to address unacceptable CERCLA risks associated with I/C exposure. Some of this soil is expected to have SPLP/TCLP lead concentrations greater than the I/C pollutant mobility PRG; therefore, the pollutant mobility concerns associated with this soil would be addressed by excavation. Additional data collected during the Soil PDI were used to update the estimated extent of contaminated soil. Figure 6-8 shows the proposed areas to be excavated under this alternative.

For the purpose of this alternative, it is assumed that the foundation of former Building 31 renders the soil beneath it inaccessible and not subject to the direct exposure PRG. This foundation consists of a 2-foot-thick concrete slab over which has been added a 4-inch layer of asphalt to allow use of the area as a parking lot. In addition, much of the lead-contaminated soil beneath former Building 31 has been treated

by in-situ chemical stabilization/solidification to the water table as part of a previous remedial action (HNUS, 1995).

Prior to excavation, a detailed survey would be made of underground obstacles (e.g., underground pipes or cables) in the areas to be excavated and, when practical, these obstacles would be moved. If obstacles prevent the use of a normal backhoe or grade-all in certain areas and if moving of these obstacles is not practical, a small backhoe or hand shovels would be used provided that the areas to be so excavated are relatively small in size. For this alternative, it is assumed that no underground obstacles would prevent the excavation of contaminated soil.

The area to be excavated is located along Albacore Road, west of former Building 31, and extends over an estimated total of 5,120 square feet to a depth of 2 feet bgs. An estimated 380 cy of contaminated soil and asphalt debris would be removed by excavation. Computations of excavation volumes are provided in Appendix H.3.

During construction activities, water sprinkling and perimeter air quality monitoring would be implemented to ensure that fugitive dust emissions are kept to an acceptable minimum. Appropriate controls such as silt curtains, sediment traps, and hay bales would also be used to minimize erosion and sedimentation. The excavated areas would be backfilled as soon as possible, and on-site staging and stockpiling of excavated soil would be kept to a minimum. Any on-site stockpiles of excavated soil would be covered with an impervious synthetic liner at the end of each day's work.

Following excavation, confirmation samples would be collected from the walls of the excavated area to verify that soil with concentrations greater than the direct exposure I/C PRG has been removed. After confirmation sampling is complete, the excavated area would be backfilled with clean soil and site pavement would be restored. The pavement system would consist of a separation geotextile, 6-inch layer of base course aggregate, 2-inch asphalt binder course, and 1-inch asphalt topping layer.

Component 2: Off-Site Disposal

Asphalt pavement debris generated during excavation would be segregated and recycled or, if required, disposed of at an off-site construction material landfill. PDI borings indicate that Zone 3 asphalt has an average thickness of 9 inches; therefore, it is estimated that 140 cy of asphalt debris would be removed from Zone 3.

Because soil would be excavated from above the water table, it is assumed that the excavated soil would contain minimal free water and would not have to be pretreated by on-site dewatering prior to off-site transportation and disposal.

To determine the proper method of disposal of the 240 cy of excavated soil, composite samples would be collected and analyzed for mass lead and TCLP lead. Based on current soil characterization data, it is anticipated that the results of these analyses would show that mass lead concentrations would be greater than the I/C direct exposure PRG and/or TCLP concentrations of lead in all of the excavated soil would be greater than the RCRA toxicity characteristic for lead (5 mg/L). Therefore, it is anticipated that the 240 cy of excavated soil would be identified as “high lead” (potential characteristic hazardous waste) and disposed of at an off-site TSDF where it would undergo treatment by chemical stabilization/solidification prior to landfilling. Volume computations are provided in Appendix H.3.

During off-site transportation of contaminated soil, appropriate spill prevention and control measures would be implemented, and DOT regulations would be followed.

Component 3: LUCs with Engineering and Institutional Controls

LUCs for Zone 3 that are protective will be established and implemented in accordance with a post-ROD LUC RD. The LUC will both restrict residential land use and maintain a protective cover layer that meets CTDEEP RSR standards to be protective under I/C use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil, maintain the I/C site use conditions, and to prevent residential development of Zone 3. Engineering controls to be specified in the LUC RD would include the pavement and buildings that already cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. No unpaved areas exist in Zone 3. Pavement maintenance would be needed in the 6,200 square foot area where soil lead concentrations are greater than the I/C pollutant mobility PRG;for costing purposes, it was assumed that 10 percent of that area would be repaved annually. Pavement maintenance would also be needed over the additional 42,560 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-5 shows the proposed areas in Zone 3 where LUCs would be required.

The areas are differentiated by CERCLA and potential non-CERCLA concerns. The area requiring CERCLA LUCs covers approximately 52,720 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, ELURs, meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 4: Monitoring

Long-term groundwater monitoring would be conducted to confirm that soil contaminants are not mobilizing and migrating to groundwater at unacceptable concentrations. In addition, LUC monitoring and 5-year reviews would be required for this alternative. The monitoring requirements for this alternative would be identical to Alternative S-3.2.

<u>Alternative S-3.5B: Excavation to Meet I/C DECs and PMCs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring.</u>

Alternative S-3.5B would consist of four major components: (1) excavation to meet direct exposure and pollutant mobility PRGs for I/C site use, (2) off-site disposal of excavated soil, (3) LUCs with engineering and institutional controls, and (4) monitoring. The estimated times for implementation of the LUCs and excavation for this alternative are 3 months and 1 month, respectively.

Component 1: Excavation to Meet Direct Exposure and Pollutant Mobility PRGs for I/C Site Use

Areas of soil with mass concentrations of lead greater than its I/C direct exposure PRG to a depth of 2 feet bgs (paved area), or with SPLP/TCLP concentrations of lead greater than its I/C pollutant mobility PRG in the remainder of the unsaturated zone (additional 2 feet bgs to the water table) would be excavated to address unacceptable CERCLA risks and pollutant mobility concerns. However, for the purpose of this alternative, it is assumed that the area of soil known to exceed either of these criteria but that are located beneath the former Building 31 foundation (now used as a parking area) would not require excavation because it would be classified as environmentally isolated and inaccessible.

Prior to excavation, a detailed survey would be made of underground obstacles (e.g., underground pipes or cables) in the areas to be excavated and, when practical, these obstacles would be moved. If obstacles prevent the use of a normal backhoe or grade-all in certain areas and if moving of these obstacles is not practical, a small backhoe or hand shovels would be used provided that the areas to be so excavated are relatively small in size. For this alternative, it is assumed that no underground obstacles would prevent the excavation of contaminated soil.

The area to be excavated would be located along Albacore Road, west of former Building 31, and extend over an estimated total 6,200 square feet to a depth of up to 4 feet bgs, as illustrated on Figure 6-7. An estimated total of 920 cy of contaminated soil and asphalt debris would be removed through excavation. Computations of excavation volumes are provided in Appendix H.3.

Because excavation of Zone 3 contaminated soil under this alternative would only extend to an estimated maximum depth of 4 feet bgs, it is assumed that all excavation would take place above the water table and that only minimal shoring and no excavation dewatering would be required.

During excavation, water sprinkling and perimeter air quality monitoring would be implemented to ensure that fugitive dust emissions are kept to an acceptable minimum. Appropriate controls such as silt curtains, sediment traps, and hay bales would also be used to minimize erosion and sedimentation. The excavated areas would be backfilled as soon as possible, and on-site staging and stockpiling of excavated soil would be kept to a minimum. Any on-site stockpiles of excavated soil would be covered with an impervious synthetic liner at the end of each day's work.

Following excavation, confirmation samples would be collected from the walls of the excavated area to verify that contaminated soil has been removed. After confirmation sampling is complete, the excavated area would be backfilled with clean soil and site pavement would be restored. The pavement system would consist of a separation geotextile, 6-inch layer of base course aggregate, 2-inch asphalt binder course, and 1-inch asphalt topping layer.

Component 2: Off-Site Disposal

Because soil would be excavated from above the water table, it is assumed that the excavated soil would contain minimal free water and would not have to be pretreated by on-site dewatering prior to off-site transportation and disposal.

Asphalt pavement debris generated during excavation activities would be segregated and recycled or, if required, disposed of at an off-site construction material landfill. PDI borings indicate that Zone 3 asphalt

has an average thickness of 9 inches; therefore, it is estimated that 170 cy of asphalt debris would be removed from Zone 3.

To determine the proper method of disposal of the 750 cy of excavated soil, composite samples would be collected and analyzed for mass lead and TCLP lead. Based on current soil characterization data, it is anticipated that the results of these analyses would show that mass lead concentrations would be greater than the I/C direct exposure PRG and/or TCLP concentrations of lead in all of the excavated soil would be greater than RCRA toxicity characteristic for lead (5 mg/L). Therefore, it is anticipated that the 620 cy of excavated soil would be identified as “high lead” (potential characteristic hazardous waste) and disposed of at an off-site TSDF where it would undergo treatment by chemical stabilization/solidification prior to landfilling and 130 cy would be disposed of as non-hazardous material. Volume computations are provided in Appendix H.3.

During off-site transportation of contaminated soil, appropriate spill prevention and control measures would be implemented, and DOT regulations would be followed.

Component 3: LUCs with Engineering and Institutional Controls

LUCs for Zone 3 that are protective will be established and implemented in accordance with a post-ROD LUC RD. The LUC will both restrict residential land use and maintain a protective cover layer that meets CTDEEP RSR standards to be protective under I/C use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil, maintain the I/C site use conditions, and to prevent residential development of Zone 3. Engineering controls to be specified in the LUC RD would include the pavement and buildings that cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. No unpaved areas exist in Zone 3. Pavement maintenance would be needed over the 48,760 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-5 shows the proposed areas in Zone 3 where LUCs would

be required. The areas are differentiated by CERCLA and potential non-CERCLA concerns. The total area requiring CERCLA LUCs covers approximately 52,720 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, ELURs, meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 4: Monitoring

Long-term groundwater monitoring would be conducted to confirm that soil contaminants are not mobilizing and migrating to groundwater at unacceptable concentrations. In addition, LUC monitoring and 5-year reviews would be required for this alternative. The monitoring requirements for this alternative would be identical to Alternative S-3.2.

Alternative Evaluation

Detailed evaluations of Alternatives S-3.1, S-3.2, S-3.3, S-3.4, and S-3.5B can be found in the Lower Subase FS report (Tetra Tech, 2010d). A detailed evaluation for Alternative S-3.5A was not completed because it would be similar to the detailed evaluation for Alternative S-3.3. Generally, no changes have been made to the Lower Subase FS alternatives, except for estimated volumes and costs.

Chemical-specific ARARs for Alternative S-3.1 are provided in Table 6-19. Chemical-, location-, and action-specific ARARs for the remaining alternatives are provided in the following tables:

- Alternative S-3.2 - Tables 6-20 through 6-22, respectively
- Alternative S-3.3 and S-3.5A - Tables 6-24 through 6-26, respectively
- Alternative S-3.4 - Tables 6-27 through 6-29, respectively
- Alternative S-3.5B - Tables 6-30 through 6-32, respectively

Table 6-33 provides a comparative analysis of Zone 3 soil remedial alternatives. Remedial cost estimates are provided in Appendix K. . The remedial alternatives for the I/C scenario must consider the potential residential concerns that need to be addressed.

6.2.1.3 Zone 4

The following soil remedial alternatives under the I/C scenario were retained for Zone 4. For all Zone 4 I/C alternatives, the COCs are lead and commingled TPH, the I/C direct exposure PRG for lead is 1,090 mg/kg, the I/C pollutant mobility PRG for lead is 0.24 mg/L, and the I/C pollutant mobility PRG for TPH is 2,500 mg/kg.

Alternative S-4.1: No Action

This would be the same CERCLA-mandated alternative as Alternative S-1.1.

Alternative S-4.2: LUCs (Engineering and Institutional Controls) and Monitoring

Alternative S-4.2 would consist of two major components: (1) LUCs with engineering and institutional controls and (2) monitoring. The estimated time for implementation of the LUCs for this alternative is 3 months. Although Alternative S-4.2 is presented, this alternative will not be considered for implementation because the pavement cover does not meet all chemical-specific ARARs (CTDEEP RSR Alternative PMC).

Component 1: LUCs with Engineering and Institutional Controls

LUCs for Zone 4 will be established and implemented in accordance with a post-ROD LUC RD. The LUC will restrict residential land use; however, the CTDEEP RSR lead Alternative PMC is exceeded under industrial/commercial use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil , maintain the I/C site use conditions, and to prevent residential development of Zone 4. Engineering controls to be specified in the LUC RD would be the existing pavement and buildings that already cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. The unpaved area in Zone 4 is outside of the CERCLA LUC area. Pavement maintenance would be needed in the 13,100 square foot area where soil lead concentrations are greater than the I/C direct exposure and pollutant mobility PRGs; for costing purposes, it was assumed that 10 percent of that area would be repaved annually. The pavement would

minimize exposure to contaminated soil and reduce the CERCLA risks associated with it to acceptable levels. Although the pavement would reduce infiltration through the contaminated soil, calculations provided in Appendix I indicate that pavement over soil that exceeds the pollutant mobility PRGs may not be sufficient to reduce pollutant mobility in Zone 4. Pavement maintenance would also be needed over the 30,940 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-5 shows the proposed areas in Zone 4 where LUCs would be required. The areas are differentiated by CERCLA and potential non-CERCLA concerns. The area requiring CERCLA LUCs covers approximately 46,680 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, ELURs, meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 2: Monitoring

A groundwater monitoring program would be developed and implemented to evaluate potential migration of lead and TPH from soil to groundwater. For the purpose of this report, it was assumed that four groundwater samples would be regularly collected from wells installed in strategic locations to be identified in the monitoring plan and that the collected samples would be analyzed for lead and TPH. It was assumed for this report that the monitoring frequency would be quarterly for the first 2 years, semi-annually for the next 2 years, annually the fifth year, and every 5 years thereafter.

Monitoring of compliance with LUCs would occur at least annually. The monitoring will confirm that regular pavement and building foundation maintenance are being performed.

Reviews would be performed every 5 years to evaluate site status, assess the continued adequacy of remedial activities, and determine whether further action is necessary. These site reviews are required because this alternative would allow lead to remain in soil at concentrations that prevent unrestricted use of the site.

Alternative S-4.3: Capping to Allow I/C Site Use and Prevent Leaching, LUCs (Engineering and Institutional Controls), and Monitoring

Alternative S-4.3 would consist of four major components: (1) capping to allow I/C site use and prevent leaching, (2) off-site disposal of excavated material, (3) LUCs with engineering and institutional controls, and (4) monitoring. The estimated times for implementation of the LUCs and capping for this alternative are 3 months and 2 months, respectively.

Component 1: Capping to Allow I/C Site Use and Prevent Leaching

Soil would be excavated to a depth of 2 feet bgs (paved area) to allow installation of the cap. Excavation of this soil will address unacceptable I/C direct exposure CERCLA risks in areas where soil mass concentrations of lead are greater than its I/C direct exposure PRG, I/C pollutant mobility concerns where SPLP/TCLP concentrations of lead are greater than the I/C pollutant mobility PRG, and/or I/C pollutant mobility concerns where concentrations of TPH are greater than its I/C pollutant mobility PRG. In areas where soil lead concentrations exceed the lead pollutant mobility PRG at depths greater than 2 feet bgs but above the mean high water table, it would be capped with an impervious cover system to prevent potential migration of lead from soil to groundwater. Additional data collected during the soil PDI were used to update the estimated extent of contaminated soil. Figure 6-9 shows the proposed area to be capped under this alternative.

The area to be excavated to allow installation of the cap is located east and west of Building 79 and extends over an estimated total of 11,600 square feet. Beneath that area, at 2 feet bgs, the area that exceeds the pollutant mobility PRG for I/C site use is estimated to extend over approximately 8,720 square feet; therefore, an impervious membrane liner would be placed at the bottom of the excavation over an 8,720 square foot area. An additional area north of Building 79 (1,500 square feet) would also be excavated to 2 feet bgs but no cap would be required in that area because there would be no remaining pollutant mobility issues after excavation is completed.

During construction activities, water sprinkling and perimeter air quality monitoring would be implemented to ensure that fugitive dust emissions are kept to an acceptable minimum. Appropriate controls such as silt curtains, sediment traps, and hay bales would also be used to minimize erosion and sedimentation. The excavated areas would be backfilled or capped as soon as possible, and on-site staging and

stockpiling of excavated soil would be kept to a minimum. Any on-site stockpiles of excavated soil would be covered with an impervious synthetic liner at the end of each day's work. In addition, during the excavation of contaminated soil in close proximity to Building 79, care would be taken not to undermine the building foundation.

Following excavation, confirmation samples would be collected from the walls of the excavated area to verify that soil with concentrations greater than the direct exposure PRG has been removed. After confirmation sampling is complete and the geomembrane is installed, the excavated area would be backfilled with clean soil and site pavement would be restored. The pavement system would consist of a separation geotextile, 6-inch layer of base course aggregate, a 2-inch asphalt binder course, and 1-inch asphalt topping layer.

Component 2: Off-Site Disposal

Asphalt pavement debris generated during excavation activities would be segregated and recycled or, if required, disposed of at an off-site construction material landfill. PDI borings indicate that Zone 4 asphalt has an average thickness of 6 inches; therefore, it is estimated that 240 cy of asphalt debris would be removed from Zone 4.

Because soil would be excavated from above the water table, it is assumed that the excavated soil would contain minimal free water and would not have to be pretreated by on-site dewatering prior to off-site transportation and disposal.

To determine the proper method of disposal of the 730 cy of excavated soil, composite samples would be collected and analyzed for mass lead and TCLP lead. Based on current soil characterization data, it is anticipated that the 650 cy of excavated soil would be identified as "high lead" (potential characteristic hazardous waste) and disposed at an off-site TSDF where it would undergo treatment by chemical stabilization/solidification prior to landfilling, 20 cy of excavated soil would be identified as "high TPH" and disposed of at an off-site TSDF where it would undergo treatment by LTTD prior to landfilling, and 60 cy would be disposed of at a municipal waste landfill. Volume computations are provided in Appendix H.3.

During off-site transportation of contaminated soil, appropriate spill prevention and control measures would be implemented, and DOT regulations would be followed.

Component 3: LUCs with Engineering and Institutional Controls

LUCs for Zone 4 that are protective will be established and implemented in accordance with a post-ROD LUC RD. The LUC will both restrict residential land use and maintain a protective cover layer that meets

CTDEEP RSR standards to be protective under I/C use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil, maintain the I/C site use conditions, and to prevent residential development of Zone 4. Storm sewer upgrade and maintenance would be needed at locations where storm sewer lines pass through contaminated soil. One of the principal engineering controls that would be specified in the LUC RD would be the regular maintenance of the cap, pavement, and buildings that cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. The unpaved area in Zone 4 is outside of the CERCLA LUC area. Pavement maintenance would be required over a 8,720 square foot capped area; for costing purposes, it was assumed that 10 percent of that area would be repaved annually. Pavement maintenance would also be needed over the additional 35,320 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-5 shows the proposed areas in Zone 4 where LUCs would be required. The areas are differentiated by CERCLA and potential non-CERCLA concerns. The total area requiring CERCLA LUCs covers approximately 46,680 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, ELURs, meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 4: Monitoring

Long-term groundwater monitoring would be conducted to confirm that soil contaminants are not mobilizing and migrating to groundwater at unacceptable concentrations. In addition, LUC monitoring and 5-year reviews would be required for this alternative. The monitoring requirements for this alternative would be identical to Alternative S-4.2.

Alternative S-4.4: In-Situ Treatment (Enhanced Bioremediation and Stabilization/Solidification) to Allow I/C Site Use and Meet I/C PMCs, LUCs (Engineering and Institutional Controls), and Monitoring

Alternative S-4.4 would consist of three major components: (1) in-situ treatment to allow I/C site use and meet PMCs for I/C site use, (2) off-site disposal of excavated material, (3) LUCs with engineering and institutional controls, and (4) monitoring. The estimated times for implementation of the LUCs and in-situ treatment for this alternative are 3 months and 16 months, respectively.

Component 1: In-Situ Treatment to Allow I/C Site Use and Meet PMCs for I/C Site Use

Areas of soil with SPLP/TCLP concentrations greater than the Zone 4 I/C lead pollutant mobility PRG in the unsaturated zone would be treated using in-situ chemical stabilization/solidification to address pollutant mobility concerns. Where soil with TPH concentrations exceeding its pollutant mobility PRG is commingled with lead-contaminated soil, the TPH contamination in the soil would be treated using in-situ enhanced bioremediation. The in-situ chemical stabilization/solidification process would change the soil characteristics and reduce potential exposure to the contaminated soil, thereby reducing the direct exposure CERCLA risks associated with the soil. Additional data collected during the soil PDI were used to update the estimated extent of contaminated soil. The area of soil with lead concentrations greater than the direct exposure PRG was estimated to also be the area of soil with soil concentrations greater than the pollutant mobility PRG. An additional 1,500 square foot area surrounding 13TB4A was estimated to have lead concentrations greater than the lead pollutant mobility PRG, and a small area within the immediate vicinity of 13TB4 also has TPH concentrations greater than the TPH pollutant mobility PRG. Figure 6-10 shows the proposed areas to be treated in-situ under this alternative.

The areas to be treated under this alternative extend over an estimated total 13,100 square feet as shown on Figure 6-10. In-situ treatment would extend to a depth of 2 feet in the area north of Building 79, to a depth of 4 feet in the area west of Building 79, and to a depth of 5 feet in the area east of Building 79.

In-situ bioremediation would consist of using oxygen release compound (ORC) to enhance the growth of indigenous microorganisms and augment the natural aerobic biodegradation of TPH in soil. For the purposes of this alternative, it is assumed that an ORC such as magnesium peroxide would be blended in

the area of soil to be treated using a backhoe and that a single application would be required. An estimated 20 cy of soil would be treated in this way by blending in magnesium peroxide as a 8-percent (by weight) solution at the rate of approximately 10 pounds of dry magnesium peroxide per pound of TPH to be removed, for an estimated total of approximately 2,100 pounds of dry magnesium peroxide (or 2,900 gallons of 8-percent solution). The blending action and addition of ORC would result in an increase in the volume of treated soil by approximately 2 cy. Because the bioremediation process would take at least 1 year to complete, this incremental volume of soil would be kept on site and dispersed through appropriate regrading as necessary to accommodate existing buildings and other structures. The exact design of the treatment system would be verified through treatability testing prior to implementation. Conceptual design calculations for in-situ bioremediation are provided in Appendix J.1. The addition of amendments to enhance in-situ aerobic degradation is regulated under Connecticut standards. Therefore, the activity will be conducted in compliance with the substantive standards under the CTDEEP Water Pollution Control regulations which address “Enhanced Aerobic Biodegradation”.

In addition, 1,780 cy of soil would be treated for lead. For treatment of contaminated shallow soil near 13TB4A, it is assumed that a backhoe would be used to blend contaminated soil in that area with controlled amounts of treatment materials to chemically stabilize the lead and TPH within the soil matrix. For deeper applications, an LDA typically 6 to 10 feet in diameter would be used to blend the contaminated soil with controlled amounts of a pozzolanic reagent such as Portland cement and water to chemically stabilize the lead within the soil matrix. Each application of the LDA would generate a column of treated soil approximately 6 to 10 feet in diameter, and this would be repeated with a slight column-to-column overlap until all areas of contaminated soil have been treated. Soil would be treated by blending in Portland cement and water at the rate of approximately 5 percent (by weight) and 2 percent (by weight), respectively, for a total estimated use of approximately 150 tons of Portland cement and 14,000 gallons of water. It was estimated that approximately 450 LDA passes would be required to treat all of the contaminated soil above the water table. In-situ stabilization with Portland cement is regulated under Connecticut standards as a discharge to the waters of the state. Therefore, the activity will be conducted in compliance with the substantive standards under the CTDEEP Water Pollution Control regulations.

Prior to treatment, treatability testing would be performed to confirm the ratio of Portland cement and water mentioned above is appropriate to achieve properly stabilized soil. Also prior to treatment, a detailed survey would be made of underground obstacles (e.g., underground pipes or cables) in the area to be treated and, when practical, these obstacles would be moved. If obstacles prevent the use of a blending auger in certain areas and if moving of these obstacles is not practical, the Portland cement and water would be manually worked into the soil to be treated using hand tools such as shovels, provided that the areas to be so treated are relatively small in size. Accordingly, it is assumed for costing purposes

that underground obstacles would not actually prevent the implementation of in-situ chemical stabilization/solidification.

Following treatment, confirmation samples would be collected beneath and around the treated area to verify that all contaminated soil has been treated. Additional confirmation samples would also be collected within approximately 1 month from the area treated with chemical stabilization/solidification and within 1 year from the area treated with enhanced bioremediation. These additional samples would be tested for SPLP lead concentrations and mass concentrations of TPH, respectively, to verify that the treated soil meets the Zone 4 I/C PRGs.

After treatment, any disturbed utilities and site pavement would be restored. The pavement system would consist of a separation geotextile, 6-inch layer of base course aggregate, 2-inch asphalt binder course, and 1-inch asphalt topping layer.

Component 2: Off-Site Disposal

Asphalt pavement would be excavated prior to treatment of the soil and the resulting asphalt debris would be recycled or, if required, disposed of at an off-site construction material landfill. PDI borings indicate that Zone 4 asphalt has an average thickness of 6 inches; therefore, it is estimated that 240 cy of asphalt debris would be removed from Zone 4.

The blending action and addition of ORC and Portland cement would result in an increase in the volume of treated soil of approximately 180 cy. Because this soil would be treated, it could be disposed of off site at a municipal solid waste landfill after testing confirmed that it was nonhazardous solid waste. An additional 120 cy of soil would be excavated and disposed of off site to allow for a 9-inch thick pavement system to replace the existing 6-inch thick asphalt.

Component 3: LUCs with Engineering and Institutional Controls

LUCs for Zone 4 that are protective will be established and implemented in accordance with a post-ROD LUC RD. The LUC will both restrict residential land use and maintain a protective cover layer that meets CTDEEP RSR standards to be protective under I/C use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil, maintain the I/C site use conditions, and to prevent residential development of Zone 4. Engineering controls to be specified in the LUC RD would include the pavement and buildings that cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it

is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. The unpaved area in Zone 4 is outside of the CERCLA LUC area. Pavement maintenance would also be needed over the 44,040 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-5 shows the proposed areas in Zone 4 where LUCs would be required. The areas are differentiated by CERCLA and potential non-CERCLA concerns. The total area requiring CERCLA LUCs covers approximately 46,680 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, ELURs, meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 4: Monitoring

Long-term groundwater monitoring would be conducted to confirm that soil contaminants are not mobilizing and migrating to groundwater at unacceptable concentrations. In addition, LUC monitoring and 5-year reviews would be required for this alternative. The monitoring requirements for this alternative would be identical to Alternative S-4.2.

<u>Alternative S-4.5A: Excavation to Meet I/C DECs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring</u>

Alternative S-4.5A would consist of four major components: (1) excavation to meet direct exposure I/C PRGs, (2) off-site disposal of excavated material, (3) LUCs with engineering and institutional controls, and (4) monitoring. The estimated times for implementation of the LUCs and excavation for this

alternative are 3 months and 1.5 months, respectively. Although Alternative S-4.5A is presented, this alternative will not be considered for implementation because the pavement cover does not meet all chemical-specific ARARs (CTDEEP RSR Alternative PMC).

Component 1: Excavation to Meet the Direct Exposure I/C PRGs

The area of soil with mass concentrations of lead greater than its I/C direct exposure PRG to a depth of 2 feet bgs (paved area) would be excavated to address unacceptable I/C CERCLA risks. Some of this soil would also have SPLP/TCLP lead concentrations greater than the I/C pollutant mobility PRG; therefore, the pollutant mobility concerns associated with this soil would be addressed by excavation. Additional data collected during the soil PDI were used to update the estimated extent of contaminated soil. Figure 6-11 shows the proposed areas to be excavated under this alternative.

Prior to excavation, a detailed survey would be made of underground obstacles (e.g., underground pipes or cables) in the areas to be excavated and, when practical, these obstacles would be moved. If obstacles prevent the use of a normal backhoe or grade-all in certain areas and if moving of these obstacles is not practical, a small backhoe or hand shovels would be used provided that the areas to be so excavated are relatively small in size. For this alternative, it is assumed that no underground obstacles would prevent the excavation of contaminated soil.

The area to be excavated is located east and west of Building 79 and extends over an estimated total of 11,600 square feet. An estimated 860 cy of contaminated soil and asphalt debris would be removed by excavation. Computations of excavation volumes are provided in Appendix H.3.

During construction activities, water sprinkling and perimeter air quality monitoring would be implemented to ensure that fugitive dust emissions are kept to an acceptable minimum. Appropriate controls such as silt curtains, sediment traps, and hay bales would also be used to minimize erosion and sedimentation. The excavated areas would be backfilled as soon as possible, and on-site staging and stockpiling of excavated soil would be kept to a minimum. Any on-site stockpiles of excavated soil would be covered with an impervious synthetic liner at the end of each day's work. In addition, during the excavation of contaminated soil in close proximity to Building 79, care would be taken not to undermine the foundation of the building.

Following excavation, confirmation samples would be collected from the walls of the excavated area to verify that soil with concentrations greater than the direct exposure PRG has been removed. After confirmation sampling is complete, the excavated area would be backfilled with clean soil and the site pavement would be restored. The pavement system would consist of a separation geotextile, 6-inch layer of base course aggregate, 2-inch asphalt binder course, and 1-inch asphalt topping layer.

Component 2: Off-Site Disposal

Asphalt pavement debris generated during excavation would be segregated and recycled or, if required, disposed of at an off-site construction material landfill. PDI borings indicate that Zone 4 asphalt has an average thickness of 6 inches; therefore, it is estimated that 215 cy of asphalt debris would be removed from Zone 4.

Because soil would be excavated from above the water table, it is assumed that the excavated soil would contain minimal free water and would not have to be pretreated by on-site dewatering prior to off-site transportation and disposal.

To determine the proper method of disposal of the 645 cy of excavated soil, composite samples would be collected and analyzed for mass lead and TCLP lead. Based on current soil characterization data, it is anticipated that the results of these analyses would show that mass lead concentrations would be greater than the I/C direct exposure PRG and/or TCLP concentrations of lead in all of the excavated soil would be greater than the RCRA toxicity characteristic for lead (5 mg/L). Therefore, it is anticipated that the 645 cy of excavated soil would be identified as “high lead” (potential characteristic hazardous waste) and disposed of at an off-site TSDF where it would undergo treatment by chemical stabilization/solidification prior to landfilling. Volume computations are provided in Appendix H.3.

During off-site transportation of contaminated soil, appropriate spill prevention and control measures would be implemented, and DOT regulations would be followed.

Component 3: LUCs with Engineering and Institutional Controls

LUCs for Zone 4 will be established and implemented in accordance with a post-ROD LUC RD. The LUC will restrict residential land use; however, the CTDEEP RSR lead Alternative PMC is exceeded under industrial/commercial use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil, maintain the I/C site use conditions, and to prevent residential development of Zone 4. Storm sewer upgrade and maintenance would be needed at locations where storm sewer lines pass through contaminated soil. Engineering controls to be specified in the LUC RD would include pavements and buildings that cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. The unpaved area in

Zone 4 is outside of the CERCLA LUC area. Pavement maintenance would be needed in the 13,100 square foot of area where the soil concentrations are greater than the I/C lead pollutant mobility PRGs; for costing purposes, it was assumed that 10 percent of that area would be repaved annually. Pavement maintenance would also be needed over the additional 30,940 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-5 shows the proposed areas in Zone 4 where LUCs would be required. The areas are differentiated by CERCLA and potential non-CERCLA concerns. The area requiring CERCLA LUCs covers approximately 46,680 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, ELURs, meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 4: Monitoring

Long-term groundwater monitoring would be conducted to confirm that soil contaminants are not mobilizing and migrating to groundwater at unacceptable concentrations. In addition, LUC monitoring and 5-year reviews would be required for this alternative. The monitoring requirements for this alternative would be identical to Alternative S-4.2.

<u>Alternative S-4.5B: Excavation to Meet I/C DECs and PMCs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring</u>

Alternative S-4.5B would consist of four major components: (1) excavation to meet direct exposure and pollutant mobility PRGs for I/C site use, (2) off-site disposal of excavated soil, (3) LUCs with engineering and institutional controls, and (4) monitoring. The estimated times for implementation of the LUCs and excavation for this alternative are 3 months and 3 months, respectively.

Component 1: Excavation to Meet Direct Exposure and Pollutant Mobility PRGs for I/C Site Use

Areas of soil with mass concentrations of lead greater than its I/C direct exposure PRG to a depth of 2 feet bgs (paved area), or with SPLP/TCLP concentrations of lead or TPH greater than their Zone 4 I/C pollutant mobility PRGs in the remainder of the unsaturated zone (additional 2 to 3 feet bgs to the water table) would be excavated to address unacceptable CERCLA risks and pollutant mobility concerns.

Prior to excavation, a detailed survey would be made of underground obstacles (e.g., underground pipes or cables) in the areas to be excavated and, when practical, these obstacles would be moved. If obstacles prevent the use of a normal backhoe or grade-all in certain areas and if moving of these obstacles is not practical, a small backhoe or hand shovels would be used provided that the areas to be so excavated are relatively small in size. For this alternative, it is assumed that no underground obstacles would prevent the excavation of contaminated soil.

The area to be excavated under this alternative extends over an estimated total 13,100 square feet, as shown on Figure 6-10. Excavation would extend to a depth of 2 feet in the area north of Building 79, to a depth of 4 feet in the area west of Building 79, to a depth of 5 feet in the area east of Building 79. An estimated total of 2,020 cy of contaminated soil and asphalt debris would be removed through excavation. Computations of excavation volumes are provided in Appendix H.3.

Because excavation of Zone 4 contaminated soil under this alternative would only extend to an estimated maximum depth of 5 feet bgs, it is assumed that all excavation would take place above the water table and that no excavation dewatering would be required. East of Building 79, where the excavation would be greater than 4 feet deep, sheet piles and shoring would be needed for support of the excavation and building foundation.

During excavation, water sprinkling and perimeter air quality monitoring would be implemented to ensure that fugitive dust emissions are kept to an acceptable minimum. Appropriate controls such as silt curtains, sediment traps, and hay bales would also be used to minimize erosion and sedimentation. The excavated areas would be backfilled as soon as possible, and on-site staging and stockpiling of excavated soil would be kept to a minimum. Any on-site stockpiles of excavated soil would be covered with an impervious synthetic liner at the end of each day's work.

Following excavation, confirmation samples would be collected from the walls of the excavated area to verify that contaminated soil has been removed. After confirmation sampling is complete, the excavated area would be backfilled with clean soil and the site pavement would be restored. The pavement system

would consist of a separation geotextile, 6-inch layer of base course aggregate, 2-inch asphalt binder course, and 1-inch asphalt topping layer.

Component 2: Off-Site Disposal

Because soil would be excavated from above the water table, it is assumed that the excavated soil would contain minimal free water and would not have to be pretreated by on-site dewatering prior to off-site transportation and disposal.

Asphalt pavement debris generated during excavation activities would be segregated and recycled or, if required, disposed of at an off-site construction material landfill. PDI borings indicate that Zone 4 asphalt has an average thickness of 6 inches; therefore, it is estimated that 245 cy of asphalt debris would be removed from Zone 4.

To determine the proper method of disposal of the 1,780 cy of excavated soil, composite samples would be collected and analyzed for mass lead, TCLP lead, and mass TPH. Based on current soil characterization data, it is anticipated that 1,700 cy of excavated soil would be identified as “high lead” (potential characteristic hazardous waste) and disposed of at an off-site TSDF where it would undergo treatment by chemical stabilization/solidification prior to landfilling, and that 20 cy of excavated soil would be identified as “high TPH” and disposed of at an off-site TSDF where it would undergo treatment by LTTD prior to landfilling. Although the goal is to excavate only soil with COC concentrations greater than I/C PRGs, it was estimated that 60 cy of soil with concentrations less than I/C PRGs may be excavated due to the distribution of contamination and the logistics of excavation; therefore, soil with concentrations of COCs less than I/C PRGs would be disposed of at a municipal solid waste landfill. Volume computations are provided in Appendix H.3.

During off-site transportation of contaminated soil, appropriate spill prevention and control measures would be implemented, and DOT regulations would be followed.

Component 3: LUCs with Engineering and Institutional Controls

LUCs for Zone 4 that are protective will be established and implemented in accordance with a post-ROD LUC RD. The LUC will both restrict residential land use and maintain a protective cover layer that meets CTDEEP RSR standards to be protective under I/C use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil, maintain the I/C site use conditions, and to prevent residential development of Zone 4. Engineering controls to be specified in

the LUC RD would include the pavement and buildings that cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. The unpaved area in Zone 4 is outside of the CERCLA LUC area. Pavement maintenance would be needed over the 44,040 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-5 shows the proposed areas in Zone 4 where LUCs would be required. The areas are differentiated by CERCLA and potential non-CERCLA concerns. The total area requiring CERCLA LUCs covers approximately 46,680 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, ELURs, meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 4: Monitoring

Long-term groundwater monitoring would be conducted to confirm that soil contaminants are not mobilizing and migrating to groundwater at unacceptable concentrations. In addition, LUC monitoring and 5-year reviews would be required for this alternative. The monitoring requirements for this alternative would be identical to Alternative S-4.2.

<u>Alternative Evaluation</u>

Detailed evaluations of Alternatives S-4.1, S-4.2, S-4.3, S-4.4, and S-4.5B can be found in the Lower Subase FS Report (Tetra Tech, 2010d). A detailed evaluation for Alternative S-4.5A was not completed

because it would be similar to the detailed evaluation for Alternative S-4.3. Generally, no changes have been made to the Lower Subase FS alternatives, except for estimated volumes and costs.

Chemical-specific ARARs for Alternative S-4.1 are provided in Table 6-19. Chemical-, location-, and action-specific ARARs for the remaining alternatives are provided in the following tables:

- Alternative S-4.2 - Tables 6-20 through 6-22, respectively
- Alternative S-4.3 and S-3.5A - Tables 6-24 through 6-26, respectively
- Alternative S-4.4 - Tables 6-27 through 6-29, respectively
- Alternative S-4.5B - Tables 6-30 through 6-32, respectively

Table 6-34 provides a comparative analysis of Zone 4 soil remedial alternatives. Remedial cost estimates are provided in Appendix K. The remedial alternatives for the I/C scenario must consider the potential residential concerns that need to be addressed.

6.2.1.4 Zone 7

The following soil remedial alternatives under the I/C scenario were retained for Zone 7. For all Zone 7 I/C alternatives, the COCs are lead and antimony, the I/C direct exposure PRG for lead is 1,090 mg/kg, the I/C pollutant mobility PRG for lead is 0.32 mg/L, and the I/C pollutant mobility PRG for antimony is 0.10 mg/L.

<u>Alternative S-7.1: No Action</u>

This would be the same CERCLA-mandated alternative as Alternative S-1.1.

<u>Alternative S-7.2: LUCs (Engineering and Institutional Controls) and Monitoring</u>

Alternative S-7.2 would consist of two major components: (1) LUCs with engineering and institutional controls and (2) monitoring. The estimated time for implementation of the LUCs for this alternative is 3 months.

Component 1: LUCs with Engineering and Institutional Controls

LUCs for Zone 7 that are protective will be established and implemented in accordance with a post-ROD LUC RD. The LUC will both restrict residential land use and maintain a protective cover layer that meets CTDEEP RSR standards to be protective under industrial/commercial use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil, maintain the I/C site use conditions, and to prevent residential development of Zone 7. Engineering controls to be specified in the LUC RD include the existing pavement and buildings that already cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. Pavement would be installed over the unpaved accessible soil east of Building 456 (1,960 sf) that exceeds the pollutant mobility PRG for lead. Pavement maintenance would then be needed in the 22,440 square foot total paved area where soil lead concentrations are greater than the I/C direct exposure and pollutant mobility PRGs. The pavement would minimize exposure to contaminated soil and reduce the CERCLA risks associated with it to acceptable levels. As indicated in Appendix I, storm sewer upgrades and maintenance would be needed at locations where storm sewer lines pass through contaminated soil. For costing purposes, it was assumed that 10 percent of that area would be repaved annually. Pavement maintenance would also be needed over the 119,600 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-12 shows the proposed areas in Zone 7 where LUCs would be required. The areas are differentiated by CERCLA and potential non-CERCLA concerns. The total area requiring CERCLA LUCs covers approximately 181,090 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, ELURs, meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 2: Monitoring

A groundwater monitoring program would be developed and implemented to evaluate potential migration of lead and antimony from soil to groundwater. For the purpose of this report, it was assumed that four groundwater samples would be regularly collected from wells installed in strategic locations to be identified in the monitoring plan and that the collected samples would be analyzed for lead and antimony. It was assumed for this report that the monitoring frequency would be quarterly for the first 2 years, semi-annually for the next 2 years, annually the fifth year, and every 5 years thereafter.

Monitoring of compliance with LUCs would occur at least annually. The monitoring will confirm that regular pavement and building foundation maintenance are being performed.

Reviews would be performed every 5 years to evaluate site status, assess the continued adequacy of remedial activities, and determine whether further action is necessary. These site reviews are required because this alternative would allow lead and antimony to remain in soil at concentrations that prevent unrestricted use of the site.

<u>Alternative S-7.3: Capping to Allow I/C Site Use and Prevent Leaching, LUCs (Engineering and Institutional Controls), and Monitoring</u>

Alternative S-7.3 would consist of four major components: (1) capping to allow I/C site use and prevent leaching, (2) off-site disposal of excavated material, (3) LUCs with engineering and institutional controls, and (4) monitoring. The estimated times for implementation of the LUCs and capping for this alternative are 3 months and 2 months, respectively.

Component 1: Capping to Allow I/C Site Use and Prevent Leaching

Soil would be excavated to a depth of 2 feet bgs (paved area) to allow installation of the cap. Excavation of this soil will address unacceptable I/C direct exposure CERCLA risks in areas where soil mass concentrations of lead are greater than its I/C direct exposure PRG and/or I/C pollutant mobility concerns in areas where SPLP/TCLP concentrations of lead are greater than the I/C pollutant mobility PRG. Because the estimated area where soil concentrations are greater than the pollutant mobility PRG increases with depth, and the maximum elevation above mean high water where soil lead concentrations exceed the pollutant mobility PRG is estimated at El 3 feet (NAVD88), the cap would cover the area where soil exceeds the I/C lead pollutant mobility PRG at El 3 feet. In addition, an area between Building 456 and the railroad embankment would be capped to cover soil with lead concentrations that exceed the I/C pollutant mobility PRG. The soil would be capped with an impervious cover system to prevent potential migration of COCs from soil to groundwater. Additional data collected during the soil PDI were

used to update the estimated extent of contaminated soil. Figure 6-13 shows the proposed areas to be capped under this alternative. The areas to be excavated to allow installation of the cap are located east and west of Building 456, and extend over an estimated 22,440 square feet.

During construction activities, water sprinkling and perimeter air quality monitoring would be implemented to ensure that fugitive dust emissions are kept to an acceptable minimum. Appropriate controls such as silt curtains, sediment traps, and hay bales would also be used to minimize erosion and sedimentation. The excavated areas would be backfilled or capped as soon as possible, and on-site staging and stockpiling of excavated soil would be kept to a minimum. Any on-site stockpiles of excavated soil would be covered with an impervious synthetic liner at the end of each day's work. In addition, during the excavation of contaminated soil in close proximity to Building 456, care would be taken not to undermine the building foundation.

Following excavation, confirmation samples would be collected from the walls of the excavated area to verify that soil with concentrations greater than the direct exposure PRG has been removed. After confirmation sampling is complete and the geomembrane is installed, the excavated area would be backfilled with clean soil and site pavement would be restored. The pavement system would consist of a separation geotextile, a 6-inch layer of base course aggregate, 2-inch asphalt binder course, and 1-inch asphalt topping layer.

Component 2: Off-Site Disposal

Asphalt pavement debris generated during excavation activities would be segregated and recycled or, if required, disposed of at an off-site construction material landfill. PDI borings indicate that Zone 7 asphalt has an average thickness of 6 inches; therefore, it is estimated that 380 cy of asphalt debris would be removed from Zone 7.

Because soil would be excavated from above the water table, it is assumed that the excavated soil would contain minimal free water and would not have to be pretreated by on-site dewatering prior to off-site transportation and disposal.

To determine the proper method of disposal of the 1,285 cy of excavated soil, composite samples would be collected and analyzed for mass lead and TCLP lead and antimony. Based on current soil characterization data, it is anticipated that 150 cy of excavated soil would be identified as "high lead" (potential characteristic hazardous waste) and disposed of at an off-site TSDF where it would undergo treatment by chemical stabilization/solidification prior to landfilling. Because the area of contamination increases with depth, some soil with concentrations less than I/C PRGs may be excavated; therefore, it was assumed that another 150 cy of soil would have concentrations of COCs less than I/C PRGs could

be re-used. An additional 150 cy of soil from east of Building 456 would be excavated for exceeding the pollutant mobility PRG for lead and would be expected to require treatment for PAHs prior to disposal. The remaining 835 cy of soil are estimated to require treatment for both lead and PAHs prior to disposal. Volume computations are provided in Appendix H.3.

During off-site transportation of contaminated soil, appropriate spill prevention and control measures would be implemented, and DOT regulations would be followed.

Component 3: LUCs with Engineering and Institutional Controls

LUCs for Zone 7 that are protective will be established and implemented in accordance with a post-ROD LUC RD. The LUC will both restrict residential land use and maintain a protective cover layer that meets CTDEEP RSR standards to be protective under I/C use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil, maintain the I/C site use conditions, and to prevent residential development of Zone 7. Storm sewer upgrade and maintenance would be needed at locations where storm sewer lines pass through contaminated soil. Engineering controls to be specified in the LUC RD would include the cap, pavement, and buildings that cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. Capping would be installed over the unpaved accessible soil east of Building 456 (1,960 sf) that exceeds the pollutant mobility PRG for lead. Pavement maintenance would be needed in the 22,440 square foot capped area; for costing purposes, it was assumed that 10 percent of that area would be repaved annually. Pavement maintenance would also be needed over the additional 119,600 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-12 shows the proposed areas in Zone 7 where LUCs would be required. The areas are differentiated by CERCLA and potential non-CERCLA concerns. The total area requiring CERCLA LUCs covers approximately 181,090 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, ELURs, meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 4: Monitoring

Long-term groundwater monitoring would be conducted to confirm that soil contaminants are not mobilizing and migrating to groundwater at unacceptable concentrations. In addition, LUC monitoring and 5-year reviews would be required for this alternative. The monitoring requirements for this alternative would be identical to Alternative S-7.2.

Alternative S-7.4: In-Situ Treatment (Stabilization/Solidification) to Allow I/C Site Use and Meet I/C PMCs, LUCs (Engineering and Institutional Controls), and Monitoring

Alternative S-7.4 would consist of three major components: (1) in-situ treatment to allow I/C site use and meet PMCs for I/C site use, (2) off-site disposal of excavated material, (3) LUCs with engineering and institutional controls, and (4) monitoring. The estimated times for implementation of the LUCs and in-situ treatment for this alternative are 3 months and 3 months, respectively.

Component 1: In-Situ Treatment to Allow I/C Site Use and Meet PMCs for I/C Site Use

Areas of soil with concentrations greater than the Zone 7 I/C pollutant mobility PRGs in the unsaturated zone would be treated using in-situ chemical stabilization/solidification to address pollutant mobility concerns. The in-situ chemical stabilization/solidification process would change the soil characteristics and reduce potential exposure to the contaminated soil, thereby reducing the direct exposure CERCLA risks associated with the soil. Additional data collected during the soil PDI were used to update the estimated extent of contaminated soil. Figure 6-14 shows the proposed area to be treated in situ under this alternative.

The area to be treated under this alternative extends over an estimated total 22,440 square feet, as shown on Figure 6-14. In-situ treatment would extend to a depth of 4 feet in the area west of Building 456

and to a depth of 5 feet in the narrow area east of Building 456. Blending of contaminated soil with stabilization materials would be performed with a LDA. An LDA is typically 6 to 10 feet in diameter and would be used to blend the contaminated soil with controlled amounts of a pozzolanic reagent such as Portland cement and water to chemically stabilize the lead and antimony within the soil matrix. Each application of the LDA would generate a column of treated soil approximately 6 to 10 feet in diameter, and this would be repeated with a slight column-to-column overlap until all areas of contaminated soil have been treated. Soil would be treated by blending in Portland cement and water at the rate of approximately 5 percent (by weight) and 2 percent (by weight), respectively, for a total estimated use of approximately 250 tons of Portland cement and 23,750 gallons of water. It was estimated that approximately 875 LDA passes would be required to treat all of the contaminated soil above the water table. In-situ stabilization with Portland cement is regulated under Connecticut standards as a discharge to the waters of the state. Therefore, the activity will be conducted in compliance with the substantive standards under the CTDEEP Water Pollution Control regulations.

Prior to treatment, treatability testing would be performed to confirm the ratio of Portland cement and water mentioned above is appropriate to achieve properly stabilized soil. Also prior to treatment, a detailed survey would be made of underground obstacles (e.g., underground pipes or cables) in the area to be treated and, when practical, these obstacles would be moved. If obstacles prevent the use of a blending auger in certain areas and if moving of these obstacles is not practical, the Portland cement and water would be manually worked into the soil to be treated using hand tools such as shovels, provided that the areas to be so treated are relatively small in size. Accordingly, it is assumed for the purpose of this report that underground obstacles would not actually prevent the implementation of in-situ chemical stabilization/solidification.

Following treatment, confirmation samples would be collected beneath and around the treated area to verify that all contaminated soil has been treated. Additional confirmation samples would also be collected within approximately 1 month from the area treated with chemical stabilization/solidification. These additional samples would be tested for SPLP concentrations of lead and antimony to verify that the treated soil meets the Zone 7 I/C PRGs.

After treatment, any disturbed utilities and site pavement would be restored. The pavement system would consist of a separation geotextile, 6-inch layer of base course aggregate, 2-inch asphalt binder course, and 1-inch asphalt topping layer.

Component 2: Off-Site Disposal

Asphalt pavement would be excavated prior to treatment of the soil and the resulting asphalt debris would be recycled or, if required, disposed of at an off-site construction material landfill. PDI borings indicate

that Zone 7 asphalt has an average thickness of 6 inches; therefore, it is estimated that 380 cy of asphalt debris would be removed from Zone 7.

The blending action and addition of Portland cement would result in an increase in the volume of treated soil of approximately 300 cy. Because this soil would be treated, it could be disposed of offsite at a municipal solid waste landfill after testing confirmed that it was nonhazardous solid waste. An additional 240 cy of soil would be excavated and disposed of offsite to allow for a 9-inch thick pavement system to replace the existing 6-inch thick asphalt.

Component 3: LUCs with Engineering and Institutional Controls

LUCs for Zone 7 that are protective will be established and implemented in accordance with a post-ROD LUC RD. The LUC will both restrict residential land use and maintain a protective cover layer that meets CTDEEP RSR standards to be protective under I/C use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil, maintain the I/C site use conditions, and to prevent residential development of Zone 7. Engineering controls to be specified in the LUC RD would include the pavement and buildings that cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. The unpaved area in Zone 7 would be treated and paved. Pavement maintenance would be needed over the 142,040 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-12 shows the proposed areas in Zone 7 where LUCs would be required. The areas are differentiated by CERCLA and potential non-CERCLA concerns. The area requiring CERCLA LUCs covers approximately 181,090 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, ELURs, meeting State property law standards,

would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 4: Monitoring

Long-term groundwater monitoring would be conducted to confirm that soil contaminants are not mobilizing and migrating to groundwater at unacceptable concentrations. In addition, LUC monitoring and 5-year reviews would be required for this alternative. The monitoring requirements for this alternative would be identical to Alternative S-7.2.

Alternative S-7.5A: Excavation to Meet I/C DECs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring

Alternative S-7.5A would consist of four major components: (1) excavation to meet direct exposure I/C PRGs, (2) off-site disposal of excavated material, (3) LUCs with engineering and institutional controls, and (4) monitoring. The estimated times for implementation of the LUCs and excavation for this alternative are 3 months and 2 months, respectively.

Component 1: Excavation to Meet the Direct Exposure I/C PRGs

The area of soil with mass concentrations of lead greater than its I/C direct exposure PRG to a depth of 2 feet bgs (paved area) would be excavated to address unacceptable CERCLA risks for I/C exposure. Some of this soil would also have SPLP/TCLP lead and antimony concentrations greater than I/C pollutant mobility PRGs; therefore, the pollutant mobility concerns associated with this soil would be addressed by excavation. Additional data collected during the soil PDI were used to update the estimated extent of contaminated soil. Figure 6-15 shows the proposed areas to be excavated under this alternative.

Prior to excavation, a detailed survey would be made of underground obstacles (e.g., underground pipes or cables) in the areas to be excavated and, when practical, these obstacles would be moved. If obstacles prevent the use of a normal backhoe or grade-all in certain areas and if moving of these obstacles is not practical, a small backhoe or hand shovels would be used provided that the areas to be so excavated are relatively small in size. For this alternative, it is assumed that no underground obstacles would prevent the excavation of contaminated soil.

The area to be excavated is located west of Building 456 and extends over an estimated total of 13,050 square feet. An estimated 970 cy of contaminated soil and asphalt debris would be removed by excavation. Computations of excavation volumes are provided in Appendix H.3.

During construction activities, water sprinkling and perimeter air quality monitoring would be implemented to ensure that fugitive dust emissions are kept to an acceptable minimum. Appropriate controls such as silt curtains, sediment traps, and hay bales would also be used to minimize erosion and sedimentation. The excavated areas would be backfilled as soon as possible, and on-site staging and stockpiling of excavated soil would be kept to a minimum. Any on-site stockpiles of excavated soil would be covered with an impervious synthetic liner at the end of each day's work. In addition, during the excavation of contaminated soil in close proximity to existing buildings, care would be taken not to undermine the foundations of these buildings.

Following excavation, confirmation samples would be collected from the walls of the excavated area to verify that soil with concentrations greater than the direct exposure PRG has been removed. After confirmation sampling is complete, the excavated area would be backfilled with clean soil and the site pavement would be restored. The pavement system would consist of a separation geotextile, a 6-inch layer of base course aggregate, 2-inch asphalt binder course, and 1-inch asphalt topping layer.

Component 2: Off-Site Disposal

Asphalt pavement debris generated during excavation would be segregated and recycled or, if required, disposed of at an off-site construction material landfill. PDI borings indicate that Zone 7 asphalt has an average thickness of 6 inches; therefore, it is estimated that 240 cy of asphalt debris would be removed from Zone 7.

Because soil would be excavated from above the water table, it is assumed that the excavated soil would contain minimal free water and would not have to be pretreated by on-site dewatering prior to off-site transportation and disposal.

To determine the proper method of disposal of the 730 cy of excavated soil, composite samples would be collected and analyzed for mass lead and TCLP lead and antimony. Based on current soil characterization data, it is anticipated that the 100 cy of excavated soil would be identified as "high lead" (potential characteristic hazardous waste) and disposed of at an off-site TSDF where it would undergo treatment by chemical stabilization/solidification prior to landfilling. Although no PAHs are COCs, the PAH concentrations in some soil are high enough that treatment for the PAHs are expected to be required prior to disposal. It is estimated that 630 cy of soil would require treatment for both lead and PAHs prior to disposal. Volume computations are provided in Appendix H.3.

During off-site transportation of contaminated soil, appropriate spill prevention and control measures would be implemented, and DOT regulations would be followed.

Component 3: LUCs with Engineering and Institutional Controls

LUCs for Zone 7 that are protective will be established and implemented in accordance with a post-ROD LUC RD. The LUC will both restrict residential land use and maintain a protective cover layer that meets CTDEEP RSR standards to be protective under I/C use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil, maintain the I/C site use conditions, and to prevent residential development of Zone 7. Storm sewer upgrade and maintenance would be needed at locations where storm sewer lines pass through contaminated soil. Engineering controls to be specified in the LUC RD would include the pavement and buildings that cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. Pavement would be installed over the accessible soil east of Building 456 (1,960 sf) that does not exceed direct exposure PRGs but does exceed the pollutant mobility PRG for lead. Pavement maintenance would then be needed in the 22,440 square foot total paved area where the soil concentrations are greater than the I/C lead and/or antimony pollutant mobility PRGs; for costing purposes, it was assumed that 10 percent of that area would be repaved annually. Pavement maintenance would also be needed over the 119,600 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-12 shows the proposed areas in Zone 7 where LUCs would be required. The areas are differentiated by CERCLA and potential non-CERCLA concerns. The total area requiring CERCLA LUCs covers approximately 181,090 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the

property is ever transferred to non-federal ownership, ELURs, meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 4: Monitoring

Long-term groundwater monitoring would be conducted to confirm that soil contaminants are not mobilizing and migrating to groundwater at unacceptable concentrations. In addition, LUC monitoring and 5-year reviews would be required for this alternative. The monitoring requirements for this alternative would be identical to Alternative S-7.2.

Alternative S-7.5B: Excavation to Meet I/C DECs and PMCs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring

Alternative S-7.5B would consist of four major components: (1) excavation to meet direct exposure and pollutant mobility PRGs for I/C site use, (2) off-site disposal of excavated soil, (3) LUCs with engineering and institutional controls, and (4) monitoring. The estimated times for implementation of the LUCs and excavation for this alternative are 3 months and 4.5 months, respectively.

Component 1: Excavation to Meet Direct Exposure and Pollutant Mobility PRGs for I/C Site Use

Areas of soil with mass concentrations of lead greater than its I/C direct exposure PRG to a depth of 2 feet bgs (paved area) or with SPLP/TCLP concentrations of lead or antimony greater than their Zone 7 I/C pollutant mobility PRGs in the remainder of the unsaturated zone (additional 2 to 3 feet bgs to the water table) would be excavated to address unacceptable CERCLA risks and pollutant mobility concerns.

Prior to excavation, a detailed survey would be made of underground obstacles (e.g., underground pipes or cables) in the areas to be excavated and, when practical, these obstacles would be moved. If obstacles prevent the use of a normal backhoe or grade-all in certain areas and if moving of these obstacles is not practical, a small backhoe or hand shovels would be used provided that the areas to be so excavated are relatively small in size. For this alternative, it is assumed that no underground obstacles would prevent the excavation of contaminated soil.

The area to be excavated under this alternative extends over an estimated total 22,440 square feet, as shown on Figure 6-14. Excavation would extend to a depth of 4 feet in the area west of Building 456 and

to a depth of 5 feet in the small area east of Building 456. An estimated total of 3,400 cy of contaminated soil and asphalt debris would be removed through excavation. Computations of excavation volumes are provided in Appendix H.3.

Because excavation of Zone 7 contaminated soil west of Building 456 under this alternative would only extend to an estimated maximum depth of 4 feet bgs, it was assumed that all excavation would take place above the water table and that no excavation dewatering would be required. East of Building 456, where the narrow excavation would be 5 feet deep, an excavator with a trench box would be used and it was assumed that no dewatering would be required.

During excavation, water sprinkling and perimeter air quality monitoring would be implemented to ensure that fugitive dust emissions are kept to an acceptable minimum. Appropriate controls such as silt curtains, sediment traps, and hay bales would also be used to minimize erosion and sedimentation. The excavated areas would be backfilled as soon as possible, and on-site staging and stockpiling of excavated soil would be kept to a minimum. Any on-site stockpiles of excavated soil would be covered with an impervious synthetic liner at the end of each day's work.

Following excavation, confirmation samples would be collected from the walls of the excavated areas to verify that contaminated soil has been removed. After confirmation sampling is complete, the excavated area would be backfilled with clean soil and the site pavement would be restored. The pavement system would consist of a separation geotextile, 6-inch layer of base course aggregate, 2-inch asphalt binder course, and 1-inch asphalt topping layer.

Component 2: Off-Site Disposal

Because soil would be excavated from above the water table, it is assumed that the excavated soil would contain minimal free water and would not have to be pretreated by on-site dewatering prior to off-site transportation and disposal.

Asphalt pavement debris generated during excavation activities would be segregated and recycled or, if required, disposed of at an off-site construction material landfill. PDI borings indicate that Zone 7 asphalt has an average thickness of 6 inches; therefore, it is estimated that 380 cy of asphalt debris would be removed from Zone 7.

To determine the proper method of disposal of the 3,020 cy of excavated soil, composite samples would be collected and analyzed for mass lead and TCLP lead and antimony. Based on current soil characterization data, it was anticipated that the 300 cy of excavated soil would be identified as "high lead" (potential characteristic hazardous waste) and disposed of at an off-site TSDF where it would

undergo treatment by chemical stabilization/solidification prior to landfilling. Although no PAHs are COCs, PAH concentrations in 290 cy of soil are high enough that LTTD treatment for PAHs was assumed to be required prior to disposal. It was estimated that 2,050 cy of soil would require treatment for both lead and PAHs prior to disposal. Because the area of contamination increases with depth, it was assumed that soil with concentrations less than I/C PRGs would be excavated; therefore, 300 cy of soil with concentrations of COCs less than I/C PRGs could be reused. In addition, 40 cy of soil exceeding the pollutant mobility PRG for lead but not direct exposure PRGs would be disposed of at a municipal solid waste landfill. Volume computations are provided in Appendix H.3.

During off-site transportation of contaminated soil, appropriate spill prevention and control measures would be implemented, and DOT regulations would be followed.

Component 3: LUCs with Engineering and Institutional Controls

LUCs for Zone 7 that are protective will be established and implemented in accordance with a post-ROD LUC RD. The LUC will both restrict residential land use and maintain a protective cover layer that meets CTDEEP RSR standards to be protective under I/C use. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to restrict the disturbance of contaminated soil, maintain the I/C site use conditions, and to prevent residential development of Zone 7. Engineering controls to be specified in the LUC RD would include the pavement and buildings that cover inaccessible and/or environmentally isolated soil. Under I/C site use, CTDEEP RSR standards classify contaminated soil as inaccessible if it is unpaved and more than 4 feet below the ground surface, more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, or beneath an existing building or another existing permanent structure. Pavement would be installed over the accessible soil east of Building 456 (1,960 sf). Pavement maintenance would be needed over the 142,040 square foot area where LUCs are needed to make contaminated soil inaccessible; for costing purposes it was assumed that 5 percent of that area would be repaved annually. Building maintenance would be necessary for underlying soil to remain inaccessible and environmentally isolated, but is considered routine; therefore, no building maintenance costs were included. The LUC RD would include procedures for the performance of regular site inspections to verify continued implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor. Figure 6-12 shows the proposed areas in Zone 7 where LUCs would be required. The areas are differentiated by CERCLA and potential non-CERCLA concerns. The total area requiring CERCLA LUCs covers approximately 181,090 square feet.

If the property covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, ELURs, meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.

Component 4: Monitoring

Long-term groundwater monitoring would be conducted to confirm that soil contaminants are not mobilizing and migrating to groundwater at unacceptable concentrations. In addition, LUC monitoring and 5-year reviews would be required for this alternative. The monitoring requirements for this alternative would be identical to Alternative S-7.2.

Alternative Evaluation

Detailed evaluations of Alternatives S-7.1, S-7.2, S-7.3, S-7.4, and S-7.5B can be found in the Lower Subase FS report (Tetra Tech, 2010d). A detailed evaluation for Alternative S-7.5A was not completed because it would be similar to the detailed evaluation for Alternative S-7.3. Generally, no changes have been made to the Lower Subase FS alternatives, except for estimated volumes and costs.

Chemical-specific ARARs for Alternative S-7.1 are provided in Table 6-19. Chemical-, location-, and action-specific ARARs for the remaining alternatives are provided in the following tables:

- Alternative S-7.2 - Tables 6-20 through 6-22, respectively
- Alternative S-7.3 and S-7.5A - Tables 6-24 through 6-26, respectively
- Alternative S-7.4 - Tables 6-27 through 6-29, respectively
- Alternative S-7.5B - Tables 6-30 through 6-32, respectively

Table 6-35 provides a comparative analysis of soil remedial alternatives for Zone 7. Remedial cost estimates are provided in Appendix K. The remedial alternatives for the I/C scenario must consider the potential residential concerns that need to be addressed.

6.2.2 Sediment Remedial Alternatives

The following sediment remedial alternatives were developed for Zone 4 and a small area of Outer Pier 1 in the Lower Subase FS, and a limited re-evaluation of the alternatives was completed in the FS Addendum. A PDI for Zone 4 and Outer Pier 1 sediment contamination will be conducted and the results used to further delineate the extent of sediment remediation required for the remedial design. The horizontal and vertical limits of remediation have been estimated for this FS Addendum but will be revised as necessary for the design based on the information available from the PDI.

Alternative SD-1: No Action

This would be the same CERCLA-mandated alternative as for soil.

Alternative SD-3: Capping with Pre-Dredging to Meet RAOs, Dewatering, On-Site Treatment and Discharge of Dewatering Fluid, Off-Site Disposal of Dewatered Sediment, LUCs (Institutional Controls), and Monitoring

Areas of surface sediment with concentrations of COCs greater than PRGs at depths of 2 feet or greater below the sediment surface would be capped to meet the sediment RAOs. One such area has been identified in Zone 4, but none have been identified in Outer Pier 1. Prior to capping, a 2-foot-thick layer of sediment would be dredged from the area to be capped so that placement of a cap would not result in unacceptably shallow conditions and also to remove the lighter and softer top layer of sediment and to provide better support for the cap. Figure 6-17 shows the area to be pre-dredged and capped (Area 1). In Area 2 shown on Figure 6-17, an uncontaminated layer of sediment covers the contaminated sediment at depths greater than 2 feet below the sediment surface. The uncontaminated sediment layer will be maintained in this area. Area 3 on Figure 6-17 is the area where maintenance dredging was previously completed. Some contaminated sediment may have been exposed during maintenance dredging; therefore, a cap will be placed in this area to cover the exposed contaminated sediment.

Capping would consist of placing a layer of clean fine sand or sandy sediment with a minimum thickness of 3 feet over the contaminated sediment. Figure 6-18 shows a typical cross-section through the areas to be capped.

The dredged sediment would be dewatered to its original in-situ volume by using barges fitted with permeable liners to operate as passive drainage beds. The dewatered sediment would then be stabilized by blending it with 8 percent (by weight) of fly ash, and the resulting stabilized sediment would be disposed of off site by landfilling. Water released by the sediment dewatering process would filter through the barges liner and flow back to the Thames River. A small fraction (estimated at 10 percent of total) of

the water released by the dewatering process would not drain and filter readily through the barges liner and would be designated as dewatering fluid. This dewatering fluid would be collected, analyzed, and treated in a 5,000 gallon-per-day (gpd) on-shore system consisting of bag filtration to control suspended solids and liquid-phase GAC adsorption to remove dissolved COCs prior to discharge to the Thames River.

LUCs that are protective for sediment will be established and implemented in accordance with a post-ROD LUC RD. The draft LUC RD will be developed within 90 days of ROD signature.

The LUC RD will establish methods to prevent the uncontrolled disturbance of the capped areas of contaminated sediment. One of the principal controls that would be specified in the LUC RD would be procedures, such as establishment of a “Safety Zone” or “No Anchor Zone” around the capped area, to avoid cap damage as a result of maintenance dredging activities and to repair such damage if it occurs. The LUC RD would also include procedures for the performance of regular (annual) site inspections to verify continued efficacy of the cap and implementation of the LUCs. The areas to which the LUCs would apply would be identified and surveyed by a licensed professional surveyor.

As long as access to the capped area is controlled by the Navy, these LUCs would be implemented in accordance with the LUC RD, in coordination with the State, which owns the subtidal area. If the property adjacent to the area covered by the LUC RD is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Naval Submarine Base - New London Federal Facility Agreement, the Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, ELURs, meeting State property law standards, would be recorded that would incorporate the LUCs called for under the ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy would retain ultimate responsibility for remedy integrity. LUCs would be maintained until the concentrations of hazardous substances in the sediment are at such levels to allow for unrestricted use and exposure.

Over the course of 30 years, natural forces may impact the caps and natural cover associated with Alternative SD-3 and routine maintenance will be required to correct any impacts. It is assumed that LUC monitoring will identify minor issues with the caps and cover (e.g., cover thickness is less than 2 feet) and minor maintenance will be required every 5 years to correct the identified issues. Typical maintenance activities would include placing additional cover material over areas where the cover thickness is less than 2 feet.

Reviews would be performed every 5 years to evaluate site status, assess the continued adequacy of remedial activities, and determine whether further action is necessary.

Alternative SD-4: Capping with Pre-Dredging to Meet RAOs, Dewatering, Off-Site Disposal of Dewatered Sediment and Dewatering Fluid, LUCs (Institutional Controls), and Monitoring

This alternative would be similar to Alternative SD-3, with the difference that the contaminated dewatering fluid would be disposed of at an off-site wastewater treatment facility.

Alternative SD-6: Dredging to Meet PRGs, Dewatering, On-Site Treatment and Discharge of Dewatering Fluid, Off-Site Disposal of Dewatered Sediment, LUCs (Institutional Controls), and Monitoring

Areas of contaminated sediment in Zone 4 and Outer Pier 1 shown on Figures 6-19 and 6-21 would be dredged to a depth of up to 7 feet below the sediment surface (bss). The dredging, barge dewatering, and on-site treatment and discharge of dewatering fluid would be similar to those of Alternative SD-3, with the difference that the volumes of sediment and dewatering fluid would be much greater. The area along the Quay Wall would be restored after dredging to maintain the stability of the slope. Figure 6-20 shows a typical cross-section through the area to be dredged and restored.

The dewatered sediment would be stabilized by blending it with 8 percent (by weight) of fly ash, and it would then be disposed of off site by landfilling. Similar to Alternative SD-3, an estimated 10 percent of the total volume of water released by dewatering would not drain and filter readily through the barges liner back to the Thames River. This dewatering fluid would be collected, analyzed, and treated on shore with a system similar to that of Alternative SD-3, but larger in size (i.e., sized for 10,000 gpd versus 5,000 gpd).

Even though the goal of Alternative SD-6 is to dredge all contaminated sediment with concentrations above PRGs, LUCs and monitoring will be implemented under this alternative because of the potential for contaminated sediments to remain beneath the existing quay wall and pier structure in Zone 4. The piers would impede conventional dredging techniques from removing the potentially contaminated sediment. The sediment could act as a potential source and recontaminate the clean sediment in the dredged area of Zone 4. The LUCs and monitoring will remain in place until it can be shown that the potentially contaminated sediment no longer presents a risk to the environment.

LUCs similar to those described in SD-3 will be implemented and maintained as required under SD-6. A sediment and surface water monitoring program will be developed and implemented for Zone 4. The details of the program will be included in a post-ROD document. It was assumed for the FS Addendum

that a 10-year monitoring program will be required and it will include regular sediment and surface water sampling and analysis, and reporting.

Under Alternative SD-6, dredging is expected to remove all contaminated sediment with concentrations greater than PRGs in Outer Pier 1. Therefore, LUCs and monitoring will not be required for Outer Pier 1.

As long as monitoring shows contaminated sediment remains in place, reviews would be performed every 5 years to evaluate site status, assess the continued adequacy of remedial activities, and determine whether further action is necessary.

Alternative SD-7: Dredging to Meet PRGs, Dewatering, Off-Site Disposal of Dewatered Sediment and Dewatering Fluid, LUCs (Institutional Controls), and Monitoring

This alternative would be similar to Alternative SD-6, with the difference that the contaminated dewatering effluent would be disposed of off site versus onsite treatment and discharge.

Alternative SD-8: Zone 4 Dredging to Meet PRGs, Dewatering, Off-Site Disposal of Dewatered Sediment and Dewatering Fluid, LUCs, and Monitoring and Outer Pier 1 – Capping to Meet RAOs, LUCs(Institutional Controls), and Monitoring

This alternative would be similar to Alternative SD-7 because it includes dredging of Zone 4 sediment and offsite disposal of the contaminated dewatering effluent. However, it differs from Alternative SD-7 because it allows the contaminated sediment in Outer Pier 1 to remain in place under the uncontaminated sediment cover, similar to the approach in Alternatives SD-3 and SD-4.

Similar to SD-6 and SD-7, LUCs and monitoring will be required for the sediment adjacent to Zone 4 until it can be shown that the potentially contaminated sediment that may remain under the Zone 4 quay wall and pier structure after dredging no longer presents a risk to the environment.

Similar to Alternatives SD-3 and SD-4, natural forces may impact the natural cover in Outer Pier 1 and routine maintenance will be required to correct any impacts. It is assumed that LUC monitoring will identify minor issues with the cover (e.g., cover thickness is less than 2 feet) and minor maintenance will be required every 5 years to correct the identified issues. Typical maintenance activities would include placing additional cover material over areas where the cover thickness is less than 2 feet.

As long as contaminated sediment remains in place, reviews would be performed every 5 years to evaluate site status, assess the continued adequacy of remedial activities, and determine whether further action is necessary.

Alternative Evaluation

Detailed descriptions and evaluations of Alternatives SD-1 through SD-7 can be found in the Lower Subase FS Report (Tetra Tech, 2010d). Revisions to the sediment alternatives were completed in this FS Addendum to address the volume changes associated with the exclusion of the sediment associated with operational concerns, to include the most recent discount rate in the cost estimates, and to add another alternative (SD-8) for dealing with the contaminated sediment. The approaches and technologies used in the alternatives remained the same; and therefore, detailed re-evaluation of these alternatives is not warranted. Chemical-, location-, and action-specific ARARs for the sediment alternatives are provided in Tables 6-36, 6-37, and 6-38, respectively. Table 6-39 provides a comparative analysis of sediment remedial alternatives for Zone 4 and Outer Pier 1. Conceptual design calculations for the sediment alternatives are provided in Appendices J and remedial cost estimates are provided in Appendix K.

TABLE 6-1

SUMMARY OF RME CANCER RISKS AND HAZARD INDICES FOR ZONE 1
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals Contributing to an HI > 1
Construction Workers	Surface/Subsurface Soil	Incidental Ingestion	2E-06	--	--	--	0.5	--
		Dermal Contact	8E-07	--	--	--	0.003	--
		Inhalation	5E-08	--	--	--	0.5	--
		Total	3E-06	--	--	Benzo(a)pyrene	1	--
	Groundwater	Dermal Contact	4E-09	--	--	--	0.04	--
		Inhalation	4E-09	--	--	--	0.003	--
		Total	8E-09	--	--	--	0.04	--
		Total All Media	3E-06				1	
Current Full-Time Employees	Surface Soil	Incidental Ingestion	3E-05	--	Benzo(a)pyrene	Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	NC	- -
		Dermal Contact	2E-05	--	Benzo(a)pyrene	Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	NC	- -
		Total	5E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	NC	- -
Future Full-Time Employees	Surface/Subsurface Soil	Incidental Ingestion	3E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	0.3	- -
		Dermal Contact	3E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	0.004	- -
		Total	6E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	0.3	- -
Child Residents	Surface/Subsurface Soil	Incidental Ingestion	5E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene, Arsenic	4	Mercury
		Dermal Contact	2E-04	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene	Benzo(a)anthracene, Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene	0.02	--
		Total	7E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene, Arsenic	4	Mercury

TABLE 6-1

SUMMARY OF RME CANCER RISKS AND HAZARD INDICES FOR ZONE 1
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals Contributing to an HI > 1
Adult Residents	Surface/Subsurface Soil	Incidental Ingestion	8E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	0.4	- -
		Dermal Contact	4E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	0.004	- -
		Total	1E-04	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene	Benzo(a)anthracene, Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene, Arsenic	0.4	- -
Lifelong Residents (Child and Adult)	Surface/Subsurface Soil	Incidental Ingestion	6E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	Benzo(k)fluoranthene	NA	- -
		Dermal Contact	2E-04	--	Benzo(a)anthracene, Benzo(a)pyrene, Dibenzo(a,h)anthracene	Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene	NA	- -
		Total	8E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	Benzo(k)fluoranthene	NA	- -

NA - Not applicable.
NC - No noncarcinogenic COPCs were identified in surface soil.

TABLE 6-2

USEPA CHEMICALS OF CONCERN FOR ZONE 1
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Chemical of Concern[1]	Impact on Human Receptors
SURFACE/SUBSURFACE SOIL	
Benzo(a)anthracene	Hypothetical Child Resident ILCR = 5E-05 Hypothetical Lifelong Resident ILCR = 6E-05
Benzo(a)pyrene	Hypothetical Child Resident ILCR = 5E-04 Hypothetical Lifelong Resident ILCR = 5E-04
Benzo(b)fluoranthene	Hypothetical Child Resident ILCR = 5E-05 Hypothetical Lifelong Resident ILCR = 5E-05
Benzo(k)fluoranthene	Hypothetical Child Resident ILCR = 2E-06 Hypothetical Lifelong Resident ILCR = 3E-06
Dibenzo(a,h)anthracene	Hypothetical Child Resident ILCR = 1E-04 Hypothetical Lifelong Resident ILCR = 1E-04
Indeno(1,2,3-cd)pyrene	Hypothetical Child Resident ILCR = 3E-05 Hypothetical Lifelong Resident ILCR = 4E-05
Arsenic	Hypothetical Child Resident ILCR = 1E-05 Hypothetical Lifelong Resident ILCR = 2E-05
Mercury	Hypothetical Child Resident HI = 4
GROUNDWATER	
No chemicals of concern were identified for groundwater.	

HQ = Hazard Quotient.
ILCR = Incremental Lifetime Cancer Risk
1 - For media with ILCRs greater than 1×10^{-4}, a COC is any carcinogenic chemical with an ILCR greater than 1×10^{-6} or a noncarcinogenic chemical contributing to target organ hazard indices (HIs) greater than 1.0.

TABLE 6-3

SUMMARY FOR ALL ZONES OF CHEMICALS RETAINED FROM HHRA AS RISK-BASED DIRECT EXPOSURE COCs
LOWER SUBASE SOIL AND GROUNDWATER COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Chemical of Concern[1]	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Surface/Subsurface Soil							
Benzo(a)anthracene	R			R			R
Benzo(a)pyrene	R			R			R
Benzo(b)fluoranthene	R			R			R
Benzo(k)fluoranthene	R						
Dibenzo(a,h)anthracene	R			R			R
Indeno(1,2,3-cd)pyrene	R			R			R
Antimony							I,R
Arsenic	R			R			R
Hexavalent chromium							R
Lead			I,R	I,R			I,R
Mercury	R						
Groundwater							
No COCs were identified for groundwater.							

1 - For media with ILCRs greater than 1×10^{-4}, a chemical of concern (COC) is any carcinogenic chemical with an ILCR greater than 1×10^{-6} or a noncarcinogenic chemical contributing to target organ hazard indices (HIs) greater than 1.0.
I - Indicates that chemical was retained as a COC for industrial direct contact exposures.
R- Indicates that chemical was retained as a COC for residential direct contact exposures.

TABLE 6-4

SUMMARY FOR ALL ZONES OF POTENTIAL PRELIMINARY REMEDIATION GOALS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

CONSTRUCTION WORKERS - SURFACE/SUBSURFACE SOIL					
Chemical of Concern	**CTDEP RSR[1] (mg/kg)**	**Target Cancer Risk Level**			**Hazard Index = 1 (mg/kg)**
		10^{-6} (mg/kg)	**10^{-5} (mg/kg)**	**10^{-4} (mg/kg)**	
Antimony	8,200	NA	NA	NA	260
Lead	NA	737[2]			

FULL-TIME EMPLOYEES - SURFACE/SUBSURFACE SOIL					
Chemical of Concern	**CTDEP RSR[1] (mg/kg)**	**Target Cancer Risk Level**			**Hazard Index = 1 (mg/kg)**
		10^{-6} (mg/kg)	**10^{-5} (mg/kg)**	**10^{-4} (mg/kg)**	
Antimony	8,200	NA	NA	NA	410
Lead	1,000	1,090[2]			

HYPOTHETICAL CHILD RESIDENTS - SURFACE/SUBSURFACE SOIL					
Chemical of Concern	**CTDEP RSR[2] (mg/kg)**	**Target Cancer Risk Level**			**Hazard Index = 1 (mg/kg)**
		10^{-6} (mg/kg)	**10^{-5} (mg/kg)**	**10^{-4} (mg/kg)**	
Benzo(a)anthracene	1	0.17	1.7	17	NA
Benzo(a)pyrene	1	0.017	0.17	1.7	NA
Benzo(b)fluoranthene	1	0.17	1.7	17	NA
Benzo(k)fluoranthene	8.4	1.7	17	170	NA
Dibenzo(a,h)anthracene	1	0.017	0.17	1.7	NA
Indeno(1,2,3-cd)pyrene	1	0.17	1.7	17	NA
Antimony	27	NA	NA	NA	31
Arsenic	10	0.56	5.6	56	22
Mercury	20	NA	NA	NA	24
Lead	400	400[4]			

HYPOTHETICAL ADULT RESIDENTS - SURFACE/SUBSURFACE SOIL					
Chemical of Concern	**CTDEP RSR[3] (mg/kg)**	**Target Cancer Risk Level**			**Hazard Index = 1 (mg/kg)**
		10^{-6} (mg/kg)	**10^{-5} (mg/kg)**	**10^{-4} (mg/kg)**	
Benzo(a)anthracene	1	1	10	100	NA
Benzo(a)pyrene	1	0.1	1	10	NA
Benzo(b)fluoranthene	1	1	10	100	NA
Dibenzo(a,h)anthracene	1	0.1	1	10	NA
Indeno(1,2,3-cd)pyrene	1	1	10	100	NA
Arsenic	10	1.3	13	130	196
Lead	400	400[4]			

TABLE 6-4

SUMMARY FOR ALL ZONES OF POTENTIAL PRELIMINARY REMEDIATION GOALS
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

LIFELONG RESIDENTS - SURFACE/SUBSURFACE SOIL					
Chemical of Concern	**CTDEP RSR[3] (mg/kg)**	**Target Cancer Risk Level**			**Hazard Index = 1 (mg/kg)**
		10^{-6} (mg/kg)	**10^{-5} (mg/kg)**	**10^{-4} (mg/kg)**	
Benzo(a)anthracene	1	0.15	1.5	15	NA
Benzo(a)pyrene	1	0.015	0.15	1.5	NA
Benzo(b)fluoranthene	1	0.15	1.5	15	NA
Benzo(k)fluoranthene	8.4	1.5	15	150	NA
Dibenzo(a,h)anthracene	1	0.015	0.15	1.5	NA
Indeno(1,2,3-cd)pyrene	1	0.15	1.5	15	NA
Arsenic	10	0.39	3.9	39	NA
Hexavalent Chromium	NA	0.30	3	30	NA
Lead	400	400[4]			

NA = Not applicable\not available.
1 - Industrial criteria, CTDEP Remediation Standard Regulations, 2007.
2 - Site-specific values derived using USEPA's Adult Lead Methodology.
3 - Residential criteria, CTDEP Remediation Standard Regulations, 2007.
4 - Office of Solid Waste and Emergency Response (OSWER) screening level for residential exposures to lead in soil.

TABLE 6-5

CTDEP CHEMICALS OF POTENTIAL CONCERN FOR ZONE 1
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Chemical of Potential Concern[1]					
SOIL				GROUNDWATER	
Industrial		Protective of Groundwater		Vapor Intrusion	Surface Water
Grassy Areas	Paved Areas	Surface Soil	Subsurface Soil		
None	Benzo(a)pyrene	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Indeno(1,2,3-cd)pyrene	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Carbazole Chrysene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene Phenanthrene Pyrene Lead Total petroleum hydrocarbons	None	Acenaphthylene Cadmium Mercury Total petroleum hydrocarbons

1 - Any chemical detected at a concentration exceeding a residential or industrial CTDEP RSR direct contact screening level or pollutant mobility criterion for soil or a volatilization or protection of surface water RSR for groundwater.

TABLE 6-6

SUMMARY OF SOIL COCs AND SELECTED PRGs
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

COC	Zone 1					Zone 3				Zone 4				Zone 7			
	PRGs					PRGs				PRGs				PRGs			
	I/C DEC[1] (mg/kg)	Res DEC[1] (mg/kg)	PMC[1,2]	I/C PMC[1,3]	Res PMC[1,3]	I/C DEC[1] (mg/kg)	Res DEC[1] (mg/kg)	I/C PMC[1]	Res PMC[1]	I/C DEC[1] (mg/kg)	Res DEC[1] (mg/kg)	I/C PMC[1]	Res PMC[1]	I/C DEC[1] (mg/kg)	Res DEC[1] (mg/kg)	I/C PMC[1]	Res PMC[1]
Benzo(a)anthracene	---	1	1 mg/kg	---	4* mg/kg	---	1	---	---	---	1	---	3.4* mg/kg	---	1	---	4.4* mg/kg
Benzo(a)pyrene	---	1	1 mg/kg	---	6* mg/kg	---	---	---	---	---	1	---	---	---	1	---	6.5* mg/kg
Benzo(b)fluoranthene	---	1	1 mg/kg	---	2.6* mg/kg	---	---	---	---	---	1	---	2.2* mg/kg	---	1	---	2.8* mg/kg
Benzo(k)fluoranthene	---	---	1 mg/kg	---	6.5* mg/kg	---	---	---	---	---	---	---	---	--	---	---	7.1* mg/kg
Carbazole	---	---	1 mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Chrysene	---	---	1 mg/kg	---	6.8* mg/kg	---	---	---	---	---	---	---	---	---	---	---	7.4* mg/kg
Dibenzo(a,h)anthracene	---	1	1 mg/kg	---	5.1* mg/kg	---	---	---	---	---	1	---	---	---	1	---	---
Indeno(1,2,3-cd)pyrene	---	1	1 mg/kg	---	6.0* mg/kg	---	---	---	---	---	1	---	---	---	1	---	---
Phenanthrene	---	---	40 mg/kg	---	40 mg/kg	---	---	---	---	---	---	---	---	---	---	---	---
Pyrene	---	---	40 mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Antimony	---	---	---	---	---	---	---	---	---	---	---	---	---	---	31*[6]	0.10* mg/L[6]	0.06 mg/L[6]
Arsenic	---	---	---	---	---	---	---	---	---	---	---	---	0.27* mg/L	---	10	---	---
Chromium, Hexavalent	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.29*[4]	---	---
Copper	---	---	---	---	---	---	---	---	---	---	---	---	---	---	3,130*	---	---
Lead	---	---	0.15 mg/L	---	0.15 mg/L	1,090*	400	0.47 mg/L	0.15 mg/L	1,090*	400	0.24* mg/L	0.15 mg/L	1,090*	400	0.32* mg/L	0.15 mg/L
Mercury	---	24*	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TPH	---	---	---	---	---	---	---	---	---	---	500[5]	2,500 mg/kg[5]	2,500 mg/kg[5]	---	---	---	---

TABLE 6-6

SUMMARY OF SOIL COCs AND SELECTED PRGs
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

COC	Chemical of Concern
CTDEP	Connecticut Department of Environmental Protection
DEC	Direct Exposure Criterion
I/C	Industrial/Commercial
LNAPL	Light non-aqueous phase liquid
PMC	Pollutant Mobility Criterion
PRG	Preliminary Remediation Goal
Res	Residential
RSR	Remediation Standard Regulation
TPH	Total Petroleum Hydrocarbons
*	Calculated site-specific criterion. See Note (1).
1	PMC and DEC are CTDEP RSR criteria, except where flagged with an asterisk (*). Flagged values are calculated site-specific criteria. Refer to Appendix G.1.
2	PMC for areas of Zone 1 where LNAPL is present, and no Alternative PMC may be calculated.
3	PMC for areas of Zone 1 where no LNAPL is present, and Alternative PMC are allowable.
4	USEPA Residential Regional Screening Level.
5	TPH commingled with lead concentrations that exceed the PMC.
6	Antimony is co-located with lead in some Zone 7 soil.

TABLE 6-7

SUMMARY OF RME CANCER RISKS AND HAZARD INDICES FOR ZONE 2
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals Contributing to an HI > 1
Construction Worker	Surface/Subsurface Soil	Incidental Ingestion	1E-07	--	--	--	0.01	- -
		Dermal Contact	3E-08	--	--	--	0.001	- -
		Inhalation	1E-08	--	--	--	0.3	- -
		Total	2E-07	--	--	--	0.3	- -
	Groundwater	Dermal Contact	1E-08	--	--	--	0.001	- -
		Inhalation	2E-10	--	--	--	0.000008	- -
		Total	1E-08	--	--	--	0.001	- -
		Total All Media	2E-07				0.3	
Current Full-Time Employee	Surface Soil	Incidental Ingestion	1E-06	--	--	--	NC	- -
		Dermal Contact	9E-07	--	--	--	NC	- -
		Total	2E-06	--	--	--	NC	- -
Future Full-Time Employee	Surface/Subsurface Soil	Incidental Ingestion	2E-06	--	--	--	0.008	- -
		Dermal Contact	1E-06	--	--	--	0.001	- -
		Total	3E-06	--	--	--	0.009	- -
Child Residents	Surface/Subsurface Soil	Incidental Ingestion	2E-05	--	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic	0.1	- -
		Dermal Contact	7E-06	--	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene	0.008	- -
		Total	3E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	0.1	- -
Adult Residents	Surface/Subsurface Soil	Incidental Ingestion	4E-06	--	--	Benzo(a)pyrene	0.01	- -
		Dermal Contact	2E-06	--	--	--	0.001	- -
		Total	6E-06	--	--	Benzo(a)pyrene, Arsenic	0.01	- -
Lifelong Residents (Child and Adult)	Surface/Subsurface Soil	Incidental Ingestion	3E-05	--	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic	NA	- -
		Dermal Contact	9E-06	--	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene	NA	- -
		Total	4E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	NA	- -

NC - No noncarcinogenic COPCs were identified for surface soil.

TABLE 6-8

SUMMARY OF RME CANCER RISKS AND HAZARD INDICES FOR ZONE 3
LOWER SUBASE SOIL AND GROUNDATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals Contributing to an HI > 1
Construction Worker	Surface/Subsurface Soil	Incidental Ingestion	3E-07	--	--	--	0.02	--
		Dermal Contact	7E-08	--	--	--	0.001	--
		Inhalation	2E-08	--	--	--	0.3	--
		Total	3E-07	--	--	--	0.3	--
	Groundwater	Dermal Contact	1E-09	--	--	--	0.006	--
		Total	1E-09	--	--	--	0.006	--
		Total All Media	3E-07				0.3	
Current Full-Time Employee	Surface Soil	Incidental Ingestion	1E-06	--	--	--	0.007	--
		Dermal Contact	2E-07	--	--	--	0.001	--
		Total	1E-06	--	--	--	0.009	--
Future Full-Time Employee	Surface/Subsurface Soil	Incidental Ingestion	4E-06	--	--	Arsenic	0.01	- -
		Dermal Contact	2E-06	--	--	--	0.002	- -
		Total	6E-06	--	--	Benzo(a)pyrene, Arsenic	0.01	- -
Child Residents	Surface/Subsurface Soil	Incidental Ingestion	5E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	0.1	- -
		Dermal Contact	2E-05	--	--	Benzo(a)anthracene, Benzo(a)pyrene, Dibenzo(a,h)anthracene	0.01	- -
		Total	6E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	0.1	- -
Adult Residents	Surface/Subsurface Soil	Incidental Ingestion	8E-06	--	--	Benzo(a)pyrene, Arsenic	0.01	- -
		Dermal Contact	3E-06	--	--	Benzo(a)pyrene	0.002	- -
		Total	1E-05	--	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic	0.01	- -
Lifelong Residents (Child and Adult)	Surface/Subsurface Soil	Incidental Ingestion	5E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	NA	- -
		Dermal Contact	2E-05	--	--	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	NA	- -
		Total	7E-05	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene	Benzo(a)anthracene, Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene, Arsenic	NA	- -

TABLE 6-9

USEPA CHEMICALS OF CONCERN FOR ZONE 3
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Chemical of Concern	Impact on Human Receptors
SURFACE/SUBSURFACE SOIL	
Lead	Concentrations of lead in several samples exceed the OSWER screening level by an order of magnitude or more.

TABLE 6-10

CTDEP CHEMICALS OF POTENTIAL CONCERN FOR ZONE 3
LOWER SUBASE SOIL AND GROUNDATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Chemical of Potential Concern[1]					
SOIL				GROUNDWATER	
Industrial		Protective of Groundwater		Vapor Intrusion	Surface Water
Grass Areas	Paved Areas	Surface Soil	Subsurface Soil		
There are no grassy areas at Zone 3.	Lead	Lead	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene Lead Total Petroleum Hydrocarbons	None	Arsenic Lead

1 - Any chemical detected at a concentration exceeding a residential or industrial CTDEP RSR direct contact screening level or pollutant mobility criterion for soil or a volatilization or protection of surface water RSR for groundwater.

TABLE 6-11

SUMMARY OF RME CANCER RISKS AND HAZARD INDICES FOR ZONE 4
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals Contributing to an HI > 1
Construction Workers	Surface/Subsurface Soil	Incidental Ingestion	8E-07	--	--	--	0.02	- -
		Dermal Contact	3E-07	--	--	--	0.002	- -
		Inhalation	2E-08	--	--	--	0.2	- -
		Total	1E-06	--	--	--	0.3	- -
	Groundwater	Dermal Contact	2E-07	--	--	--	0.04	- -
		Inhalation	1E-09	--	--	--	0.0007	- -
		Total	2E-07	--	--	--	0.04	- -
		Total All Media	1E-06				0.3	
Current Full-Time Employees	Surface Soil	Incidental Ingestion	2E-05	--	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic	0.02	- -
		Dermal Contact	2E-05	--	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene	0.003	- -
		Total	4E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	0.02	- -
Future Full-Time Employees	Surface/Subsurface Soil	Incidental Ingestion	1E-05	--	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic	0.02	- -
		Dermal Contact	1E-05	--	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene	0.002	- -
		Total	2E-05	--	--	Benzo(a)anthracene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic	0.02	- -
Child Residents	Surface/Subsurface Soil	Incidental Ingestion	2E-04	--	Benzo(a)anthracene, Benzo(a)pyrene, Dibenzo(a,h)anthracene	Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene, Arsenic	0.2	- -
		Dermal Contact	7E-05	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene	Benzo(a)anthracene, Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene	0.01	- -
		Total	3E-04	--	Benzo(a)anthracene, Benzo(a)pyrene, Dibenzo(a,h)anthracene	Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene, Arsenic	0.2	- -
Adult Residents	Surface/Subsurface Soil	Incidental Ingestion	3E-05	--	--	Benzo(a)anthracene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic	0.02	- -
		Dermal Contact	1E-05	--	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene	0.002	- -
		Total	4E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	0.02	- -

TABLE 6-11

SUMMARY OF RME CANCER RISKS AND HAZARD INDICES FOR ZONE 4
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals Contributing to an HI > 1
Lifelong Residents (Child and Adult)	Surface/Subsurface Soil	Incidental Ingestion	2E-04	--	Benzo(a)anthracene, Benzo(a)pyrene, Dibenzo(a,h)anthracene	Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene, Arsenic	NA	- -
		Dermal Contact	8E-05	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene	Benzo(a)anthracene, Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene	NA	- -
		Total	3E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	Indeno(1,2,3-cd)pyrene, Arsenic	NA	- -

TABLE 6-12

USEPA CHEMICALS OF CONCERN FOR ZONE 4
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Chemical of Concern[1]	Impact on Human Receptors
SURFACE/SUBSURFACE SOIL	
Benzo(a)anthracene	Hypothetical Child Resident ILCR = 2E-05 Hypothetical Lifelong Resident ILCR = 3E-05
Benzo(a)pyrene	Hypothetical Child Resident ILCR = 1E-04 Hypothetical Lifelong Resident ILCR = 2E-04
Benzo(b)fluoranthene	Hypothetical Child Resident ILCR = 1E-05 Hypothetical Lifelong Resident ILCR = 2E-05
Dibenzo(a,h)anthracene	Hypothetical Child Resident ILCR = 7E-05 Hypothetical Lifelong Resident ILCR = 8E-05
Indeno(1,2,3-cd)pyrene	Hypothetical Child Resident ILCR = 1E-05 Hypothetical Lifelong Resident ILCR = 1E-05
Arsenic	Hypothetical Child Resident ILCR = 6E-06 Hypothetical Lifelong Resident ILCR = 9E-06
Lead	Risks for child residents, construction workers and full-time employees exceed acceptable levels.

ILCR = Incremental Lifetime Cancer Risk

1 - For media with ILCRs greater than 1×10^{-4}, a COC is any carcinogenic chemical with an ILCR greater than 1×10^{-6} or a noncarcinogenic chemical contributing to target organ hazard indices (HIs) greater than 1.0.

TABLE 6-13

CTDEP CHEMICALS OF POTENTIAL CONCERN FOR ZONE 4
LOWER SUBASE SOIL AND GROUNDATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Chemical of Potential Concern[1]					
SOIL				GROUNDWATER	
Industrial		Protective of Groundwater		Vapor Intrusion	Surface Water
Grassy Areas	Paved Areas	Surface Soil	Subsurface Soil		
None	Benzo(a)pyrene Dibenzo(a,h)anthracene Lead Total petroleum hydrocarbons	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Carbazole Chrysene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene Lead Total petroleum hydrocarbons	Arsenic Lead Total petroleum hydrocarbons	None	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Cadmium Copper Lead Mercury Zinc Total petroleum hydrocarbons

1 - Any chemical detected at a concentration exceeding a residential or industrial CTDEP RSR direct contact screening level or pollutant mobility criterion for soil or a volatilization or protection of surface water RSR for groundwater.

TABLE 6-14

SUMMARY OF RME CANCER RISKS AND HAZARD INDICES FOR ZONE 5
LOWER SUBASE SOIL AND GROUNDATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals Contributing to an HI > 1
Construction Workers	Surface/Subsurface Soil	Incidental Ingestion	1E-07	--	--	--	0.02	- -
		Dermal Contact	3E-08	--	--	--	0.001	- -
		Inhalation	2E-07	--	--	--	0.4	- -
		Total	4E-07	--	--	--	0.4	- -
	Groundwater	Dermal Contact	2E-09	--	--	--	0.1	- -
		Inhalation	1E-08	--	--	--	0.01	
		Total	2E-08	--	--	--	0.1	- -
		Total All Media	4E-07				1	
Current Full-Time Employees	Surface Soil	Incidental Ingestion	9E-07	--	--	--	0.008	- -
		Dermal Contact	2E-07	--	--	--	0.001	- -
		Total	1E-06	--	--	--	0.009	- -
Future Full-Time Employees	Surface/Subsurface Soil	Incidental Ingestion	2E-06	--	--	--	0.01	- -
		Dermal Contact	1E-06	--	--	--	0.002	- -
		Total	3E-06	--	--	--	0.01	- -
Child Residents	Surface/Subsurface Soil	Incidental Ingestion	2E-05	--	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic	0.1	--
		Dermal Contact	7E-06	--	--	Benzo(a)pyrene	0.01	--
		Total	3E-05	--	Benzo(a)pyrene	Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	0.1	--
Adult Residents	Surface/Subsurface Soil	Incidental Ingestion	4E-06	--	--	Benzo(a)pyrene	0.01	- -
		Dermal Contact	2E-06	--	--	--	0.002	- -
		Total	5E-06	--	--	Benzo(a)pyrene	0.02	- -
Lifelong Residents (Child and Adult)	Surface/Subsurface Soil	Incidental Ingestion	2E-05	--	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic	NA	- -
		Dermal Contact	8E-06	--	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene	NA	- -
		Total	3E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	NA	- -

TABLE 6-15

SUMMARY OF RME CANCER RISKS AND HAZARD INDICES FOR ZONE 6
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals Contributing to an HI > 1
Construction Workers	Surface/Subsurface Soil	Incidental Ingestion	1E-07	--	--	--	0.01	- -
		Dermal Contact	2E-08	--	--	--	0.0009	- -
		Inhalation	1E-08	--	--	--	0.3	- -
		Total	1E-07	--	--	--	0.3	- -
	Groundwater	Dermal Contact	1E-09	--	--	--	0.008	- -
		Inhalation	3E-09	--	--	--	0.0001	
		Total	5E-09	--	--	--	0.008	- -
		Total All Media	1E-07				0.3	
Current Full-Time Employees	Surface Soil	Incidental Ingestion	2E-06	--	--	--	0.008	- -
		Dermal Contact	1E-06	--	--	--	0.001	- -
		Total	4E-06	--	--	Benzo(a)pyrene	0.01	- -
Future Full-Time Employees	Surface/Subsurface Soil	Incidental Ingestion	2E-06	--	--	--	0.007	- -
		Dermal Contact	7E-07	--	--	--	0.001	- -
		Total	2E-06	--	--	--	0.01	- -
Child Residents	Surface/Subsurface Soil	Incidental Ingestion	1E-05	--	--	Benzo(a)pyrene, Arsenic	0.1	- -
		Dermal Contact	4E-06	--	--	Benzo(a)pyrene	0.007	- -
		Total	2E-05	--	--	Benzo(a)pyrene, Arsenic	0.1	- -
Adult Residents	Surface/Subsurface Soil	Incidental Ingestion	3E-06	--	--	--	0.01	- -
		Dermal Contact	9E-07	--	--	--	0.001	- -
		Total	4E-06	--	--	Benzo(a)pyrene, Arsenic	0.01	- -
Lifelong Residents (Child and Adult)	Surface/Subsurface Soil	Incidental Ingestion	2E-05	--	--	Benzo(a)pyrene, Arsenic	NA	- -
		Dermal Contact	5E-06	--	--	Benzo(a)pyrene	NA	- -
		Total	2E-05	--	--	Benzo(a)pyrene, Arsenic	NA	- -

TABLE 6-16

SUMMARY OF RME CANCER RISKS AND HAZARD INDICES FOR ZONE 7
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals Contributing to an HI > 1
Construction Workers	Surface/Subsurface Soil	Incidental Ingestion	1E-06	--	--	--	2	Antimony
		Dermal Contact	3E-07	--	--	--	0.006	--
		Inhalation	1E-07	--	--	--	0.5	--
		Total	1E-06	--	--	--	2	Antimony
	Groundwater	Dermal Contact	5E-09	--	--	--	0.04	--
		Inhalation	4E-10	--	--	--	0.0001	--
		Total	6E-09	--	--	--	0.04	--
		Total All Media	1E-06				2	
Current Full-Time Employees	Surface Soil	Incidental Ingestion	2E-05	--	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene	0.05	--
		Dermal Contact	1E-05	--	--	Benzo(a)pyrene, Dibenzo(a,h)anthracene	0.001	--
		Total	3E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	0.05	--
Future Full-Time Employees	Surface/Subsurface Soil	Incidental Ingestion	2E-05	--	--	Benzo(a)pyrene, Arsenic	2	Target Organs HI ≤ 1
		Dermal Contact	9E-06	--	--	Benzo(a)pyrene	0.008	- -
		Total	2E-05	--	--	Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	2	Target Organs HI ≤ 1
Child Residents	Surface/Subsurface Soil	Incidental Ingestion	2E-04	--	Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	Benzo(a)anthracene, Indeno(1,2,3-cd)pyrene	14	Antimony
		Dermal Contact	6E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	0.05	--
		Total	2E-04	--	Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	Benzo(a)anthracene, Indeno(1,2,3-cd)pyrene	14	Antimony
Adult Residents	Surface/Subsurface Soil	Incidental Ingestion	3E-05	--	--	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	2	Target Organs HI ≤ 1
		Dermal Contact	1E-05	--	--	Benzo(a)pyrene	0.007	- -
		Total	4E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	2	Target Organs HI ≤ 1

TABLE 6-16

SUMMARY OF RME CANCER RISKS AND HAZARD INDICES FOR ZONE 7
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals Contributing to an HI > 1
Lifelong Residents (Child and Adult)	Surface/Subsurface Soil	Incidental Ingestion	2E-04	--	Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	Benzo(a)anthracene, Indeno(1,2,3-cd)pyrene, Hexavalent Chromium	NA	- -
		Dermal Contact	7E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	NA	- -
		Total	3E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	Indeno(1,2,3-cd)pyrene, Hexavalent chromium	NA	- -

TABLE 6-17

USEPA CHEMICALS OF CONCERN FOR ZONE 7
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Chemical of Concern[1]	Impact on Human Receptors
SURFACE/SUBSURFACE SOIL	
Benzo(a)anthracene	Hypothetical Child Resident ILCR = 1E-05 Hypothetical Lifelong Resident ILCR = 2E-05
Benzo(a)pyrene	Hypothetical Child Resident ILCR = 1E-04 Hypothetical Lifelong Resident ILCR = 2E-04
Benzo(b)fluoranthene	Hypothetical Child Resident ILCR = 2E-05 Hypothetical Lifelong Resident ILCR = 3E-05
Dibenzo(a,h)anthracene	Hypothetical Child Resident ILCR = 3E-05 Hypothetical Lifelong Resident ILCR = 3E-05
Indeno(1,2,3-cd)pyrene	Hypothetical Child Resident ILCR = 6E-06 Hypothetical Lifelong Resident ILCR = 7E-06
Antimony	Construction Worker HI = 2 Hypothetical Child Resident HI = 14
Arsenic	Hypothetical Child Resident ILCR = 2E-05 Hypothetical Lifelong Resident ILCR = 3E-05
Hexavalent chromium	Hypothetical Lifelong Resident ILCR = 2E-06
Lead	Risks for hypothetical child residents, construction workers, and full-time employees exceed acceptable levels.

HQ = Hazard Quotient.
ILCR = Incremental Lifetime Cancer Risk
1 - For media with ILCRs greater than 1×10^{-4}, a COC is any carcinogenic chemical with an ILCR greater than 1×10^{-6} or a noncarcinogenic chemical contributing to target organ hazard indices (HIs) greater than 1.0.

TABLE 6-18

CTDEP CHEMICALS OF POTENTIAL CONCERN FOR ZONE 7
LOWER SUBASE SOIL AND GROUNDATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Chemicals of Potential Concern[1]					
SOIL				GROUNDWATER	
Industrial		Protective of Groundwater		Vapor Intrusion	Surface Water
Grassy Areas	Paved Areas	Surface Soil	Subsurface Soil		
Benzo(a)pyrene	Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene Lead	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene Antimony Lead	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Carbazole Chrysene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene Antimony Arsenic Lead Total petroleum hydrocarbons	None	Acenaphthylene Arsenic Lead Selenium Zinc

1 - Any chemical detected at a concentration exceeding a residential or industrial CTDEP RSR direct contact screening level or pollutant mobility criterion for soil or a volatilization or protection of surface water RSR for groundwater.

TABLE 6-19

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-1.1, S-3.1, S-4.1, AND S-7.1: NO ACTION
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Cancer Slope Factors (CSFs)	United States Environmental Protection Agency (USEPA) Integrated Risk Information System (IRIS) and others	To Be Considered (TBC)	These are guidance values used in risk assessment to evaluate the potential carcinogenic risk caused by exposure to contaminants.	Would not comply. The No Action alternatives would not maintain building foundations and paved areas, regulate the disturbance of contaminated soil, or prevent hypothetical future residential development, any of which could result in unacceptable carcinogenic risks. In addition, No Action would not warn of potential migration of soil chemicals of concern (COCs) to groundwater, which could also result in unacceptable risk from exposure.
Reference Doses (RfDs)	EPA IRIS and others	TBC	These are guidance values used in risk assessment to evaluate the potential noncarcinogenic hazard caused by exposure to contaminants.	Would not comply. The No Action alternatives would not maintain building foundations and paved areas, regulate the disturbance of contaminated soil, or prevent hypothetical future residential development, any of which could result in unacceptable noncarcinogenic hazards. In addition, No Action would not warn of potential migration of soil COCs to groundwater, which could also result in unacceptable risk from exposure.
Guidelines for Carcinogen Risk Assessment	EPA/630/P-03/001F (March 2005)	TBC	These guidelines are used to perform human health risk assessments.	Would not comply. The No Action alternatives would not maintain building foundations and paved areas, regulate the disturbance of contaminated soil, or prevent hypothetical future residential development, any of which could result in unacceptable carcinogenic risks. In addition, No Action would not warn of potential migration of soil COCs to groundwater, which could also result in unacceptable risk from exposure.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F (March 2005)	TBC	These guidelines are used to perform human health risk assessments.	Would not comply. The No Action alternatives would not maintain building foundations and paved areas, regulate the disturbance of contaminated soil, or prevent hypothetical future residential development, any of which could result in unacceptable carcinogenic risks to children. In addition, No Action would not warn of potential migration of soil COCs to groundwater, which could also result in unacceptable risk from exposure.

TABLE 6-19

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-1.1, S-3.1, S-4.1, AND S-7.1: NO ACTION
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL (continued)				
Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil	EPA-540-R-03-001, OSWER Dir #9285.7-54 (January 2003)	TBC	EPA guidance for evaluating the risks posed by lead in soil.	Would not comply. The No Action alternatives would not meet this standard because potential lead risk would not be addressed.
STATE OF CONNECTICUT				
Remediation Standard Regulations (RSRs)	Connecticut General Statutes (CGS) §22a-133k; Regulations of Connecticut State Agencies (RCSA) §22a-133k - 1 through 3	Applicable	These regulations establish Direct Exposure Criteria (DECs) and Pollutant Mobility Criteria (PMCs) for contaminated soil. Particularly, §22a-133k-2(d)(2) allows for the development of alternative DECs, and §22a-133k-2(c)(2)(E) allows for the development and use of Alternative PMCs for soil overlying groundwater classified as GB. These Alternative PMCs are equal to the GA PMCs multiplied by a site-specific dilution factor (DF) developed based on site-specific hydrogeologic characteristics.	Would not comply. The No Action alternatives would not address current exceedances of residential Alternative DECs and Alternative PMCs. In addition, the No Action alternatives would not prevent hypothetical future residential development, which would result in exposure to soil with concentrations greater than Residential Alternative DECs. Alternative DECs and PMCs for each zone are identified in Table 6-6.

TABLE 6-20

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-1.2, S-3.2, S-4.2, AND S-7.2: LUCs (ENGINEERING AND INSTITUTIONAL) AND MONITORING
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Cancer Slope Factors (CSFs)	United States Environmental Protection Agency (USEPA) Integrated Risk Information System (IRIS) and others	To Be Considered (TBC)	These are guidance values used in risk assessment to evaluate the potential carcinogenic risk caused by exposure to contaminants.	Would comply. The land use controls (LUCs) of Alternatives S-1.2, S-3.2, S-4.2, and S-7.2 would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable industrial/ commercial (I/C) carcinogenic risks. In addition, the monitoring of these same alternatives would warn of potential migration of soil chemicals of concern (COCs) to groundwater, which would also minimize unacceptable risks.
Reference Doses (RfDs)	EPA IRIS and others	TBC	These are guidance values used in risk assessment to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	Would comply. The LUCs of Alternatives S-1.2, S-3.2, S-4.2, and S-7.2 would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable I/C noncarcinogenic hazards. In addition, the monitoring of these same alternatives would warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks.
Guidelines for Carcinogen Risk Assessment	EPA/630/P-03/001F (March 2005)	TBC	These guidelines are used to perform human health risk assessments.	Would comply. The LUCs of Alternatives S-1.2, S-3.2, S-4.2, and S-7.2 would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable I/C carcinogenic risks. In addition, the monitoring of these same alternatives would warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks.

TABLE 6-20

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-1.2, S-3.2, S-4.2, AND S-7.2: LUCs (ENGINEERING AND INSTITUTIONAL) AND MONITORING
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL (continued)				
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F (March 2005)	TBC	These guidelines are used to perform human health risk assessments.	Would comply. The LUCs of Alternatives S-1.2, S-3.2, S-4.2, and S-7.2 would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable I/C carcinogenic risks to children. In addition, the monitoring of these same alternatives would warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks to children.
Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil	EPA-540-R-03-001, OSWER Dir #9285.7-54 (January 2003)	TBC	USEPA guidance for evaluating the risks posed by lead in soil.	Would comply. The LUCs of Alternatives S-1.2, S-3.2, S-4.2, and S-7.2 would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risk from exposure to lead contaminated soil. In addition, the monitoring of these same alternatives would warn of potential migration of lead from soil to groundwater, which would also minimize unacceptable risks.

TABLE 6-20

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-1.2, S-3.2, S-4.2, AND S-7.2: LUCs (ENGINEERING AND INSTITUTIONAL) AND MONITORING
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
STATE OF CONNECTICUT				
Remediation Standard Regulations (RSRs)	Connecticut General Statutes (CGS) §22a-133k; Regulations of Connecticut State Agencies (RCSA) §22a-133k - 1 through 3	Applicable	These regulations establish Direct Exposure Criteria (DEC) and Pollutant Mobility Criteria (PMC) for contaminated soil. Particularly, §22a-133k-2(d)(2) allows for the development of alternative DECs, and §22a-133k-2(c)(2)(E) allows for the development and use of Alternative PMC for soil overlying groundwater classified as GB. These Alternative PMC are equal to the GA PMC multiplied by a site-specific dilution factor (DF) which is developed based on site-specific hydrogeologic characteristics. In addition, §22a-133k-2(f) allows for the use of engineered controls to isolate contaminated soil that may cause unacceptable direct exposure or pollutant mobility risks.	Alternatives S-1.2, S-3.2, and S-7.2 would comply with Alternative DECs and Alternative PMCs of these regulations through the use of LUCs (engineering and institutional controls). Under Alternative S-7.2, upgrade and maintenance of the storm sewers passing through contaminated soil would be required. Alternative S-4.2 would comply with the Alternative DEC of these regulations, but not fully comply with the Alternative PMC of these regulations. The LUCs for this alternative would not fully address the pollutant mobility issue. However, the LUCs of this alternative would reduce risks from the Alternative PMC exceedance. Under Alternative S-4.2, upgrade and maintenance of the storm sewers passing through contaminated soil would be required. All of the alternatives would prevent even greater risks from residential development. In addition, the groundwater monitoring for all of the alternatives would warn of potential migration of soil COCs to groundwater. The building foundations and pavement will be established, monitored and maintained in compliance with these standards. Alternative DECs and PMCs for each zone are identified in Table 6-6.

TABLE 6-21

ASSESSMENT OF LOCATION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-1.2, S-3.2, S-4.2, AND S-7.2: LUCs (ENGINEERING AND INSTITUTIONAL) AND MONITORING
LOWER SUBASE SOIL AND GROUNDATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Fish and Wildlife Coordination Act	16 USC Part 661 *et. seq.*, 40 CFR 122	Applicable	Protects fish and wildlife when actions at the site would result in the control or structural modification of a natural stream, body of water, wetlands, floodplain, or flood-prone areas. The statute requires federal agencies to take into account the effects of remedial actions and prevent loss or damage to resources.	Would comply. The groundwater monitoring of Alternatives S-1.2, S-3.2, S-4.2, and S-7.2 would provide adequate warning of the potential migration of soil chemicals of concern (COCs) to groundwater and surface water. Federal resource agencies would be consulted to prevent, mitigate, or compensate for loss of fish and wildlife.
Coastal Zone Management Act	16 USC Parts 1451 *et. seq.*	Applicable	Requires that any actions that affect a land or water use or water resource of the coastal zone must be conducted in a manner consistent to the maximum extent practical with enforceable policies of state-approved management programs.	Would comply. The monitoring activities and establishment and long-term maintenance of the cover system in Alternatives S-1.2, S-3.2, S-4.2, and S-7.2 would comply with the substantive requirements of this act.
Floodplain Management and Protection of Wetlands	44 CFR 9	Relevant and appropriate	FEMA regulations that set forth the policy, procedure and responsibilities to implement and enforce Executive Order 11988 Floodplain Management and Executive Order 11990, Protection of Wetlands.	Would comply. The monitoring activities and establishment and long-term maintenance of the cover system in Alternatives S-1.2, S-3.2, S-4.2, and S-7.2 will be implemented in compliance with these standards. The Navy will solicit public comment as part of the proposed plan on the measures taken through the remedial action to protect floodplain and wetland resources.
STATE OF CONNECTICUT				
Coastal Management Act	Regulations of Connecticut State Agencies (RCSA) §22a-90 to 112	Applicable	The sites are in a coastal zone management area. Therefore, requirements for site planning must include approval of activities within the coastal zone to minimize project impacts to this area.	Would comply. The monitoring activities and establishment and long-term maintenance of the cover system in Alternatives S-1.2, S-3.2, S-4.2, and S-7.2 would comply with the substantive requirements of this act.
Tidal Wetlands and Watercourses	RCSA §22a-30-1 through 17	Applicable	These rules regulate all activities within or affecting tidal wetlands and watercourses.	Would comply. The monitoring activities and establishment and long-term maintenance of the cover system in Alternatives S-1.2, S-3.2, S-4.2, and S-7.2 would be managed to prevent erosion and other disturbance to tidal wetlands and the Thames River.
Flood Management Regulations	RCSA 25-68h-1 through 25-68h-3	Relevant and Appropriate	These regulations govern State activities in floodplains to minimize flood risk and prevent flood hazards. Also addresses stormwater runoff.	Would comply. The monitoring activities and establishment and long-term maintenance of the cover system in Alternatives S-1.2, S-3.2, S-4.2, and S-7.2 would consider the potential for disturbance of floodplains. Any work in floodplains would comply with the substantive provisions of the regulations.

TABLE 6-21

ASSESSMENT OF LOCATION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-1.2, S-3.2, S-4.2, AND S-7.2: LUCs (ENGINEERING AND INSTITUTIONAL) AND MONITORING
LOWER SUBASE SOIL AND GROUNDATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
STATE OF CONNECTICUT (Continued)				
Connecticut Endangered Species Act	CGS § 26-303 thru 314	Applicable	Remedial actions may not jeopardize the continued existence of state-listed endangered or threatened species, or adversely modify or destroy their critical habitat.	Would comply. The monitoring activities and establishment and long-term maintenance of the cover system in Alternatives S-1.2, S-3.2, S-4.2, and S-7.2 would not disturb aquatic habitats in the Thames River which are used by the state-threatened Atlantic Sturgeon and would address risks posed by potential migration of soil COCs to the Thames River.

TABLE 6-22

ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-1.2, S-3.2, S-4.2, AND S-7.2: LUCs (ENGINEERING AND INSTITUTIONAL) AND MONITORING
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Requirement	Citation	Status	Synopsis	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Clean Water Act (CWA), Section 402, National Pollution Discharge Elimination System (NPDES)	United States Code (USC) 1342; 40 Code of Federal Regulations (CFR) 122 through 125	Applicable	These standards govern point source discharges of pollutants to surface water. Includes stormwater requirements for construction projects that disturb over one acre.	The stormwater standards under these regulations would be met during any establishment or maintenance of the building foundations and paved areas.
Clean Water Act, National Recommended Water Quality Criteria (NRWQC)	33 USC § 1251 et seq.; 40 CFR 122.44	Relevant and Appropriate	Used to establish water quality standards for the protection of aquatic life.	Standards to be used for monitoring water quality in the Thames River during active remedial activities within the floodplain and as part of long-term water quality monitoring for alternatives that leave waste in place.
Clean Air Act (CAA), National Emissions Standards for Hazardous Air Pollutants (NESHAPs)	42 USC §12(b)(1); 40 CFR Part 61	Applicable	The regulations establish emissions standards for 189 hazardous air pollutants. Standards set for dust control and other release sources.	Activities during the establishment and maintenance of the building foundations and paved areas that would generate dust and air pollutants would comply with these regulations.
STATE OF CONNECTICUT				
Hazardous Waste Management: Generator and Handler Requirements, Listing, and Identification	Regulations of Connecticut State Agencies (RCSA) §22a-449(c) 100-101	Applicable	Connecticut is delegated to administer the federal Resource Conservation and Recovery Act (RCRA) statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference	Would comply. No significant excavation would be part of the monitoring and establishment and long-term maintenance of the building foundations and paved areas of Alternatives S-1.2, S-3.2, S-4.2, and S-7.2. However, soil excavated during general Subase maintenance would be tested, and any soil identified as hazardous waste would be managed in accordance with these regulations.
Hazardous Waste Management: Generator Standards	RCSA § 22a-449(c)-102	Applicable	This section establishes standards for various classes of generators. The standards of 40 CFR 262 are incorporated by reference.	Would comply. Any hazardous waste that would be generated from the monitoring activities and establishment and long-term maintenance of the building foundations and paved areas of Alternatives S-1.2, S-3.2, S-4.2, and S-7.2 would be handled and disposed of in compliance with these standards.
Water Quality Standards	Regulations promulgated under Connecticut General Statutes (CGS) §22a-426	Applicable	Connecticut's Water Quality Standards establish specific numeric criteria, designated uses, and anti-degradation policies for groundwater and surface water. Groundwater at the site is classified under these regulations as GB. Includes stormwater requirements for construction projects that disturb over 1 acre.	Would comply. The long-term groundwater monitoring and establishment and long-term maintenance of the building foundations and paved areas of Alternatives S-1.2, S-3.2, S-4.2, and S-7.2 would ensure that groundwater quality standards for GB groundwater would be maintained outside of the compliance zone for the waste management area. Monitoring would also ensure that stormwater and groundwater standards would be met.

TABLE 6-22

ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-1.2, S-3.2, S-4.2, AND S-7.2: LUCs (ENGINEERING AND INSTITUTIONAL) AND MONITORING
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Requirement	Citation	Status	Synopsis	Evaluation of Alternative Compliance with ARAR
STATE OF CONNECTICUT (Continued)				
Air Pollution Control	RCSA §22a-174 1-20	Applicable	These regulations pertain to construction and operation of specified types of emission sources and contain emission standards that must be met. Pollutant abatement controls may be required. Specific standards pertain to fugitive dust (18b).	Would comply. The monitoring activities and establishment and long-term maintenance of the building foundations and paved areas of Alternatives S-1.2, S-3.2, S-4.2, and S-7.2 would be performed so as to minimize fugitive emissions and would comply with the substantive requirements of these regulations.
Guidelines for Soil Erosion and Sediment Control	Connecticut Council on Soil and Water Conservation	To Be Considered (TBC)	Technical and administrative guidance for development, adoption, and implementation of an erosion and sediment control program.	Would comply. No significant excavation would be part of the monitoring and establishment and long-term maintenance of the building foundations and paved areas of Alternatives S-1.2, S-3.2, S-4.2, and S-7.2. However, some excavation may be required to upgrade and maintain the storm sewers under Alternatives S-4.2 and S-7.2. Erosion and sedimentation control measures would be implemented as required.

TABLE 6-23

SUMMARY OF COMPARATIVE ANALYSIS OF ZONE 1 SOIL REMEDIAL ALTERNATIVES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Evaluation Criterion	Alternative S-1.1 No Action	Alternative S-1.2 LUCs (Engineering and Institutional Controls) and Monitoring	Alternative S-1.5 Excavation to Meet Residential DECs and PMCs, On-Site Dewatering, and Off-Site Disposal
Overall Protection of Human Health and Environment	Not protective.	Protective.	Most protective.
Compliance with ARARs and TBCs			
Chemical-Specific	Would not comply.	Would comply.	Would comply.
Location-Specific	No location-specific ARARs.	Would comply.	Would comply.
Action-Specific	Not applicable.	Would comply.	Would comply.
Long-Term Effectiveness and Permanence	Not effective.	Effective.	Most effective.
Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment	There is no treatment.	There is no treatment.	There is no treatment, except the treatment of water generated from the dewatering process prior to discharge to the Thames River. A very small mass of COCs will be treated by this process.
Short-Term Effectiveness	No short-term risks. Would not achieve soil RAOs.	Short-term risks to address: Worker exposure during groundwater sampling or utility excavation activities; no impacts to environment or community. Three months to implement and achieve soil RAOs. Minimum potential for short-term risks.	Short-term risks to address: Worker exposure during excavation; transport of contaminated soil through community; dust from excavation. Nine months to implement and achieve soil RAOs. Would meet Zone 1 soil PRGs for residential direct exposure and pollutant mobility at completion.

TABLE 6-23

SUMMARY OF COMPARATIVE ANALYSIS OF ZONE 1 SOIL REMEDIAL ALTERNATIVES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Evaluation Criterion	Alternative S-1.1 No Action	Alternative S-1.2 LUCs (Engineering and Institutional Controls) and Monitoring	Alternative S-1.5 Excavation to Meet Residential DECs and PMCs, On-Site Dewatering, and Off-Site Disposal
Implementability	Requires only five-year reviews.	Issues include: Instituting CERCLA LUCs over approximately 44,755 square feet (sf) of paved area and maintaining pavement over 24,400 sf to make contaminated soil inaccessible, maintaining monitoring wells; No base construction approval needed; LUC RD can be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	Includes excavation to depths up to 15 feet over a 44,755 sf area and disposal of 12,610 cy of material. Issues include: sheet piles for excavation support; dewatering system required; water treatment and disposal system required; base construction approval needed; resources are readily available.
Costs:			
Capital	$0	$23,000	$6,157,000
O&M NPW (Years)	$104,000 (30)	$397,000 (30)	$0
NPW (Years)	$104,000 (30)	$420,000 (30)	$6,157,000

ARARs	Applicable or Relevant and Appropriate Requirements
cy	Cubic yards
DECs	Direct Exposure Criteria (Connecticut)
I/C	Industrial/commercial
LTTD	Low-temperature thermal desorption
LUCs	Land use controls
LUC RD	Land Use Control Remedial Design
NPW	Net present worth
O&M	Operation and maintenance
PAHs	Polycyclic aromatic hydrocarbons
PMCs	Pollutant Mobility Criteria (Connecticut)
PRGs	Preliminary Remedial Goals
RAOs	Remedial Action Objectives
sf	Square feet
TBCs	To be considered (criteria)

TABLE 6-24

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.3, S-4.3, AND S-7.3: CAPPING TO MEET I/C PRGs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING AND SOIL ALTERNATIVES S-3.5A, S-4.5A, AND S-7.5A: EXCAVATION TO MEET DECs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
LOWER SUBASE SOIL AND GROUNWATER COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Cancer Slope Factors (CSFs)	United States Environmental Protection Agency (USEPA) Integrated Risk Information System (IRIS) and others	To Be Considered (TBC)	These are guidance values used in risk assessment to evaluate the potential carcinogenic risk caused by exposure to contaminants.	Would comply. Alternatives S-3.3, S-4.3, and S-7.3 and Alternatives S-3.5A, S-4.5A, and S-7.5A would include installing a cover system (cap or engineered control) over or removal of soil that could result in unacceptable industrial/commercial (I/C) carcinogenic risks and contribute to the migration of soil chemicals of concern (COCs) to groundwater. These alternatives would also include land use controls (LUCs) that would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risks. Storm sewer upgrades and maintenance would be required for Alternatives S-4.3, S-7.3, S-4.5A, and, S-7.5A to address soil-to-groundwater pollutant mobility. The groundwater monitoring included with these same alternatives would warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks.
Reference Doses (RfDs)	USEPA IRIS and others	TBC	These are guidance values used in risk assessment to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	Would comply. Alternatives S-3.3, S-4.3, and S-7.3 and Alternatives S-3.5A, S-4.5A, and S-7.5A would include installing a cover system (cap or engineered control) over or removal of soil that could result in unacceptable I/C carcinogenic risks and contribute to the migration of soil COCs to groundwater. These alternatives would also include LUCs that would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risks. Storm sewer upgrades and maintenance would be required for Alternatives S-4.3, S-7.3, S-4.5A, and S-7.5A to address soil-to-groundwater pollutant mobility. The groundwater monitoring included with these same alternatives would warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks.

TABLE 6-24

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.3, S-4.3, AND S-7.3: CAPPING TO MEET I/C PRGs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING AND SOIL ALTERNATIVES S-3.5A, S-4.5A, AND S-7.5A: EXCAVATION TO MEET DECs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL (continued)				
Guidelines for Carcinogen Risk Assessment	EPA/630/P-03/001F (March 2005)	TBC	These guidelines are used to perform human health risk assessments.	Would comply. Alternatives S-3.3, S-4.3, and S-7.3 and Alternatives S-3.5A, S-4.5A, and S-7.5A would include installing a cover system (cap or engineered control) over or removal of soil that could result in unacceptable I/C carcinogenic risks and contribute to the migration of soil COCs to groundwater. These alternatives would also include LUCs that would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risks. Storm sewer upgrades and maintenance would be required for Alternatives S-4.3, S-7.3, S-4.5A, and S-7.5A to address soil-to-groundwater pollutant mobility. The groundwater monitoring included with these same alternatives would warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F (March 2005)	TBC	These guidelines are used to perform human health risk assessments.	Would comply. Alternatives S-3.3, S-4.3, and S-7.3 and Alternatives S-3.5A, S-4.5A, and S-7.5A would include installing a cover system (cap or engineered control) over or removal of soil that could result in unacceptable I/C carcinogenic risks and contribute to the migration of soil COCs to groundwater. These alternatives would also include LUCs that would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risks. Storm sewer upgrades and maintenance would be required for Alternatives S-4.3, S-7.3, S-4.5A, and S-7.5A to address soil-to-groundwater pollutant mobility. The groundwater monitoring included with these same alternatives would warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks.

TABLE 6-24

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.3, S-4.3, AND S-7.3: CAPPING TO MEET I/C PRGs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING AND SOIL ALTERNATIVES S-3.5A, S-4.5A, AND S-7.5A: EXCAVATION TO MEET DECs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL (continued)				
Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil	EPA-540-R-03-001, Office of Solid Waste and Emergency Response (OSWER) Directive #9285.7-54 (January 2003)	TBC	USEPA guidance for evaluating the risks posed by lead in soil.	Would comply. Alternatives S-3.3, S-4.3, and S-7.3 and Alternatives S-3.5A, S-4.5A, and S-7.5A would include installing a cover system (cap or engineered control) over or removal of soil that could result in unacceptable I/C carcinogenic risks and contribute to the migration of soil COCs to groundwater. These alternatives would also include LUCs that would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risks. Storm sewer upgrades and maintenance would be required for Alternatives S-4.3, S-7.3, S-4.5A, and S-7.5A to address soil-to-groundwater pollutant mobility. The groundwater monitoring included with these same alternatives would warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks.

TABLE 6-24

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.3, S-4.3, AND S-7.3: CAPPING TO MEET I/C PRGs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING AND SOIL ALTERNATIVES S-3.5A, S-4.5A, AND S-7.5A: EXCAVATION TO MEET DECs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
STATE OF CONNECTICUT				
Remediation Standard Regulations (RSRs)	Connecticut General Statutes (CGS) §22a-133k; Regulations of Connecticut State Agencies (RCSA) 22a-133k - 1 through 3 (Appendices A and B)	Applicable	These regulations establish Direct Exposure Criteria (DECs) and Pollutant Mobility Criteria (PMCs) for contaminated soil. Particularly, §22a-133k-2(d)(2) allows for the development of alternative DECs, and §22a-133k-2(c)(2)(E) allows for the development and use of Alternative PMCs for soil overlying groundwater classified as GB. These Alternative PMCs are equal to the GA PMCs multiplied by a site-specific dilution factor (DF) developed based on site-specific hydrogeologic characteristics. In addition, §22a-133k-2(f) allows for the use of engineered controls to isolate contaminated soil that may cause unacceptable direct exposure or pollutant mobility risks.	Would comply for Alternatives S-3.3, S-4.3, and S-7.3 and Alternatives S-3.5A and S-7.5A. These alternatives would excavate and dispose off site soil with COC concentrations exceeding Alternative I/C DECs and Alternative PMCs (if less than 2 feet deep) and install a cover system (impervious cap or engineered control) over soil with COC concentrations exceeding Alternative I/C PMCs (if below 2 feet deep), thus eliminating the risk of exposure and minimizing the potential migration of soil COCs to groundwater. Alternative S-4.5A would comply with the Alternative DECs of these regulations but would not fully comply with the Alternative PMCs because the LUCs would not fully address the pollutant mobility issue. However, the LUCs for Alternative S-4.5A would reduce risks from the Alternative PMC exceedances. Storm sewer upgrades and maintenance would be required for Alternatives S-4.3, S-7.3, S-4.5A, and S-7.5A to address soil-to-groundwater pollutant mobility. In addition, these alternatives would include groundwater monitoring to provide a warning of the potential migration of soil COCs to groundwater. The cover systems will be constructed, monitored, and maintained in compliance with these standards. Compliance with LUCs would also meet these standards. Alternative DECs and PMCs for each zone are identified in Table 6-6.

TABLE 6-25

ASSESSMENT OF LOCATION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.3, S-4.3, AND S-7.3: CAPPING TO MEET I/C PRGs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING AND SOIL ALTERNATIVES S-3.5A, S-4.5A, AND S-7.5A: EXCAVATION TO MEET DECs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Fish and Wildlife Coordination Act	16 United States Code (USC) Part 661 *et. seq.*, 40 Code of Federal Regulations (CFR) 122	Applicable	Protects fish and wildlife when actions at a site would result in the control or structural modification of a natural stream, body of water, wetlands, floodplain, or flood-prone area. The statute requires federal agencies to take into account the effects of remedial actions and prevent loss of or damage to resources.	Would comply. The capping, excavation, and off-site disposal of Alternatives S-3.3, S-4.3, and S-7.3 and the excavation, off-site disposal, and LUCs of Alternatives S-3.5A, S-4.5A, and S-7.5A would minimize the potential migration of soil chemicals of concern (COCs) to groundwater or to surface water that could eventually impact fish and wildlife in the Thames River. Federal resource agencies would be consulted to prevent, mitigate, or compensate for loss to fish and wildlife.
Coastal Zone Management Act	16 USC Parts 1451 *et. seq.*	Applicable	Requires that any actions that affect a land or water use or water resource of the coastal zone be conducted in a manner consistent to the maximum extent practical with enforceable policies of state-approved management programs.	Would comply. The capping, excavation, and off-site disposal of Alternatives S-3.3, S-4.3, and S-7.3 and the excavation, off-site disposal, and LUCs of Alternatives S-3.5A, S-4.5A, and S-7.5A would comply with the substantive requirements of this act.
Floodplain Management and Protection of Wetlands	44 CFR 9	Relevant and appropriate	Federal Emergency Management Agency (FEMA) regulations that set forth the policy, procedure, and responsibilities to implement and enforce Executive Order 11988 Floodplain Management, and Executive Order 11990, Protection of Wetlands.	Would comply. The capping, excavation, and off-site disposal of Alternatives S-3.3, S-4.3, and S-7.3 and the excavation, off-site disposal, and LUCs of Alternatives S-3.5A, S-4.5A, and S-7.5A would be implemented in compliance with these standards. The Navy would solicit public comment as part of the proposed plan on the measures taken through the remedial action to protect floodplain and wetland resources.
STATE OF CONNECTICUT				
Coastal Management Act	Regulations of Connecticut State Agencies (RCSA) §22a-90 to 112	Applicable	The sites are in a coastal zone management area; therefore, requirements for site planning must include approval of activities within the coastal zone to minimize project impacts to this area.	Would comply. The capping, excavation, and off-site disposal of Alternatives S-3.3, S-4.3, and S-7.3 and the excavation, off-site disposal, and LUCs of Alternatives S-3.5A, S-4.5A, and S-7.5A would comply with the substantive requirements of this act.

TABLE 6-25

ASSESSMENT OF LOCATION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.3, S-4.3, AND S-7.3: CAPPING TO MEET I/C PRGs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING AND SOIL ALTERNATIVES S-3.5A, S-4.5A, AND S-7.5A: EXCAVATION TO MEET DECs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
STATE OF CONNECTICUT (continued)				
Tidal Wetlands and Watercourses	RCSA §22a-30-1 through 17	Applicable	These rules regulate all activities within or affecting tidal wetlands and watercourses.	Would comply. The capping, excavation, and off-site disposal of Alternatives S-3.3, S-4.3, and S-7.3 and the excavation, off-site disposal, and LUCs of Alternatives S-3.5A, S-4.5A, and S-7.5A would be managed to prevent erosion and other disturbance to tidal wetlands and the Thames River.
Flood Management Regulations	RCSA 25-68h-1 through 25-68h-3	Relevant and appropriate	These regulations address activities in floodplains to minimize flood risk and prevent flood hazards. Also address stormwater runoff.	Would comply. The capping, excavation, and off-site disposal of Alternatives S-3.3, S-4.3, and S-7.3 and the excavation, off-site disposal, and LUCs of Alternatives S-3.5A, S-4.5A, and S-7.5A would not adversely impact the floodplain resources. The cap would be designed, constructed, and maintained to be protective in the event of a 100-year storm event. The monitoring associated with these alternatives would be performed to minimize impacts to floodplain resources.
Connecticut Endangered Species Act	Connecticut General Statutes (CGS) §26-303 through 314	Applicable	Remedial actions may not jeopardize the continued existence of state-listed endangered or threatened species, or adversely modify or destroy their critical habitat.	Would comply. The capping, excavation, and off-site disposal of Alternatives S-3.3, S-4.3, and S-7.3 and the excavation, off-site disposal, and LUCs of Alternatives S-3.5A, S-4.5A, and S-7.5A would not cause disturbance to aquatic habitats in the Thames River, which are used by the state-threatened Atlantic Sturgeon, and would address risks posed by potential migration of soil COCs to the Thames River.

TABLE 6-26

ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.3, S-4.3, AND S-7.3: CAPPING TO MEET I/C PRGs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING AND SOIL ALTERNATIVES S-3.5A, S-4.5A, AND S-7.5A: EXCAVATION TO MEET DECs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Clean Air Act (CAA), National Emissions Standards for Hazardous Air Pollutants (NESHAPs)	42 United States Code (USC) §12(b)(1); 40 Code of Federal Regulations (CFR) Part 61	Applicable	The regulations establish emissions standards for 189 hazardous air pollutants. Standards set for dust control and other release sources.	The soil excavated during implementation of Alternatives S-3.3, S-4.3, and S-7.3 to allow for cap installation and as part of Alternatives S-3.5A, S-4.5A, and S-7.5A would be performed in compliance with these standards. Engineering controls could be used, if necessary, to meet this standard.
Clean Water Act, National Recommended Water Quality Criteria (NRWQC)	33 USC § 1251 et seq.; 40 CFR 122.44	Relevant and Appropriate	Used to establish water quality standards for the protection of aquatic life.	Standards to be used for monitoring water quality in the Thames River during active remedial activities within the floodplain and as part of long-term water quality monitoring for alternatives that leave waste in place.
Clean Water Act (CWA), Section 402, National Pollution Discharge Elimination System (NPDES)	USC 1342; 40 CFR 122 through 125	Applicable	These standards govern point source discharges of pollutants to surface water. Includes stormwater requirements for construction projects that disturb over one acre.	Alternatives S-3.3, S-4.3, and S-7.3 and would include soil disturbance activities during the installation of the cap and Alternatives S-3.5A, S-4.5A, and S-7.5A would include soil excavation. If any soil disturbance activities encompass an area greater than 1 acre, they would be performed in accordance with this standard.
STATE OF CONNECTICUT				
Hazardous Waste Management: Generator and Handler Requirements, Listing and Identification	Regulations of Connecticut State Agencies (RCSA) § 22a-449(c) 100-101	Applicable	Connecticut is delegated to administer the federal Resource Conservation and Recovery Act (RCRA) statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference.	Would comply. The soil excavated as part of Alternatives S-3.3, S-4.3, S-7.3,S-3.5A, S-4.5A, and S-7.5A would be tested, and any soil identified as hazardous would be managed in accordance with these regulations.
Hazardous Waste Management: Generator Standards	RCSA § 22a-449(c)-102	Applicable	This section establishes standards for various classes of generators. The standards of 40 CFR 262 are incorporated by reference.	Would comply. The soil excavated as part of Alternatives S-3.3, S-4.3, S-7.3,S-3.5A, S-4.5A, and S-7.5A would be tested, and any soil identified as hazardous would handled and disposed of in compliance with these standards.

TABLE 6-26

ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.3, S-4.3, AND S-7.3: CAPPING TO MEET I/C PRGs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING AND SOIL ALTERNATIVES S-3.5A, S-4.5A, AND S-7.5A: EXCAVATION TO MEET DECs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis	Evaluation of Alternative Compliance with ARAR
STATE OF CONNECTICUT (continued)				
Water Quality Standards	Regulations promulgated under Connecticut General Statutes (CGS) §22a-426	Applicable	Connecticut's Water Quality Standards establish specific numeric criteria, designated uses, and anti-degradation policies for groundwater and surface water. Groundwater at the site is classified under these regulations as GB. Includes stormwater requirements for construction projects that disturb over one acre.	Would comply. The capping and long-term groundwater monitoring of Alternatives S-3.3, S-4.3, S-7.3, S-3.5A, S-4.5A, and S-7.5A would ensure that groundwater quality standards for GB groundwater would be maintained. Monitoring would ensure that stormwater and groundwater standards were being met.
Air Pollution Control	RCSA §22a-174 1-20	Applicable	These regulations pertain to the construction and operation of specified types of emission sources and contain emission standards that must be met. Pollutant abatement controls may be required. Specific standards pertain to fugitive dust (18b).	Would comply. The capping and excavation of Alternatives S-3.3, S-4.3, S-7.3, S-3.5A, S-4.5A, and S-7.5A would be performed so as to minimize fugitive emissions and would comply with the substantive requirements of these regulations.
Connecticut Guidelines for Soil Erosion and Sediment Control	Connecticut Council on Soil and Water Conservation	To Be Considered (TBC)	Technical and administrative guidance for development, adoption, and implementation of an erosion and sediment control program.	Would comply. The capping and excavation of Alternatives S-3.3, S-4.3, S-7.3, S-3.5A, S-4.5A, and S-7.5A would include an appropriate erosion and sedimentation control program that would comply with these guidelines.

TABLE 6-27

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.4, S-4.4, AND S-7.4
IN-SITU TREATMENT (CHEMICAL STABILIZATION/SOLIDIFICATION/BIOREMEDIATION) TO MEET I/C PRGs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
LOWER SUBASE SOIL AND GROUNDATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Cancer Slope Factors (CSFs)	United States Environmental Protection Agency (USEPA) Integrated Risk Information System (IRIS) and others	To Be Considered (TBC)	These are guidance values used in risk assessment to evaluate the potential carcinogenic risk caused by exposure to contaminants.	Would comply. Alternatives S-3.4, S-4.4, and S-7.4 would include in-situ chemical stabilization/ solidification of soil that could result in unacceptable industrial/commercial (I/C) carcinogenic risks and contribute to the migration of soil chemicals of concern (COCs) to groundwater. These alternatives would also include land use controls (LUCs) that would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risks. The monitoring of these same alternatives would warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks.
Reference Doses (RfDs)	USEPA IRIS and others	TBC	These are guidance values used in risk assessment to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	Would comply. Alternatives S-3.4, S-4.4, and S-7.4 would include in-situ chemical stabilization/ solidification of soil that could result in unacceptable I/C non-carcinogenic risks and contribute to the migration of soil COCs to groundwater. These alternatives would also include LUCs that would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risks. The monitoring of these same alternatives would warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks.

TABLE 6-27

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.4, S-4.4, AND S-7.4
IN-SITU TREATMENT (CHEMICAL STABILIZATION/SOLIDIFICATION/BIOREMEDIATION) TO MEET I/C PRGs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
LOWER SUBASE SOIL AND GROUNDATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL (continued)				
Guidelines for Carcinogen Risk Assessment	EPA/630/P-03/001F (March 2005)	TBC	These guidelines are used to perform human health risk assessments.	Would comply. Alternatives S-3.4, S-4.4, and S-7.4 would include in-situ chemical stabilization/ solidification of soil that could result in unacceptable I/C carcinogenic risks and contribute to the migration of soil COCs to groundwater. These alternatives would also include LUCs that would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risks. The monitoring of these same alternatives would warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F (March 2005)	TBC	These guidelines are used to perform human health risk assessments.	Would comply. Alternatives S-3.4, S-4.4, and S-7.4 would include in-situ chemical stabilization/ solidification of soil that could result in unacceptable I/C carcinogenic risks and contribute to the migration of soil COCs to groundwater. These alternatives would also include LUCs that would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risks. The monitoring of these same alternatives would warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks.

TABLE 6-27

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.4, S-4.4, AND S-7.4
IN-SITU TREATMENT (CHEMICAL STABILIZATION/SOLIDIFICATION/BIOREMEDIATION) TO MEET I/C PRGs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
LOWER SUBASE SOIL AND GROUNDATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL (continued)				
Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil	EPA-540-R-03-001, Office of Solid Waste and Emergency Response (OSWER) Directive #9285.7-54 (January 2003)	TBC	USEPA guidance for evaluating the risks posed by lead in soil.	Would comply. Alternatives S-3.4, S-4.4, and S-7.4 would meet this standard because potential risk from adult exposure to lead would be addressed through in-situ chemical stabilization/solidification of soil that could contribute to unacceptable I/C risks. These alternatives would also include LUCs that would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risks from exposure to lead contaminated soil. The monitoring of these same alternatives would warn of potential migration of lead from soil to groundwater, which would also minimize unacceptable risks.
STATE OF CONNECTICUT				
Remediation Standard Regulations (RSRs)	Connecticut General Statutes (CGS) §22a-133k; Regulations of Connecticut State Agencies (RCSA) §22a-133k - 1 through 3 (Appendices A and B)	Applicable	These regulations establish Direct Exposure Criteria (DECs) and Pollutant Mobility Criteria (PMCs) for contaminated soil. Particularly, §22a-133k-2(d)(2) allows for the development of alternative DECs, and §22a-133k-2(c)(2)(E) allows for the development and use of Alternative PMCs for soil overlying groundwater classified as GB. These Alternative PMCs are equal to the GA PMCs multiplied by a site-specific dilution factor (DF) developed based on site-specific hydrogeologic characteristics.	Would comply. The in-situ chemical stabilization/ solidification of Alternatives S-3.4, S-4.4, and S-7.4 would remedy current exceedances of Alternative I/C PMCs. Although in-situ treatment would not reduce mass lead concentrations, the LUCs and pavement and building maintenance of these alternatives would prevent exposure to contaminated soil. In addition, the groundwater monitoring of these alternatives would warn of potential migration of soil COCs to groundwater. Alternative DECs and PMCs for each zone are identified in Table 6-6.

TABLE 6-28

ASSESSMENT OF LOCATION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.4, S-4.4, AND S-7.4
IN-SITU TREATMENT (CHEMICAL STABILIZATION/SOLIDIFICATION/BIOREMEDIATION) TO MEET I/C PRGs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Fish and Wildlife Coordination Act	16 United States Code (USC) Part 661 *et. seq.*, 40 Code of Federal Regulations (CFR) 122	Applicable	Protects fish and wildlife when actions at a site would result in the control or structural modification of a natural stream, body of water, wetland, floodplain, or flood-prone area. The statute requires federal agencies to take into account the effects of remedial actions and prevent loss or damage to resources.	Would comply. The in-situ chemical stabilization/ solidification of Alternatives S-3.4, S-4.4, and S-7.4 would prevent the potential migration of COCs from soil to groundwater or to surface water that could eventually impact fish and wildlife in the Thames River. In addition, the groundwater monitoring associated with these alternatives would provide a warning of potential migration of COCs. Federal resource agencies would be consulted to prevent, mitigate, or compensate for loss of fish and wildlife.
Coastal Zone Management Act	16 USC Parts 1451 *et. seq.*	Applicable	Requires that any actions that affect a land or water use or water resource of the coastal zone be conducted in a manner consistent to the maximum extent practical with enforceable policies of state-approved management programs.	Would comply. The in-situ treatment and monitoring activities of Alternatives S-3.4, S-4.4, and S-7.4 would comply with the substantive requirements of this act.
Floodplain Management and Protection of Wetlands	44 CFR 9	Relevant and appropriate	Federal Emergency Management Agency (FEMA) regulations that set forth the policy, procedure and responsibilities to implement and enforce Executive Order 11988, Floodplain Management, and Executive Order 11990, Protection of Wetlands.	Would comply. The in-situ treatment and monitoring activities of Alternatives S-3.4, S-4.4, and S-7.4 would be implemented in compliance with these standards. The Navy would solicit public comment as part of the proposed plan on the measures taken through the remedial action to protect floodplain and wetland resources.
STATE OF CONNECTICUT				
Coastal Management Act	Regulations of Connecticut State Agencies (RCSA) §22a-90 to 112	Applicable	The sites are in a coastal zone management area. Therefore, requirements for site planning must include approval of activities within the coastal zone to minimize project impacts to this area.	Would comply. The in-situ treatment and monitoring activities of Alternatives S-3.4, S-4.4, and S-7.4 would comply with the substantive requirements of this act.
Tidal Wetlands and Watercourses	RCSA §22a-30-1 through 17	Applicable	These rules regulate all activities within or affecting tidal wetlands and watercourses.	Would comply. The in-situ treatment and monitoring activities of Alternatives S-3.4, S-4.4, and S-7.4 would be managed to prevent erosion and other disturbance to tidal wetlands and the Thames River.

TABLE 6-28

ASSESSMENT OF LOCATION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.4, S-4.4, AND S-7.4
IN-SITU TREATMENT (CHEMICAL STABILIZATION/SOLIDIFICATION/BIOREMEDIATION) TO MEET I/C PRGs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
STATE OF CONNECTICUT (continued)				
Flood Management Regulations	RCSA 25-68h-1 through 25-68h-3	Relevant and appropriate	These regulations address activities in floodplains to minimize flood risk and prevent flood hazards. Also address stormwater runoff.	Would comply. The in-situ treatment and monitoring activities of Alternatives S-3.4, S-4.4, and S-7.4 would consider the potential for disturbance of floodplains. Any work in floodplains would comply with the substantive provisions of the regulations.
Connecticut Endangered Species Act	Connecticut General Statutes (CGS) § 26-303 thru 314	Applicable	Remedial actions may not jeopardize the continued existence of state-listed endangered or threatened species, or adversely modify or destroy their critical habitat.	Would comply. The in-situ treatment and monitoring activities of Alternatives S-3.4, S-4.4, and S-7.4 would not cause disturbance to aquatic habitats in the Thames River, which are used by the state-threatened Atlantic Sturgeon, and would address risks posed by potential migration of soil COCs to the Thames River.

TABLE 6-29

ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.4, S-4.4, AND S-7.4
IN-SITU TREATMENT (STABILIZATION/SOLIDIFICATION/BIOREMEDIATION) TO MEET I/C PRGs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Resource Conservation and Recovery Act (RCRA), Interim Status Treatment, storage, and disposal facility (TSDF) Standards, Chemical, Physical and Biological Treatment	40 Code of Federal Regulations (CFR) § 265.401(b)	Relevant and appropriate	Treatment reagents must not be placed in a treatment process or equipment if they could cause the treatment process or equipment to rupture, leak, corrode, or otherwise fail before the end of its intended life. Inspections are required to make sure that any treatment process is operating correctly.	Would comply. Any reagents use for in-situ treatment under Alternatives S-3.4, S-4.4, and S-7.4 would not be used if they adversely affected the treatment process. Inspections would be performed to ensure this.
Clean Water Act, National Recommended Water Quality Criteria (NRWQC)	33 USC § 1251 et seq.; 40 CFR 122.44	Relevant and Appropriate	Used to establish water quality standards for the protection of aquatic life.	Standards to be used for monitoring water quality in the Thames River during active remedial activities within the floodplain and as part of long-term water quality monitoring for alternatives that leave waste in place.
Clean Water Act (CWA), Section 402, National Pollution Discharge Elimination System (NPDES)	United States Code (USC) 1342; 40 CFR 122 through 125	Applicable	These standards govern point source discharges of pollutants to surface water. Includes stormwater requirements for construction projects that disturb over 1 acre.	Alternatives S-3.4, S-4.4, and S-7.4 would include soil disturbance activities during implementation of in-situ treatment. If any soil disturbance activities occur over an area greater than 1 acre, they would be performed in accordance with this standard.
STATE OF CONNECTICUT				
Hazardous Waste Management: Generator and Handler Requirements, Listing and Identification	Regulations of Connecticut State Agencies (RCSA) §22a-449(c) 100-101	Applicable	Connecticut is delegated to administer the federal RCRA statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference.	Would comply. Soil excavated as part of the in-situ treatment and monitoring of Alternatives S-3.4, S-4.4, and S-7.4 would be tested. Any soil identified as hazardous would be managed in accordance with these regulations. Confirmatory sampling would determine whether any soil with hazardous characteristics is left in place following treatment.
Hazardous Waste Management: Generator Standards	RCSA § 22a-449(c)-102	Applicable	This section establishes standards for various classes of generators. The standards of 40 CFR 262 are incorporated by reference.	Would comply. Any hazardous waste that would be generated from the in-situ treatment and monitoring activities of Alternatives S-3.4, S-4.4, and S-7.4 would be handled and disposed of in compliance with these standards.
Water Quality Standards	Regulations promulgated under Connecticut General Statutes (CGS) §22a-426	Applicable	Connecticut's Water Quality Standards establish specific numeric criteria, designated uses, and anti-degradation policies for groundwater and surface water. Groundwater at the site is classified under these regulations as GB. Includes stormwater requirements for construction projects that disturb over 1 acre.	Would comply. The in-situ treatment and long-term groundwater monitoring of Alternatives S-3.4, S-4.4, and S-7.4 would ensure that groundwater quality standards for GB groundwater would be maintained. Monitoring would ensure that stormwater and groundwater standards were being met.

TABLE 6-29

ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.4, S-4.4, AND S-7.4
IN-SITU TREATMENT (STABILIZATION/SOLIDIFICATION/BIOREMEDIATION) TO MEET I/C PRGs, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis	Evaluation of Alternative Compliance with ARAR
STATE OF CONNECTICUT (Continued)				
Air Pollution Control	RCSA § 22a-174 1-20	Applicable	These regulations pertain to the construction and operation of specified types of emission sources and contain emission standards that must be met. Pollutant abatement controls may be required. Specific standards pertain to fugitive dust (18b).	Would comply. The in-situ treatment and monitoring activities of Alternatives S-3.4, S-4.4, and S-7.4 would be performed so as to minimize fugitive emissions and would comply with the substantive requirements of these regulations.
Guidelines for Soil Erosion and Sediment Control	Connecticut Council on Soil and Water Conservation	To Be Considered (TBC)	Technical and administrative guidance for development, adoption, and implementation of an erosion and sediment control program.	Would comply. Any excavation activities associated with the in-situ treatment and monitoring of Alternatives S-3.4, S-4.4, and S-7.4 would include an appropriate erosion and sedimentation control program that would comply with these guidelines.
Water Pollution Control	RCSA §22a-430-1 to 4	Applicable	These regulations govern the treatment and discharge of water into surface water, groundwater, and publicly owned treatment works. Applications of reagents to soil for stabilization and treatment are also permitted through this program.	Would comply. Alternatives S-3.4, S-4.4, and S-7.4 would include soil stabilization with Portland cement which is regulated as a discharge to the waters of the State, and which would comply with the substantive requirements of the Water Pollution Control Regulations. Alternative S-4.4 includes the addition of magnesium peroxide for aerobic degradation which is regulated as a discharge to the waters of the State, and which would comply with the substantive standards under the CTDEEP Water Pollution Control Regulations which address “Enhanced Aerobic Biodegredation”.

TABLE 6-30

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.5B, S-4.5B, AND S-7.5B
EXCAVATION TO MEET I/C PRGs, OFF-SITE TREATMENT AND DISPOSAL, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Cancer Slope Factors (CSFs)	United States Environmental Protection Agency (USEPA) Integrated Risk Information System (IRIS) and others	To Be Considered (TBC)	These are guidance values used in risk assessment to evaluate the potential carcinogenic risk caused by exposure to contaminants.	Would comply. Alternatives S-3.5B, S-4.5B, and S-7.5B would include excavation and off-site treatment and disposal of soil that could result in unacceptable industrial/commercial (I/C) carcinogenic risks and contribute to the migration of chemicals of concern (COCs) to groundwater. These alternatives would also include land use controls (LUCs) that would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risks. The monitoring of these same alternatives would also warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks.
Reference Doses (RfDs)	USEPA IRIS and others	TBC	These are guidance values used in risk assessment to evaluate the potential noncarcinogenic hazard caused by exposure to contaminants.	Would comply. Alternatives S-3.5B, S-4.5B, and S-7.5B would include excavation and off-site treatment and disposal of soil that could result in unacceptable I/C noncarcinogenic risks and contribute to the migration of COCs to groundwater. These alternatives would also include LUCs that would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risks. The monitoring of these same alternatives would also warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks.

TABLE 6-30

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.5B, S-4.5B, AND S-7.5B
EXCAVATION TO MEET I/C PRGs, OFF-SITE TREATMENT AND DISPOSAL, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL (continued)				
Guidelines for Carcinogen Risk Assessment	EPA/630/P-03/001F (March 2005)	TBC	These guidelines are used to perform human health risk assessments.	Would comply. Alternatives S-3.5B, S-4.5B, and S-7.5B would include excavation and off-site treatment and disposal of soil that could result in unacceptable I/C carcinogenic risks and contribute to the migration of COCs to groundwater. These alternatives would also include LUCs that would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risks. The monitoring of these same alternatives would also warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F (March 2005)	TBC	These guidelines are used to perform human health risk assessments.	Would comply. Alternatives S-3.5B, S-4.5B, and S-7.5B would include excavation and off-site treatment and disposal of soil that could result in unacceptable I/C carcinogenic risks and contribute to the migration of COCs to groundwater. These alternatives would also include LUCs that would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risks. The monitoring of these same alternatives would also warn of potential migration of soil COCs to groundwater, which would also minimize unacceptable risks.

TABLE 6-30

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.5B, S-4.5B, AND S-7.5B
EXCAVATION TO MEET I/C PRGs, OFF-SITE TREATMENT AND DISPOSAL, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL (continued)				
Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil	EPA-540-R-03-001, Office of Solid Waste and Emergency Response (OSWER) Directive #9285.7-54 (January 2003)	TBC	USEPA guidance for evaluating the risks posed by lead in soil.	Would comply. Alternatives S-3.5B, S-4.5B, and S-7.5B would meet this standard because potential lead risk from adult exposure would be addressed through excavation and off-site treatment and disposal of all lead-contaminated soil associated with unacceptable risk. These alternatives would also include LUCs that would ensure maintenance of building foundations and paved areas, regulate the disturbance of contaminated soil, and prohibit hypothetical future residential development, all of which would address unacceptable risks from exposure to lead-contaminated soil. The monitoring of these same alternatives would also warn of potential migration of lead from soil to groundwater, which would also minimize unacceptable risks.
STATE OF CONNECTICUT				
Remediation Standard Regulations (RSRs)	Connecticut General Statutes (CGS) §22a-133k; Regulations of Connecticut State Agencies (RCSA) §22a-133k - 1 through 3 (Appendices A and B)	Applicable	These regulations establish Direct Exposure Criteria (DECs) and Pollutant Mobility Criteria (PMCs) for contaminated soil. Particularly, §22a-133k-2(d)(2) allows for the development of alternative DECs, and §22a-133k-2(c)(2)(E) allows for the development and use of Alternative PMCs for soil overlying groundwater classified as GB. These Alternative PMCs are equal to the GA PMCs multiplied by a site-specific dilution factor (DF) developed based on site-specific hydrogeologic characteristics.	Would comply. Alternatives S-3.5B, S-4.5B, and S-7.5B would include excavation and off-site treatment and disposal, which would remedy current exceedances of Alternative I/C DECs and Alternative PMCs. These alternatives would also include LUCs, which would prevent risk from exposure under residential site use, and monitoring, which would warn of the potential migration of soil COCs to groundwater. Alternative DECs and PMCs for each zone are identified in Table 6-6.

TABLE 6-31

ASSESSMENT OF LOCATION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.5B, S-4.5B, AND S-7.5B
EXCAVATION TO MEET I/C PRGs, OFF-SITE TREATMENT AND DISPOSAL, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Fish and Wildlife Coordination Act	16 United States Code (USC) Part 661 *et. seq.*, 40 Code of Federal Regulations (CFR) 122	Applicable	Protects fish and wildlife when actions at a site would result in the control or structural modification of a natural stream, body of water, wetlands, floodplain, or flood-prone areas. The statute requires federal agencies to take into account the effects of remedial actions and prevent loss or damage to resources.	Would comply. The excavation and off-site treatment and disposal of Alternatives S-3.5B, S-4.5B, and S-7.5B would remove soil chemical of concern (COCs) and prevent their potential migration to groundwater or surface water, which could eventually impact fish and wildlife in the Thames River. In addition, the monitoring of these alternatives would provide warning of the potential migration of COCs from soil to groundwater and surface water. Federal resource agencies would be consulted to prevent, mitigate, or compensate for loss of fish and wildlife.
Coastal Zone Management Act	16 USC Parts 1451 *et. seq*.	Applicable	Requires that any actions that affect a land or water use or water resource of the coastal zone must be conducted in a manner consistent to the maximum extent practical with enforceable policies of state-approved management programs.	Would comply. The excavation, off-site treatment and disposal, and monitoring activities of Alternatives S-3.5B, S-4.5B, and S-7.5B would comply with the substantive requirements of this act.
Floodplain Management and Protection of Wetlands	44 CFR 9	Relevant and appropriate	Federal Emergency Management Agency (FEMA) regulations that set forth the policy, procedure and responsibilities to implement and enforce Executive Order 11988, Floodplain Management, and Executive Order 11990, Protection of Wetlands.	Would comply. The excavation and off-site treatment and disposal of Alternatives S-3.5B, S-4.5B, and S-7.5B would be implemented in compliance with these standards. The Navy would solicit public comment as part of the proposed plan on the measures taken through the remedial action to protect floodplain and wetland resources.
STATE OF CONNECTICUT				
Connecticut Coastal Management Act	Regulations of Connecticut State Agencies (RCSA) §22a-90 to 112	Applicable	The sites are in a coastal zone management area; therefore, requirements for site planning approval of activities within the coastal zone to minimize project impacts to this area.	Would comply. The excavation, off-site treatment and disposal, and monitoring activities of Alternatives S-3.5B, S-4.5B, and S-7.5B would comply with the substantive requirements of this act.
Tidal Wetlands and Watercourses	RCSA §22a-30-1 through 17	Applicable	These rules regulate all activities within or affecting tidal wetlands and watercourses.	Would comply. The excavation, off-site treatment and disposal, and monitoring activities of Alternatives S-3.5B, S-4.5B, and S-7.5B would be managed to prevent erosion and other disturbance to tidal wetlands.

TABLE 6-31

ASSESSMENT OF LOCATION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.5B, S-4.5B, AND S-7.5B
EXCAVATION TO MEET I/C PRGs, OFF-SITE TREATMENT AND DISPOSAL, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
STATE OF CONNECTICUT (continued)				
Flood Management Regulations	RCSA 25-68h-1 through 25-68h-3	Relevant and appropriate	These regulations address activities in floodplains to minimize flood risk and prevent flood hazards. Also address stormwater runoff.	Would comply. The excavation, off-site treatment and disposal, and monitoring activities of Alternatives S-3.5B, S-4.5B, and S-7.5B would consider the potential for disturbance of floodplains. Any work in floodplains would comply with the substantive provisions of the regulations.
Connecticut Endangered Species Act	Connecticut General Statutes (CGS) §26-303 through 314	Applicable	Remedial actions may not jeopardize the continued existence of state-listed endangered or threatened species, or adversely modify or destroy their critical habitat.	Would comply. The excavation, off-site treatment and disposal, and monitoring activities of Alternatives S-3.5B, S-4.5B, and S-7.5B would not disturb aquatic habitats in the Thames River, which are used by the state-threatened Atlantic Sturgeon, and would address risks posed by potential migration of soil COCs to the Thames River.

TABLE 6-32

ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.5B, S-4.5B, AND S-7.5B
EXCAVATION TO MEET I/C PRGs, OFF-SITE TREATMENT AND DISPOSAL, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Clean Air Act (CAA), National Emissions Standards for Hazardous Air Pollutants (NESHAPs)	42 United States Code (USC) §12(b)(1); 40 Code of Federal Regulations (CFR) Part 61	Applicable	The regulations establish emissions standards for 189 hazardous air pollutants. Standards set for dust control and other release sources.	Would comply. Soil excavation under Alternatives S-3.5B, S-4.5B, and S-7.5B would be performed in compliance with these standards. Engineering controls could be used, if necessary, to meeting this standard.
Clean Water Act, National Recommended Water Quality Criteria (NRWQC)	33 USC § 1251 et seq.; 40 CFR 122.44	Relevant and Appropriate	Used to establish water quality standards for the protection of aquatic life.	Standards to be used for monitoring water quality in the Thames River during active remedial activities within the floodplain and as part of long-term water quality monitoring for alternatives that leave waste in place.
Clean Water Act (CWA), Section 402, National Pollution Discharge Elimination System (NPDES)	USC 1342; 40 CFR 122 through 125	Applicable	These standards govern point source discharges of pollutants to surface water. Includes stormwater requirements for construction projects that disturb over 1 acre.	Would comply. Any construction activities during implementation of Alternatives S-3.5B, S-4.5B, and S-7.5B would be performed in accordance with the stormwater requirements of these standards.
STATE OF CONNECTICUT				
Hazardous Waste Management: Generator and Handler Requirements, Listing and Identification	Regulations of Connecticut State Agencies (RCSA) §22a-449(c) 100-101	Applicable	Connecticut is delegated to administer the federal Resource Conservation and Recovery Act (RCRA) statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference.	Would comply. The soil excavated as part of Alternatives S-3.5B, S-4.5B, and S-7.5B would be tested, and any soil identified as hazardous would be managed in accordance with these regulations. Confirmatory sampling would determine whether any soil with hazardous characteristics is left in place following excavation.
Hazardous Waste Management: Generator Standards	RCSA §22a-449(c)-102	Applicable	This section establishes standards for various classes of generators. The standards of 40 CFR 262 are incorporated by reference.	Would comply. Soil excavated as part of Alternatives S-3.5B, S-4.5B, and S-7.5B would be tested for hazardous characteristics. Any excavated soil identified as hazardous would be handled and disposed of in compliance with these standards.
Water Quality Standards	Regulations Promulgated under Connecticut General Statutes (CGS) §22a-426	Applicable	Connecticut's Water Quality Standards establish specific numeric criteria, designated uses, and anti-degradation policies for groundwater and surface water. Groundwater at the site is classified under these regulations as GB. Includes stormwater requirements for construction projects that disturb over 1 acre.	Would comply. The excavation, off-site treatment and disposal, and long-term groundwater monitoring of Alternatives S-3.5B, S-4.5B, and S-7.5B would ensure that groundwater quality standards for GB groundwater would be maintained. Monitoring would ensure that stormwater and groundwater standards were being met.

TABLE 6-32

ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVES S-3.5B, S-4.5B, AND S-7.5B
EXCAVATION TO MEET I/C PRGs, OFF-SITE TREATMENT AND DISPOSAL, LUCs (ENGINEERING AND INSTITUTIONAL), AND MONITORING
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis	Evaluation of Alternative Compliance with ARAR
STATE OF CONNECTICUT (continued)				
Air Pollution Control	RCSA §22a-174 1-20	Applicable	These regulations pertain to construction and operation of specified types of emission sources and contain emission standards that must be met. Pollutant abatement controls may be required. Specific standards pertain to fugitive dust (18b).	Would comply. The excavation, off-site treatment and disposal, and long-term groundwater monitoring of Alternatives S-3.5B, S-4.5B, and S-7.5B would be performed so as to minimize fugitive emissions and would comply with the substantive requirements of these regulations.
Connecticut Guidelines for Soil Erosion and Sediment Control	Connecticut Council on Soil and Water Conservation	To Be Considered (TBC)	Technical and administrative guidance for development, adoption, and implementation of an erosion and sediment control program.	Would comply. Excavation activities associated with Alternatives S-3.5B, S-4.5B, and S-7.5B would include an appropriate erosion and sedimentation control program that would comply with these guidelines.

TABLE 6-33

SUMMARY OF COMPARATIVE ANALYSIS OF ZONE 3 SOIL REMEDIAL ALTERNATIVES
LOWER SUBSASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Evaluation Criterion	Alternative S-3.1 No Action	Alternative S-3.2 LUCs (Engineering and Institutional Controls) and Monitoring	Alternative S-3.3 Capping to Allow I/C Site Use and Prevent Leaching, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-3.4 In-Situ Treatment (Stabilization/ Solidification) to Allow I/C Site Use and Meet I/C PMCs, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-3.5A Excavation to Meet I/C DECs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-3.5B Excavation to Meet I/C DECs and PMCs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-3.6 Excavation to Meet Residential DECs and PMCs, On-Site Dewatering, and Off-Site Disposal
Overall Protection of Human Health and Environment	Not protective.	Protective.	More protective than Alternatives S-3.2 and S-3.5A.	Approximately as protective as Alternative S-3.3 but more protective than Alternatives S-3.2 and S-3.5A.	More protective than Alternative S-3.2 but less protective than Alternatives S-3.3 and S-3.4.	More protective than Alternatives S-3.2, S-3.3, S-3.4 and S-3.5A.	Most protective.
Compliance with ARARs and TBCs							
Chemical-Specific	Would not comply.	Would comply.	Would comply.	Would comply.	Would comply.	Would comply.	Would comply.
Location-Specific	No location-specific ARARs.	Would comply.	Would comply.	Would comply.	Would comply.	Would comply.	Would comply.
Action-Specific	Not applicable.	Would comply.	Would comply	Would comply.	Would comply.	Would comply.	Would comply.
Long-Term Effectiveness and Permanence	Not effective.	Effective.	More effective than Alternative S-3.2 and S-3.5A.	Approximately as effective as Alternative S-3.3 but more effective than Alternatives S-3.2 and S-3.5A.	More effective than Alternative S-3.2 but less effective than Alternatives S-3.3 and S-3.4.	More effective than Alternatives S-3.2, S-3.3, S-3.4, and S-3.5A.	Most effective.
Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment	There is no treatment.	There is no treatment.	There is no treatment.	Would reduce lead toxicity and mobility by in-situ chemical stabilization/solidification. Total of 617 cy treated.	There is no treatment.	There is no treatment.	There is no treatment, except the treatment of water generated from the dewatering process prior to discharge to the Thames River. A very small mass of COCs will be treated by this process.
Short-Term Effectiveness	No short-term risks. Would not achieve soil RAOs or meet Zone 3 soil PRGs.	Short-term risks to address: worker exposure during groundwater sampling; no impacts to environment or community. Three months to implement and achieve soil RAOs. Zone 3 soil I/C direct exposure and pollutant mobility PRGs would be met through engineering controls.	Short-term risks to address: worker exposure during cap installation and groundwater sampling; transport of contaminated soil through the community; dust from excavation. After planning, 1 month to implement and achieve soil RAOs. Zone 3 soil I/C PRGs for direct exposure would be met through excavation and off-site disposal, and I/C pollutant mobility PRGs would be met through engineering controls and capping.	Short-term risks to address: worker exposure during treatment and groundwater sampling; no impacts to environment or community. After planning, 1 month to implement and achieve soil RAOs. Would meet Zone 3 soil I/C PRGs for pollutant mobility at completion.	Short-term risks to address: worker exposure during excavation; transport of contaminated soil through the community; dust from excavation. After planning, 1 month to implement and achieve soil RAOs. Would meet Zone 3 soil I/C PRGs for direct exposure and pollutant mobility at completion.	Short-term risks to address: worker exposure during excavation; transport of contaminated soil through the community; dust from excavation. After planning, 1.5 months to implement and achieve soil RAOs. Zone 3 soil PRGs for I/C direct exposure would be met through excavation and off-site disposal and I/C pollutant mobility would be met through engineering controls.	Short-term risks to address: worker exposure during excavation; transport of contaminated soil through the community; dust from excavation. After planning, 4 months to implement and achieve soil RAOs. Would meet Zone 3 soil PRGs for residential direct exposure and pollutant mobility at completion.

TABLE 6-33

SUMMARY OF COMPARATIVE ANALYSIS OF ZONE 3 SOIL REMEDIAL ALTERNATIVES
LOWER SUBSASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Evaluation Criterion	Alternative S-3.1 No Action	Alternative S-3.2 LUCs (Engineering and Institutional Controls) and Monitoring	Alternative S-3.3 Capping to Allow I/C Site Use and Prevent Leaching, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-3.4 In-Situ Treatment (Stabilization/ Solidification) to Allow I/C Site Use and Meet I/C PMCs, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-3.5A Excavation to Meet I/C DECs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-3.5B Excavation to Meet I/C DECs and PMCs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-3.6 Excavation to Meet Residential DECs and PMCs, On-Site Dewatering, and Off-Site Disposal
Implementability	Requires only five-year reviews.	Issues include: Instituting CERCLA LUCs over 52,270 square feet (sf) of pavement, maintaining 6,200 sf of pavement for Engineering Controls and 42,560 sf of pavement to make contaminated soil inaccessible, maintaining monitoring wells; no base construction approval needed; LUC RD could be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	Cap installation includes excavation to a depth of 2 feet over a 6,200 sf area [460 cubic yards (cy)], and installation of 4,830 sf of geomembrane. Issues include: excavation and construction may interfere with base activities; underground utilities may interfere with construction; maintaining paved areas and monitoring wells; base construction approval needed; LUC RD could be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	In-situ treatment includes excavation of asphalt over a 6,200 sf area (170 cy), treatment of 750 cy of soil and disposal of 75 cy of excess soil. Issues include: treatment may interfere with base activities; underground utilities may interfere with treatment; treatability tests needed; maintaining paved areas and monitoring wells; base construction approval needed; LUC RD could be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	Includes excavation to a depth of 2 feet over a 5,120 sf area and disposal of 380 cy of material. Issues include: excavation may interfere with base activities; underground utilities may interfere with excavation; maintaining paved areas and monitoring wells; base construction approval needed; LUC RD could be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	Includes excavation to a depth of 4 feet over a 6,200 sf area and disposal of 920 cy of material. Issues include: excavation may interfere with base activities; underground utilities may interfere with excavation; maintaining paved areas and monitoring wells; base construction approval needed; LUC RD could be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	Includes excavation to depths up to 15 feet over a 54,080 sf area and disposal of 11,910 cy of material. Issues include: sheet piles for excavation support; dewatering system required; water treatment and disposal system required; base construction approval needed; resources are readily available.
Costs:							
Capital	$0	$26,000	$373,000	$641,000	$319,000	$563,000	$7,749,000
O&M NPW (Years)	$104,000 (30)	$499,000 (30)	$494,000 (30)	$455,000(30)	$500,000 (30)	$476,000 (30)	$0
NPW (Years)	$104,000 (30)	$525,000 (30)	$867,000 (30)	$1,096,000 (30)	$819,000 (30)	$1,039,000 (30)	$7,749,000 (1)

ARARs Applicable or Relevant and Appropriate Requirements
cy Cubic yards
DEC Direct Exposure Criteria
I/C Industrial/commercial
LTTD Low-temperature thermal desorption
LUCs Land use controls
Land Use Control Remedial Design
NPW Net present worth
O&M Operation and maintenance
PAHs Polycyclic aromatic hydrocarbons
PMC Pollutant Mobility Criteria
PRGs Preliminary Remediation Goals
RAOs Remedial Action Objectives
sf Square feet LUC RD
TBCs To Be Considered (criteria)

TABLE 6-34

SUMMARY OF COMPARATIVE ANALYSIS OF ZONE 4 SOIL REMEDIAL ALTERNATIVES
LOWER SUBSASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Evaluation Criterion	Alternative S-4.1 No Action	Alternative S-4.2 LUCs (Engineering and Institutional Controls) and Monitoring	Alternative S-4.3 Capping to Allow I/C Site Use and Prevent Leaching, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-4.4 In-Situ Treatment (Enhanced Bioremediation or Stabilization/ Solidification) to Allow I/C Site Use and Meet I/C PMCs, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-4.5A Excavation to Meet I/C DECs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-4.5B Excavation to Meet I/C DECs and PMCs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-4.6 Excavation to Meet Residential DECs and PMCs, On-Site Dewatering, and Off-Site Disposal
Overall Protection of Human Health and Environment	Not protective.	May not be protective.	More protective than Alternatives S-4.2 and S-4.5A.	Approximately as protective as Alternative S-4.3 but more protective than Alternatives S-4.2 and S-4.5A.	More protective than Alternative S-4.2 but not as protective as Alternatives S-4.3 and S-4.4.	More protective than Alternatives S-4.2, S-4.3, S-4.4, and S-4.5A.	Most protective.
Compliance with ARARs and TBCs							
Chemical-Specific	Would not comply.	Would not comply with all ARARs; therefore, will not be implemented.	Would comply.	Would comply.	Would not comply with all ARARs; therefore, will not be implemented.	Would comply.	Would comply.
Location-Specific	No location-specific ARARs.	Would comply.	Would comply.	Would comply.	Would comply.	Would comply.	Would comply.
Action-Specific	Not applicable.	Would comply.	Would comply	Would comply.	Would comply.	Would comply.	Would comply.
Long-Term Effectiveness and Permanence	Not effective.	May not be effective.	More effective than Alternatives S-4.2 and S-4.5A.	Approximately as effective as Alternative S-4.3 but more effective than Alternative S-4.2 and S-4.5A.	More effective than Alternative S-4.2 but not as effective as Alternatives S-4.3 and S-4.4.	More effective than Alternatives S-4.2, S-4.3, S-4.4, and S-4.5A.	Most effective.
Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment	There is no treatment.	There is no treatment.	There is no treatment.	Would reduce lead toxicity and mobility in 1,780 cy of soil by in-situ chemical stabilization/ solidification. Would reduce toxicity, mobility, and volume of commingled TPH in 20 cy by in-situ enhanced bioremediation.	There is no treatment.	There is no treatment.	There is no treatment, except the treatment of water generated from the dewatering process prior to discharge to the Thames River. A very small mass of COCs will be treated by this process.
Short-Term Effectiveness	No short-term risks. Would not achieve soil RAOs.	Short-term risks to address: worker exposure during groundwater sampling; no impacts to environment or community. Three months to implement and achieve most soil RAOs. Zone 4 soil I/C PRGs for direct exposure would be met through engineering controls, but soil I/C PRGs for pollutant mobility would not be completely met through engineering controls.	Short-term risks to address: worker exposure during cap installation and groundwater sampling; transport of contaminated soil through the community; dust from excavation. After planning, 2 months to implement and achieve soil RAOs. Zone 4 lead PRG for I/C direct exposure would be met through excavation and off-site disposal, and I/C pollutant mobility PRGs would be met through engineering controls and capping.	Short-term risks to address: worker exposure during treatment and groundwater sampling; no impacts to environment or community. After planning, 16 months to implement and achieve soil RAOs. Would meet Zone 4 I/C lead PRGs for direct exposure and pollutant mobility at completion through treatment and engineering controls. For Zone 4 commingled TPH, direct exposure and pollutant mobility CTDEEP RSRs would be met within 1 year through treatment.	Short-term risks to address: worker exposure during excavation and groundwater sampling; transport of contaminated soil through the community; dust from excavation. After planning, 1.5 months to implement and achieve most soil RAOs. Zone 4 lead I/C PRG for direct exposure would be met through excavation and off-site disposal, but the I/C PRG for pollutant mobility would not be completely met through engineering controls.	Short-term risks to address: Worker exposure during excavation and groundwater sampling; Transport of contaminated soil through the community; Dust from excavation. After planning, 3 months to implement and achieve soil RAOs. Would meet Zone 4 soil I/C PRGs for direct exposure and pollutant mobility at completion.	Short-term risks to address: Worker exposure during excavation; Transport of contaminated soil through the community; Dust from excavation. After planning, 5 months to implement and achieve soil RAOs. Would meet Zone 4 soil PRGs for residential direct exposure and pollutant mobility at completion.

TABLE 6-34

SUMMARY OF COMPARATIVE ANALYSIS OF ZONE 4 SOIL REMEDIAL ALTERNATIVES
LOWER SUBSASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Evaluation Criterion	Alternative S-4.1 No Action	Alternative S-4.2 LUCs (Engineering and Institutional Controls) and Monitoring	Alternative S-4.3 Capping to Allow I/C Site Use and Prevent Leaching, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-4.4 In-Situ Treatment (Enhanced Bioremediation or Stabilization/ Solidification) to Allow I/C Site Use and Meet I/C PMCs, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-4.5A Excavation to Meet I/C DECs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-4.5B Excavation to Meet I/C DECs and PMCs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-4.6 Excavation to Meet Residential DECs and PMCs, On-Site Dewatering, and Off-Site Disposal
Implementability	Requires only five-year reviews.	Issues include: Instituting CERCLA LUCs over 46,680 square feet (sf) of pavement, maintaining 13,100 sf of pavement for Engineering Controls and 30,940 sf of pavement to make contaminated soil inaccessible, maintaining monitoring wells; no base construction approval needed; LUC RD could be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	Cap installation includes excavation to a depth of 2 feet over a 13,100 sf area [970 cubic yards (cy)], and installation of 8,720 sf of geomembrane. Issues include: excavation and construction may interfere with base activities; underground utilities may interfere with construction; maintaining paved areas and monitoring wells; base construction approval needed; LUC RD could be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	In-situ treatment includes excavation of asphalt over a 13,100 sf area (240 cy), treatment of 1,780 cy of soil and disposal of 300 cy of excess soil. Issues include: treatment may interfere with base activities; underground utilities may interfere with treatment; treatability tests needed; maintaining paved areas and monitoring wells; base construction approval needed; LUC RD could be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	Includes excavation to a depth of 2 feet over a 11,600 sf area and disposal of 860 cy of material. Issues include: excavation may interfere with base activities; underground utilities may interfere with excavation; maintaining paved areas and monitoring wells; base construction approval needed; LUC RD could be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	Includes excavation to depths of up to 5 feet over 13,100 sf area and disposal of 2,020 cy of material. Issues include: excavation may interfere with base activities; underground utilities may interfere with excavation; maintaining paved areas and monitoring wells; base construction approval needed; LUC RD could be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	Includes excavation to depths up to 15 feet over a 60,000 sf area and disposal of 21,330 cy of material. Issues include: sheet piles for excavation support; dewatering system required; water treatment and disposal system required; base construction approval needed; resources are readily available.
Costs:							
Capital	$0	$70,000	$774,000	$953,000	$629,000	$1,296,000	$5,001,000
O&M NPW (Years)	$104,000 (30)	$596,000 (30)	$580,000 (30)	$471,000 (30)	$597,000 (30)	$467,000 (30)	$0
NPW (Years)	$104,000 (30)	$666,000(30)	$1,354,000 (30)	$1,424,000 (30)	$1,226,000 (30)	$1,763,000 (30)	$5,001,000 (1)

ARARs	Applicable or Relevant and Appropriate Requirements
cy	Cubic yards
DEC	Direct Exposure Criteria
I/C	Industrial/commercial
LTTD	Low-temperature thermal desorption
LUCs	Land use controls
LUC RD	Land Use Control Remedial Design
NPW	Net present worth
O&M	Operation and maintenance
PAHs	Polycyclic aromatic hydrocarbons
PMC	Pollutant Mobility Criteria
PRGs	Preliminary Remediation Goals
RAOs	Remedial Action Objectives
sf	Square feet
TBCs	To Be Considered (criteria)
TPH	Total petroleum hydrocarbons

TABLE 6-35

SUMMARY OF COMPARATIVE ANALYSIS OF ZONE 7 SOIL REMEDIAL ALTERNATIVES
LOWER SUBSASE SOIL AND GROUNDATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Evaluation Criterion	Alternative S-7.1 No Action	Alternative S-7.2 LUCs (Engineering and Institutional Controls) and Monitoring	Alternative S-7.3 Capping to Allow I/C Site Use and Prevent Leaching, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-7.4 In-Situ Treatment (Stabilization/ Solidification) to Allow I/C Site Use and Meet I/C PMCs, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-7.5A Excavation to Meet I/C DEC, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-7.5B Excavation to Meet I/C DEC and PMCs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-7.6 Excavation to Meet Residential DECs and PMCs, On-Site Dewatering, and Off-Site Disposal
Overall Protection of Human Health and Environment	Not protective.	Protective.	More protective than Alternatives S-7.2 and S-7.5A.	Approximately as protective as Alternative S-7.3 but more protective than Alternatives S-7.2 and S-7.5A.	More protective than Alternative S-7.2 but not as protective as Alternatives S-7.3 and S-7.4.	More protective than Alternatives S-7.2, S-7.3, S-7.4, and S-7.5A.	Most protective.
<u>Compliance with ARARs and TBCs</u>							
Chemical-Specific	Would not comply.	Would comply.	Would comply.	Would comply.	Would comply.	Would comply.	Would comply.
Location-Specific	No location-specific ARARs.	Would comply.	Would comply.	Would comply.	Would comply.	Would comply.	Would comply.
Action-Specific	Not applicable.	Would comply.	Would comply	Would comply.	Would comply.	Would comply.	Would comply.
Long-Term Effectiveness and Permanence	Not effective.	Effective.	More effective than Alternative S-7.2 and Alternative S-7.5A.	More effective than Alternative S-7.2 and approximately as effective as Alternative S-7.3.	More effective than Alternative S-7.2 but not as effective as Alternatives S-7.3 and S-7.4.	More effective than Alternatives S-7.2, S-7.3, S-7.4, and S-7.5A.	Most effective.
Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment	There is no treatment.	There is no treatment.	There is no treatment.	Would reduce toxicity and mobility of antimony and lead in 2,982 cy of soil by in-situ chemical stabilization/ solidification.	There is no treatment.	There is no treatment.	There is no treatment, except the treatment of water generated from the dewatering process prior to discharge to the Thames River. A very small mass of COCs will be treated by this process.
Short-Term Effectiveness	No short-term risks. Would not achieve soil RAOs.	Short-term risks to address: worker exposure during groundwater sampling; no impacts to environment or community. Three months to implement and achieve soil RAOs. Zone 7 soil PRGs for I/C direct exposure or pollutant mobility would be met through engineering controls.	Short-term risks to address: worker exposure during cap installation and groundwater sampling; transport of contaminated soil through community; dust from excavation. After planning, 2 months to implement and achieve soil RAOs. Zone 7 soil PRG for I/C direct exposure would be met through excavation and off-site disposal, and the I/C pollutant mobility PRG would be met through engineering controls and capping.	Short-term risks to address: worker exposure during cap installation and groundwater sampling; transport of contaminated soil through community; dust from excavation. After planning, 3 months to implement and achieve soil RAOs. Would meet Zone 7 lead PRG for I/C direct exposure through treatment and engineering controls. Zone 7 lead and antimony PRGs for I/C pollutant mobility would be met through treatment.	Short-term risks to address: worker exposure during excavation and groundwater sampling; transport of contaminated soil through community; dust from excavation. After planning, 2 months to implement and achieve soil RAOs. Would meet Zone 7 soil PRG for I/C direct exposure through excavation and off-site disposal, and the I/C pollutant mobility PRG through engineering controls.	Short-term risks to address: worker exposure during excavation and groundwater sampling; transport of contaminated soil through community; dust from excavation. After planning, 4.5 months to implement and achieve soil RAOs. Would meet Zone 7 soil PRGs for I/C direct exposure and pollutant mobility at completion.	Short-term risks to address: worker exposure during excavation; transport of contaminated soil through community; dust from excavation. After planning, 10 months to implement and achieve soil RAOs. Would meet Zone 7 soil PRGs for residential direct exposure and pollutant mobility at completion.

TABLE 6-35

SUMMARY OF COMPARATIVE ANALYSIS OF ZONE 7 SOIL REMEDIAL ALTERNATIVES
LOWER SUBSASE SOIL AND GROUNDATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Evaluation Criterion	Alternative S-7.1 No Action	Alternative S-7.2 LUCs (Engineering and Institutional Controls) and Monitoring	Alternative S-7.3 Capping to Allow I/C Site Use and Prevent Leaching, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-7.4 In-Situ Treatment (Stabilization/ Solidification) to Allow I/C Site Use and Meet I/C PMCs, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-7.5A Excavation to Meet I/C DEC, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-7.5B Excavation to Meet I/C DEC and PMCs, Off-Site Disposal, LUCs (Engineering and Institutional Controls), and Monitoring	Alternative S-7.6 Excavation to Meet Residential DECs and PMCs, On-Site Dewatering, and Off-Site Disposal
Implementability	Requires only five-year reviews.	Issues include: Installing pavement over 1,960 sf, Instituting CERCLA LUCs over 181,080 square feet (sf) of pavement, maintaining 22,440 sf of pavement for Engineering Controls and 119,600 sf of pavement to make contaminated soil inaccessible , maintaining monitoring wells; no base construction approval needed; LUC RD could be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	Cap installation includes excavation to a depth of 2 feet over a 22,440 sf area [1,660 cubic yards (cy)], and installation 22,440 sf of geomembrane. Issues include: excavation and construction may interfere with base activities; underground utilities may interfere with construction; maintaining paved areas and monitoring wells; base construction approval needed; LUC RD could be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	In-situ treatment includes excavation of asphalt over a 20,480 sf area (380 cy), treatment of 3,020 cy of soil and disposal of 540 cy of excess soil. Issues include: treatment may interfere with base activities; underground utilities may interfere with treatment; treatability tests needed; maintaining paved areas and monitoring wells; base construction approval needed; LUC RD could be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	Includes excavation to a depth of 2 feet over a 13,050 sf area and disposal of 970 cy of material. Issues include: excavation may interfere with base activities; underground utilities may interfere with excavation; maintaining paved areas and monitoring wells; base construction approval needed; LUC RD could be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	Includes excavation to depths of up to 5 feet over 22,440 sf area and disposal of 3,400 cy of material. Issues include: excavation may interfere with base activities; underground utilities may interfere with excavation; maintaining paved areas and monitoring wells; base construction approval needed; LUC RD could be readily developed and implemented; inspections and reviews readily performed; property transfer (if needed) could be readily accomplished; resources are readily available.	Includes excavation to depths up to 15 feet over a 213,760 sf area and disposal of 63,340 cy of material. Issues include: sheet piles for excavation support; dewatering system required; water treatment and disposal system required; base construction approval needed; resources are readily available.
Costs:							
Capital	$0	$75,000	$1,353,000	$1,325,000	$837,000	$2,275,000	$22,508,000
O&M NPW (Years)	$104,000 (30)	$1,012,000 (30)	$1,012,000 (30)	$826,000 (30)	$1,012,000 (30)	$826,000 (30)	$0
NPW (Years)	$104,000 (30)	$1,087,000 (30)	$2,365,000(30)	$2,151,000 (30)	$1,849,000 (30)	$3,101,000 (30)	$22,508,000 (1)

ARARs	Applicable or Relevant and Appropriate Requirements
cy	Cubic yards
DEC	Direct Exposure Criteria (Connecticut)
I/C	Industrial/commercial
LTTD	Low-temperature thermal desorption
LUCs	Land use controls
LUC RD	Land Use Control Remedial Design
NPW	Net present worth
O&M	Operation and maintenance
PAHs	Polycyclic aromatic hydrocarbons
PMC	Pollutant Mobility Criteria (Connecticut)
PRGs	Preliminary Remediation Goals
RAOs	Remedial Action Objectives
sf	Square feet
TBCs	To Be Considered (criteria)
TPH	Total petroleum hydrocarbons

TABLE 6-36

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SEDIMENT ALTERNATIVES SD-3 AND SD-4 (CAPPING), SD-6 AND SD-7 (DREDGING), AND SD-8 (DREDGING AND CAPPING)
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Cancer Slope Factors (CSFs)	United States Environmental Protection Agency (EPA) Integrated Risk Information System (IRIS) and others	To Be Considered (TBC) for all alternatives	These are guidance values used in risk assessment to evaluate the potential carcinogenic hazard caused by exposure to contaminants.	Would comply. These standards would be used to determine that there are no unacceptable carcinogenic risks from direct exposure to contaminated sediment. Alternatives SD-3, SD-4, SD-6, SD-7, and SD-8 would meet these standards because potential risk from adult exposure to contaminated sediment would be addressed through capping or dredging and off-site disposal of contaminated sediment. The alternatives also include LUCs and monitoring to ensure long-term protectiveness.
Reference Doses (RfDs)	EPA IRIS and others	TBC for all alternatives	These are guidance values used in risk assessment to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	Would comply. These standards would be used to determine that there are no unacceptable non-carcinogenic risks from direct exposure to contaminated sediment. Alternatives SD-3, SD-4, SD-6, SD-7, and SD-8 would meet these standards because potential risk from adult exposure to contaminated sediment would be addressed through capping or dredging and off-site disposal of contaminated sediment. The alternatives also include LUCs and monitoring to ensure long-term protectiveness.
Guidelines for Carcinogen Risk Assessment	EPA/630/P-03/001F (March 2005)	TBC for all alternatives	These guidelines are used to perform human health risk assessments.	Would comply. These standards would be used to determine that there are no unacceptable carcinogenic risks from direct exposure to contaminated sediment. Alternatives SD-3, SD-4, SD-6, SD-7, and SD-8 would meet these standards because potential risk from adult exposure to contaminated sediment would be addressed through capping or dredging and off-site disposal of contaminated sediment. The alternatives also include LUCs and monitoring to ensure long-term protectiveness.

TABLE 6-36

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SEDIMENT ALTERNATIVES SD-3 AND SD-4 (CAPPING), SD-6 AND SD-7 (DREDGING), AND SD-8 (DREDGING AND CAPPING)
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL (continued)				
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F (March 2005)	TBC for all alternatives	These guidelines are used to perform human health risk assessments.	Would comply. These standards would be used to determine that there are no unacceptable carcinogenic risks to children from direct exposure to contaminated sediment. Alternatives SD-3, SD-4, SD-6, SD-7, and SD-8 would meet these standards because potential risk from child exposure to contaminated sediment would be addressed through capping or dredging and off-site disposal of contaminated sediment. The alternatives also include LUCs and monitoring to ensure long-term protectiveness.
Effect Range Median-Quotient (ERM-Q)	Long, Edward, et al, 1995. Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments, and Long and Morgan, 1991. Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program.	TBC	Provide guidance values for identifying potential risk to ecological receptors exposed to contaminated sediments. The citations provide the ERM values which were then used in conjunction with site-specific toxicity test data to develop the PRGs.	Would comply. The document would be used to develop standards used for evaluating risk to aquatic ecological receptors exposed to contaminated sediment. Guidance was used to establish sediment PRGs. Alternatives SD-3, SD-4, SD-6, SD-7, and SD-8 would meet the standards because potential risk to aquatic ecological receptors to contaminated sediment would be addressed through capping or dredging and off-site disposal of contaminated sediment. The alternatives also include LUCs and monitoring to ensure long-term protectiveness.

TABLE 6-36

ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SEDIMENT ALTERNATIVES SD-3 AND SD-4 (CAPPING), SD-6 AND SD-7 (DREDGING), AND SD-8 (DREDGING AND CAPPING)
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
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Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL (continued)				
Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil	EPA-540-R-03-001, OSWER Dir #9285.7.54 (January 2003)	TBC for all alternatives	EPA guidance for evaluating the risks posed by lead in sediment.	Would comply Alternatives SD-3, SD-4, SD-6, SD-7, and SD-8 would meet this standard because potential lead risk from adult exposure to lead in contaminated sediment would be addressed through capping or dredging and off-site disposal. The alternatives also include LUCs and monitoring to ensure long-term protectiveness.
STATE OF CONNECTICUT				
None				

TABLE 6-37

ASSESSMENT OF LOCATION-SPECIFIC ARARs AND TBCs
SEDIMENT ALTERNATIVES SD-3 AND SD-4 (CAPPING), SD-6 AND SD-7 (DREDGING), AND SD-8 (DREDGING AND CAPPING)
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Clean Water Act (CWA) Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material	33 United States Code (USC) 1344; 40 Code of Federal Regulations (CFR) Part 230 and 320-323	Applicable to all alternatives.	These rules regulate the discharge of dredge and fill materials in wetlands and navigable waters. Such discharges are not allowed if practicable alternatives are available.	All alternatives would comply. Dredging operations including sediment dewatering would be conducted in a manner that will minimize discharges to wetlands or navigable waters. Resource agencies have indicated that mitigation would not be required for altering aquatic habitat. Any capping or cap maintenance activities (Alternatives SD-3, SD-4, and SD-8) would also meet these standards. The Navy has determined that Alternative SD-8 is the least environmentally damaging practicable alternative to protect wetland resources from site contamination.
Rivers and Harbors Act, Section 10	33 USC 403; 33 CFR Parts 320-323	Applicable to all alternatives.	Sets forth criteria for obstructions or alterations of navigable waters.	The dredging, dewatering, and potentially capping and cap maintenance activities (Alternatives SD-3, SD-4, and SD-8) components of all alternatives would meet the substantive environmental requirements of these standards.
Fish and Wildlife Coordination Act	16 USC Part 661 *et seq.*,	Applicable to all alternatives.	Protects fish and wildlife when actions at the site would result in the control or structural modification of a natural stream, body of water, wetland, floodplain, or flood-prone area. The statute requires federal agencies to take into account the effects of remedial actions and prevent loss or damage to resources.	The dredging, dewatering, and potentially capping and cap maintenance activities (Alternatives SD-3, SD-4, and SD-8) components of all alternatives would be conducted so as to minimize impacts to fish and wildlife in the Thames River. Federal and State resource agencies would be consulted to prevent, mitigate, or compensate for loss of fish and wildlife.
Coastal Zone Management Act	16 USC Parts 1451 *et seq*.	Applicable to all alternatives.	Requires that any actions that affect a land or water use or natural resource of the coastal zone must be conducted in a manner consistent to the maximum extent practical with enforceable policies of state-approved management programs.	The dredging, dewatering, and potentially capping and cap maintenance activities (Alternatives SD-3, SD-4, and SD-8) components of all alternatives would be conducted so as to comply with the substantive requirements of this act.

TABLE 6-37

ASSESSMENT OF LOCATION-SPECIFIC ARARs AND TBCs
SEDIMENT ALTERNATIVES SD-3 AND SD-4 (CAPPING), SD-6 AND SD-7 (DREDGING), AND SD-8 (DREDGING AND CAPPING)
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
FEDERAL (Continued)				
Floodplain Management and Protection of Wetlands	44 CFR 9	Relevant and appropriate	FEMA regulations that set forth the policy, procedure and responsibilities to implement and enforce Executive Order 11988 Floodplain Management and Executive Order 11990, Protection of Wetlands.	All alternatives would comply. Remedial alternatives conducted within the 500-year floodplain of the Thames River or within federal jurisdictional wetlands will be implemented in compliance with these standards. The Navy will solicit public comment as part of the proposed plan on the measures taken through the remedial action to protect floodplain and wetland resources.
STATE OF CONNECTICUT				
Coastal Management Act	Regulations of Connecticut State Agencies (RCSA) §22a-90 to 112	Applicable to all alternatives.	Requires that any actions must be conducted in a manner consistent with state-approved management programs.	The dredging, dewatering, and potentially capping and cap maintenance activities (Alternatives SD-3, SD-4, and SD-8) components of all alternatives would be conducted so as to as to comply with the substantive requirements of this act.
Regulation of Dredging and Erection of Structures and Placement of Fill in Tidal, Coastal, or Navigable Waters	CGS 22a-359 through 363f	Applicable to all alternatives.	This statute regulates dredging and the erection of structures and the placement of fill, and work incidental thereto, in the tidal, coastal or navigable waters of the state waterward of the high tide line. Work within the regulated zone must be conducted with due regard for indigenous aquatic life, fish and wildlife, the prevention or alleviation of shore erosion and coastal flooding, the use and development of adjoining uplands, the improvement of coastal and inland navigation for all vessels, including small craft for recreational purposes, the use and development of adjacent lands and properties and the interests of the state, including pollution control, water quality, recreational use of public water and management of coastal resources, with proper regard for the rights and interests of all persons concerned.	The dredging, dewatering, and potentially capping and cap maintenance activities (Alternatives SD-3, SD-4, and SD-8) components of all alternatives would be conducted so as to as to comply with the substantive requirements of this act.

TABLE 6-37

ASSESSMENT OF LOCATION-SPECIFIC ARARs AND TBCs
SEDIMENT ALTERNATIVES SD-3 AND SD-4 (CAPPING), SD-6 AND SD-7 (DREDGING), AND SD-8 (DREDGING AND CAPPING)
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation of Alternative Compliance with ARAR
STATE OF CONNECTICUT (continued)				
Tidal Wetlands and Watercourses	Regulations of Connecticut State Agencies (RCSA) §22a-30-1 through 17	Applicable to all alternatives.	These rules regulate all activities within or affecting tidal wetlands and watercourses.	The dredging, dewatering, and potentially capping and cap maintenance activities (Alternatives SD-3, SD-4, and SD-8) components of all alternatives would be conducted so as to prevent erosion, sedimentation and other disturbance to tidal wetlands and watercourses
Flood Management Regulations	RCSA 25-68h-1 through 25-68h-3	Relevant and Appropriate to all alternatives.	These regulations address activities by state agencies in flood plains to minimize flood risk and prevent flood hazards.	All alternatives would comply with this standard. Any shoreline activities within the 100-year coastal flood hazard zone would comply with the substantive provisions of these regulations.
Endangered Species Act	CGS §26-303 through 314	Applicable to all alternatives.	Remedial actions may not jeopardize the continued existence of state-listed endangered or threatened species, or adversely modify or destroy their critical habitat.	The dredging, dewatering, and potentially capping and cap maintenance activities (Alternatives SD-3, SD-4, and SD-8) components of all alternatives would be conducted so as to minimize disturbance to aquatic habitats in the Thames River which are used by the state-threatened Atlantic Sturgeon.

TABLE 6-38

ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs
SEDIMENT ALTERNATIVES SD-3 AND SD-4 (CAPPING), SD-6 AND SD-7 (DREDGING), AND SD-8 (DREDGING AND CAPPING)
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis	Evaluation of Alternative Compliance with ARAR
FEDERAL				
Clean Water Act (CWA), Section 304; National Recommended Water Quality Criteria (NRWQC)	33 United States Code (USC) 1314; 40 Code of Federal Regulations (CFR) 122.44	Relevant and Appropriate to all alternatives.	Guidelines establish National Recommended Water Quality Criteria (NRWQC) for the protection of human health and/or the aquatic organisms.	All alternatives would comply. Water quality monitoring would ensure that these criteria are not exceeded during dredging and dewatering operations. Alternatives SD-3, SD-4, and SD-8 that include capping and leaving waste in place might require long-term monitoring of water quality under these standards.
CWA, Section 402, National Pollution Discharge Elimination System (NPDES)	33 USC 1342; 40 CFR 122 through 125	Applicable to Alternatives SD-3 and SD-6 (discharge to Thames River). Not applicable to Alternatives SD-4, SD-7, and SD-8.	These standards govern the discharge of water into surface waters.	Alternatives SD-3 and SD-6 would comply. Dewatering operations would meet these standards through active or passive treatment before dewatering fluid is discharged back to the Thames River.
CWA; General Pretreatment Regulations for Existing and New Sources of Pollution	40 CFR § 403	Applicable to Alternatives SD-4, SD-7, and SD-8 (off-site disposal). Not applicable to Alternatives SD-3 and SD-6 (discharge to Thames River).	Standards for direct discharge of dewatering fluid or any other discharge into a Publicly Owned Treatment Works (POTW).	Alternatives SD-4, SD-7, and SD-8 would comply with these standards if off-site disposal of dewatering fluid involves discharge to a POTW.
Toxic Substance Control Act (TSCA), Polychlorinated Biphenyls (PCB) Remediation Waste Risk-Based Standards	15 USC § 2601 *et seq.*; 40 CFR 761.61(c)	Applicable to all alternatives.	Risk-based standards for the sampling, cleanup, or disposal of PCB remediation waste. Written approval for the proposed risk-based clean-up will be obtained from the Office of Site Remediation and Restoration, EPA Region 1.	Alternatives SD-3 and SD-4 would comply by capping PCB contaminated sediment in place to prevent risks to human health and the environment. Alternatives SD-6 and SD-7 would comply because sediment exceeding the unrestricted use, risk-based standard of 1 mg/kg would be excavated/dredged and disposed of off-site. Alternative SD-8 would comply through a combination of dredging contaminated sediment and the maintenance of existing caps. The Navy will seek public comment in the Proposed Plan as to whether the finding that the proposed remedy for PCB contamination at the Site will not pose an unreasonable risk of injury to health or the environment. An EPA finding that the remedy meets these standards will be included in the Record of Decision.

TABLE 6-38

ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs
SEDIMENT ALTERNATIVES SD-3 AND SD-4 (CAPPING), SD-6 AND SD-7 (DREDGING), AND SD-8 (DREDGING AND CAPPING)
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Requirement	Citation	Status	Synopsis	Evaluation of Alternative Compliance with ARAR
FEDERAL (Continued)				
Clean Air Act (CAA), National Emissions Standards for Hazardous Air Pollutants (NESHAPs),	42 USC §12(b)(1); 40 CFR Part 61	Applicable to all alternatives.	The regulations establish emissions standards for 189 hazardous air pollutants. Standards set for dust control and other release sources.	All alternatives would comply. If removal activities, including excavation/dredging or processing of contaminated sediment, generate regulated air pollutants, measures would be implemented to meet these standards.
United States Environmental Protection Agency (U.S. EPA) Contaminated Sediment Remediation Guidance for Hazardous Waste Sites	EPA-540-R-05-012; Office of Solid Waste and Emergency Response (OSWER) 9355.0-85 December 2005	To Be Considered (TBC) for all alternatives.	Guidance on the remediation of contaminated sediments, including capping and dredging.	All Alternatives would comply. Capping and dredging alternatives would be designed and implemented utilizing this guidance.
Coast Guard Anchorage Ground and Regulated Navigation Area Rules	33 CFR Part 110; 165	To Be Considered	The Coast Guard may promulgate site-specific rules to establish federal anchorage areas and regulated navigation areas (RNAs). Once promulgated such a rule is also the basis for the National Oceanic and Atmospheric Administration (NOAA) to revise navigation charts to show the restricted area.	If, in the future, the Navy transfers the SUBASE to a non-federal owner, it will explore the option of coordinating with the Coast Guard and river stakeholders in the promulgation of a Rule to establish a RNA for the portion of the river requiring LUCs. An RNA would create federally enforceable restrictions to protect the LUC area from disturbance and to delineate the area of the LUCs on federal navigation charts.
STATE OF CONNECTICUT				
Hazardous Waste Management: Generator and Handler Requirements, Listing and Identification	Regulations of Connecticut State Agencies (RCSA) §22a-449(c) 100-101	Applicable to all alternatives.	Connecticut is delegated to administer the federal Resource Conservation and Recovery Act (RCRA) statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference	All alternatives would comply. Hazardous waste determinations would be performed on all contaminated sediment excavated/dredged to determine that the levels of regulated constituents do not exceed applicable limits. Any contaminated sediments which exceed hazardous waste standards would be managed in accordance with requirements of these regulations. Also, wastes produced from dewatering process would be tested to determine whether they exceed applicable limits.
Hazardous Waste Management: Generator Standards	RCSA § 22a-449(c)-102	Applicable to all alternatives.	This section establishes standards for various classes of generators. The standards of 40 CFR 262 are incorporated by reference.	All alternatives would comply. Any hazardous waste generated as a result of either excavation/dredging or dewatering operations would be handled and disposed of in compliance with these standards.

TABLE 6-38

ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs
SEDIMENT ALTERNATIVES SD-3 AND SD-4 (CAPPING), SD-6 AND SD-7 (DREDGING), AND SD-8 (DREDGING AND CAPPING)
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
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Requirement	Citation	Status	Synopsis	Evaluation of Alternative Compliance with ARAR
STATE OF CONNECTICUT (Continued)				
Solid Waste Management	RSCA §22a-209 -1 through 16	Applicable to solid waste managed on-site (all alternatives).	Management and siting requirements for the disposal of solid waste.	All alternatives would comply. All material that does not exceed hazardous waste threshold that would be managed on-site as solid waste and disposed off-site in an appropriate licensed solid waste facility.
Water Pollution Control	RCSA §22a-430-1 through 8	Not applicable to Alternatives SD-4, SD-7, and SD-8 (off-site disposal). Applicable to Alternatives SD-3 and SD-6 (discharge to Thames River).	These rules regulate water discharge to surface water.	Alternatives SD-3 and SD-6 would comply. Dewatering operations would meet these standards through active or passive treatment before dewatering fluid is discharged back to the Thames River.
Air Pollution Control	RCSA §22a-174 1-20	Applicable to all alternatives.	These regulations pertain to the construction and operation of specified types of emission sources and contain emission standards that must be met. Pollutant abatement controls may be required. Specific standards pertain to fugitive dust (18b).	All alternatives would comply. If removal activities, including excavation/dredging or processing of contaminated sediment, generates regulated air pollutants, measures would be implemented to meet the substantive requirements of these regulations. However, under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), actual permits would not be required.
Connecticut Guidelines for Soil Erosion and Sediment Control	Connecticut Council on Soil and Water Conservation	TBC for all alternatives.	Technical and administrative guidance for development, adoption and implementation of erosion and sediment control program.	All alternatives would comply. Excavation/dredging operations would include an appropriate erosion and sedimentation control program that would comply with this guidance.

TABLE 6-39

SUMMARY OF COMPARATIVE ANALYSIS OF ZONE 4 AND OUTER PIER 1 SEDIMENT REMEDIAL ALTERNATIVES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Evaluation Criterion	Alternative SD-1 No Action	Alternative SD-3 Capping with Pre-Dredging to Meet RAOs, Dewatering, On-Site Treatment and Discharge of Dewatering Fluid, Off-Site Disposal of Dewatered Sediment, LUCs (Institutional Controls), and Monitoring	Alternative SD-4 Capping with Pre-Dredging to Meet RAOs, Dewatering, Off-Site Disposal of Dewatered Sediment and Dewatering Fluid, LUCs (Institutional Controls), and Monitoring	Alternative SD-6 Dredging to Meet PRGs, Dewatering, On-Site Treatment and Discharge of Dewatering Fluid, Off-Site Disposal of Dewatered Sediment, LUCs (Institutional Controls), and Monitoring	Alternative SD-7 Dredging to Meet PRGs, Dewatering, Off-Site Disposal of Dewatered Sediment and Dewatering Fluid, LUCs (Institutional Controls), and Monitoring	Alternative SD-8 Zone 4 - Dredging to Meet PRGs, Dewatering, Off-Site Disposal of Dewatered Sediment and Dewatering Fluid, LUCs (Institutional Controls), and Monitoring and Outer Pier 1 – Capping to Meet RAOs, LUCs (Institutional Controls) and Monitoring
Overall Protection of Human Health and Environment	Not protective.	Protective.	Would be as protective as Alternative SD-3.	Would be more protective than Alternatives SD-3, SD-4, and SD-8 because of the removal of the contaminated sediment. Most protective.	Would be as protective as Alternative SD-6.	Would be more protective than Alternatives SD-3 and SD-4 because of the removal of a majority of the contaminated sediment, but less protective than Alternatives SD-6 and SD-7, which remove all contaminated sediment.
<u>Compliance with ARARs and TBCs</u> Chemical-Specific Location-Specific Action-Specific	 Would not comply. Would not comply No location-specific ARARs.	 Would comply. Would comply. Would comply.	 Would comply. Would comply. Would comply.	 Would comply Would comply Would comply	 Would comply Would comply Would comply	 Would comply Would comply. The Navy has determined that under CWA Section 404 Alternative SD-8 is the least environmentally damaging practicable alternative to protect wetland resources from site contamination. Would comply
Long-Term Effectiveness and Permanence	Not effective.	Effective.	Slightly less effective than Alternative SD-3.	More effective than Alternative SD-7. Most effective.	More effective than Alternatives SD-3, SD-4, and SD-8.	More effective than Alternatives SD-3 and SD-4.
Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment	There is no treatment.	Would treat on site 26,900 gallons of dewatering fluid with subsequent discharge to the Thames River.	There is no treatment.	Would treat on site 468,000 gallons of dewatering fluid with subsequent discharge to the Thames River.	There is no treatment.	There is no treatment.
Short-Term Effectiveness	No short-term risks. Would not achieve sediment RAOs or meet sediment PRGs.	Short-term risks to address: worker exposure during dredging, capping, monitoring, dewatering, and treatment; transport of contaminated sediment through the community; solids in surface water from dredging; effect of dredging and cap on benthic organisms. Two months to implement and achieve sediment RAOs and meet sediment PRGs.	Short-term risks to address: worker exposure during dredging, capping, the monitoring, and dewatering; transport of contaminated sediment and dewatering fluid through the community; solids in surface water from dredging; effect of dredging and cap on benthic organisms. Two months to implement and achieve sediment RAOs and meet sediment PRGs.	Short-term risks to address: worker exposure during dredging, monitoring, dewatering, and treatment; transport of contaminated sediment through the community; solids in surface water from dredging; effect of dredging on benthic organisms. Risks would be properly mitigated. Six months to implement and achieve sediment RAOs and meet sediment PRGs.	Short-term risks to address: worker exposure during dredging, monitoring, and dewatering; transport of contaminated sediment and dewatering fluid through the community; solids in surface water from dredging; effect of dredging on benthic organisms. Six months to implement and achieve sediment RAOs and meet sediment PRGs.	Short-term risks to address: worker exposure during dredging, capping, monitoring, and dewatering; transport of contaminated sediment and dewatering fluid through the community; solids in surface water from dredging; effect of dredging on benthic organisms. Five months to implement and achieve sediment RAOs and meet sediment PRGs.
Implementability	Requires only five-year reviews.	Issues include: Dredging 1,330 cy of sediment, disposing of 1,463 cy of treated sediment, and placing 3,660 cy of cap; dredging depth control; cap placement control; constructing on-site water treatment system; obtaining base construction approval; developing and implementing LUC RD and monitoring program; acquiring required resources; and maintaining cap/cover over 97,300 ft^2.	Issues include: Dredging 1,330 cy of sediment, disposing of 1,463 cy of treated sediment, and placing 3,660 cy of cap; dredging depth control; cap placement control; obtaining base construction approval; developing and implementing LUC RD and monitoring program; obtaining acquiring required resources; and maintaining cap/cover over 97,300 ft^2.	Issues include: Dredging 23,160 cy of sediment, disposing of 25,470 cy of treated sediment, and placing 10,250 cy of backfill; dredging depth control; constructing on-site water treatment system; obtaining base construction approval; developing and implementing LUC RD and monitoring program; and acquiring required resources.	Issues include: Dredging 23,160 cy of sediment, disposing of 25,470 cy of treated sediment, and placing 10,250 cy of backfill; dredging depth control; obtaining base construction approval; developing and implementing LUC RD and monitoring program; and acquiring required resources.	Issues include: Dredging 19,700 cy of sediment, disposing of 21,660 cy of treated sediment, and placing 10,250 cy of backfill; dredging depth control; obtaining base construction approval; developing and implementing LUC RD; acquiring required resources; and maintaining cap/cover over 13,500 ft^2.

TABLE 6-39

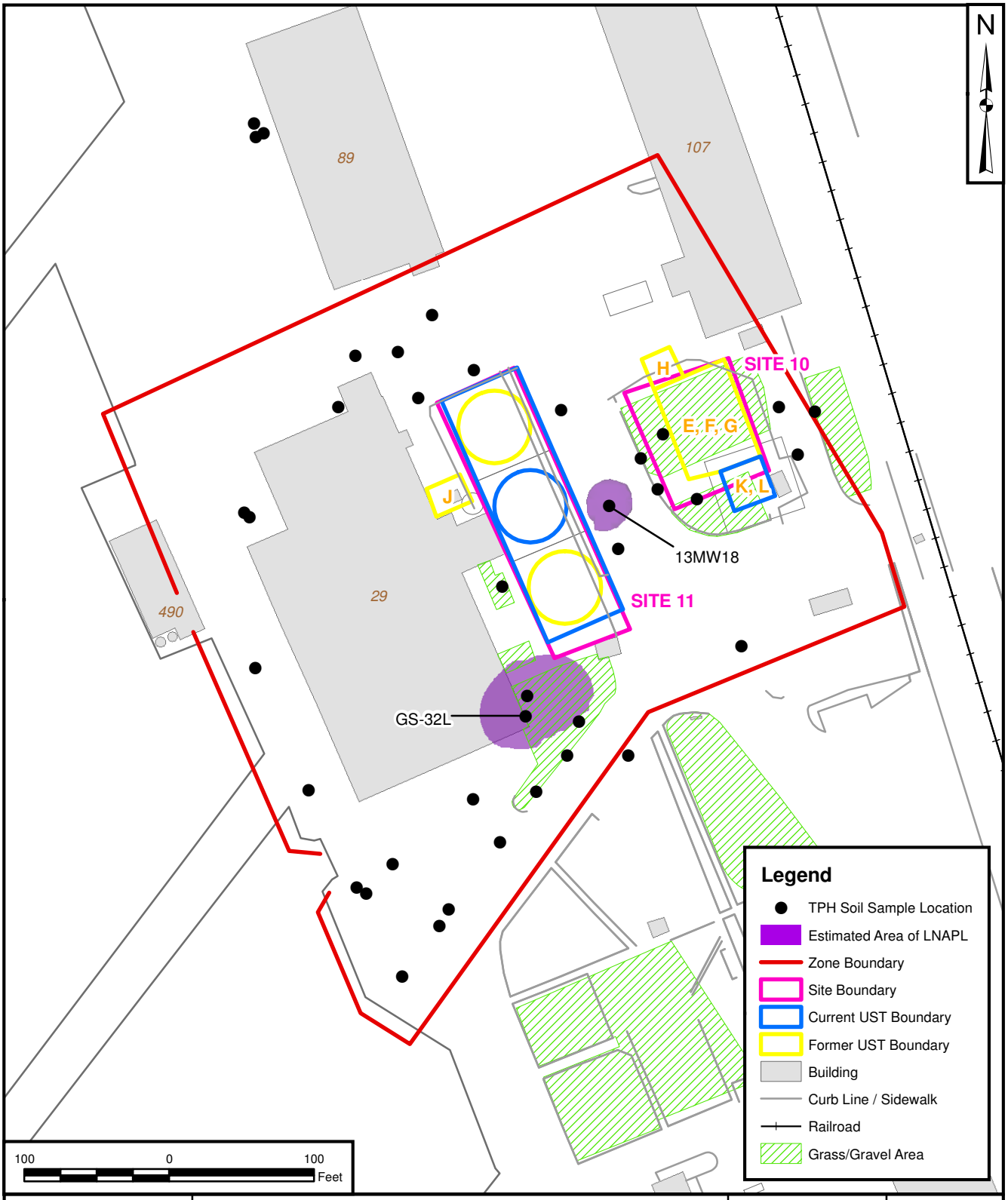
SUMMARY OF COMPARATIVE ANALYSIS OF ZONE 4 AND OUTER PIER 1 SEDIMENT REMEDIAL ALTERNATIVES
LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FEASIBILITY STUDY ADDENDUM
NSB-NLON, GROTON, CONNECTICUT

Evaluation Criterion	Alternative SD-1 No Action	Alternative SD-3 Capping with Pre-Dredging to Meet RAOs, Dewatering, On-Site Treatment and Discharge of Dewatering Fluid, Off-Site Disposal of Dewatered Sediment, LUCs (Institutional Controls), and Monitoring	Alternative SD-4 Capping with Pre-Dredging to Meet RAOs, Dewatering, Off-Site Disposal of Dewatered Sediment and Dewatering Fluid, LUCs (Institutional Controls), and Monitoring	Alternative SD-6 Dredging to Meet PRGs, Dewatering, On-Site Treatment and Discharge of Dewatering Fluid, Off-Site Disposal of Dewatered Sediment, LUCs (Institutional Controls), and Monitoring	Alternative SD-7 Dredging to Meet PRGs, Dewatering, Off-Site Disposal of Dewatered Sediment and Dewatering Fluid, LUCs (Institutional Controls), and Monitoring	Alternative SD-8 Zone 4 - Dredging to Meet PRGs, Dewatering, Off-Site Disposal of Dewatered Sediment and Dewatering Fluid, LUCs (Institutional Controls), and Monitoring and Outer Pier 1 – Capping to Meet RAOs, LUCs (Institutional Controls) and Monitoring
Costs:						
Capital	$0	$1,384,000	$1,222,000	$8,147,000	$7,340,000	$6,276,000
O&M NPW (Years)	$104,000	$1,130,000 (30)	$1,130,000 (30)	$187,000 (10)	$187,000 (10)	$878,000 (30)
NPW (Years)	$104,000	$2,514,000 (30)	$2,352,000 (30)	$8,334,000 (10)	$7,527,000 (10)	$7,154,000 (30)

NOTES:

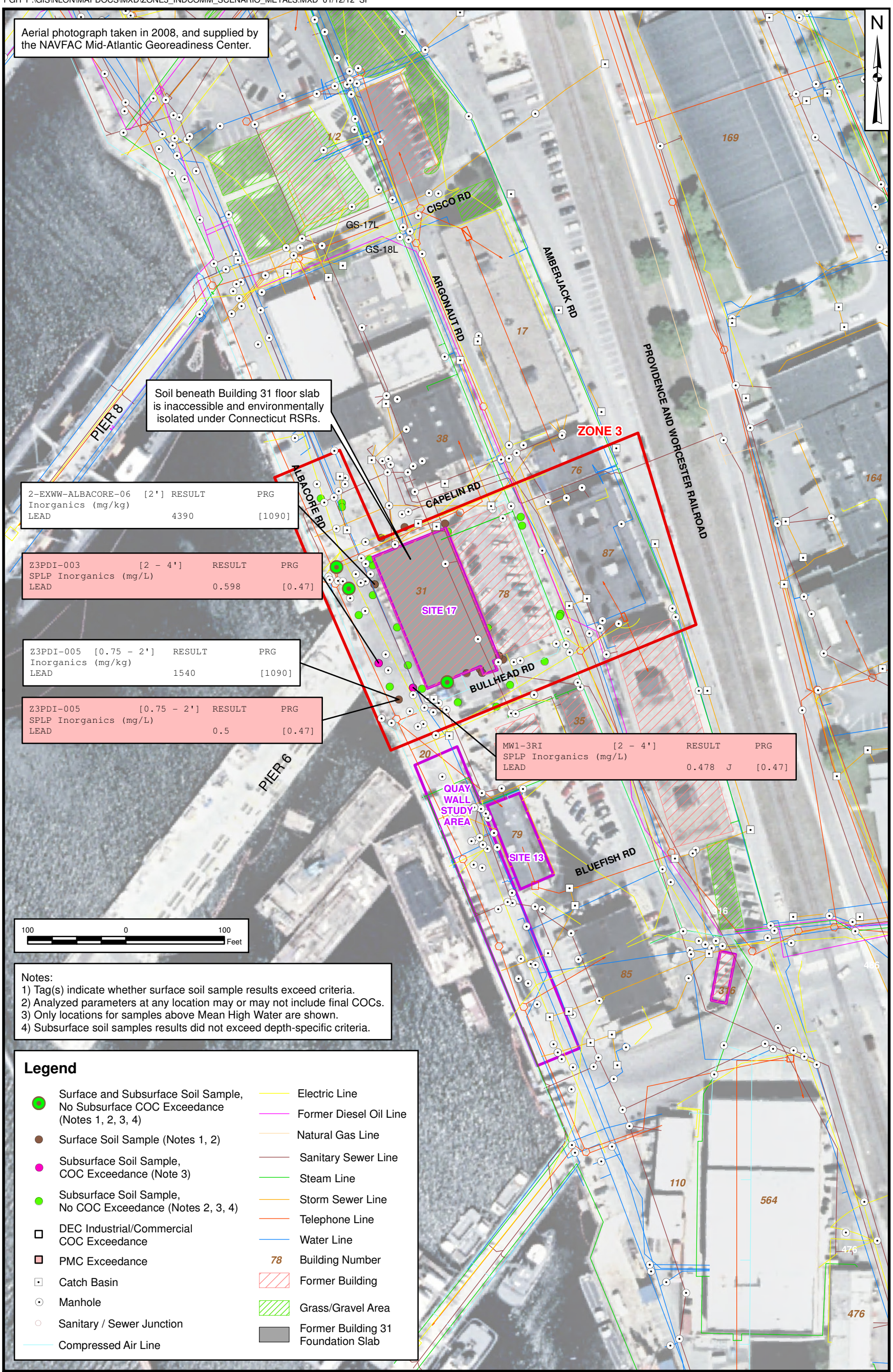
ARARs Applicable or Relevant and Appropriate Requirements
COCs Chemicals of concern
cy cubic yard
ft^2 square feet
LUCs Land use controls
LUC RD Land use control remedial design
NPW Net present worth
O&M Operation and maintenance
PRGs Preliminary Remediation Goals
RAOs Remedial Action Objectives

PGH P:\GIS\NLON\MXD\ZONE1_LNAPL_SITEMAP.MXD 12/9/11 KM



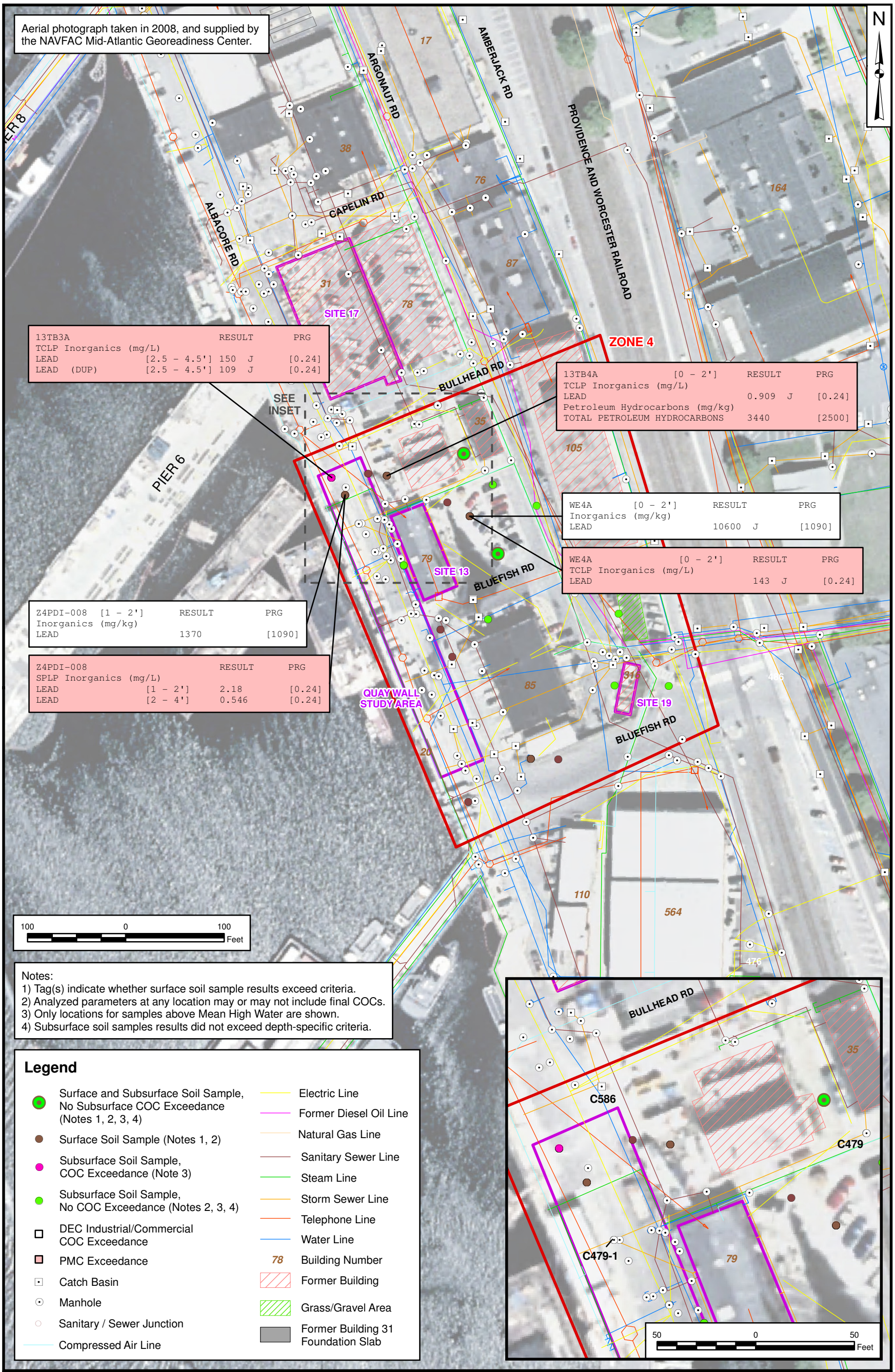
DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	02/02/11		3271	WE67
CHECKED BY	DATE	ZONE 1 AREA OF LNAPL LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY	DATE
N. BALSAMO	12/9/11		CAR	08/25/11
REVISED BY	DATE		APPROVED BY	DATE
___	___		___	___
SCALE			FIGURE NO.	REV
AS NOTED			FIGURE 6-1	0

PGH P:\GIS\NLON\MAPDOCS\MXD\ZONE3_INDCOMM_SCENARIO_METALS.MXD 01/12/12 SP



DRAWN BY J. ENGLISH	DATE 02/01/11	TETRA TECH	CONTRACT NUMBER 2630 / OWNER NUMBER WE57
CHECKED BY N. BALSAMO	DATE 01/12/12	DISTRIBUTION OF ZONE 3 SOIL COCs UNDER INDUSTRIAL/COMMERCIAL SCENARIO LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR / DATE 01/12/11
COST/SCHEDULE-AREA			APPROVED BY — / DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 6-2 / REV 0

PGH P:\GIS\NEWLONDON_NSB\MAPDOCS\MXD\ZONE4_INDCOMM_SCENARIO_METALS.MXD 08/12/11 SS



Notes:
1) Tag(s) indicate whether surface soil sample results exceed criteria.
2) Analyzed parameters at any location may or may not include final COCs.
3) Only locations for samples above Mean High Water are shown.
4) Subsurface soil samples results did not exceed depth-specific criteria.

Legend

- Surface and Subsurface Soil Sample, No Subsurface COC Exceedance (Notes 1, 2, 3, 4)
- Surface Soil Sample (Notes 1, 2)
- Subsurface Soil Sample, COC Exceedance (Note 3)
- Subsurface Soil Sample, No COC Exceedance (Notes 2, 3, 4)
- DEC Industrial/Commercial COC Exceedance
- PMC Exceedance
- Catch Basin
- Manhole
- Sanitary / Sewer Junction
- Compressed Air Line
- Electric Line
- Former Diesel Oil Line
- Natural Gas Line
- Sanitary Sewer Line
- Steam Line
- Storm Sewer Line
- Telephone Line
- Water Line
- 78 Building Number
- Former Building
- Grass/Gravel Area
- Former Building 31 Foundation Slab

DRAWN BY J. ENGLISH	DATE 02/01/11	TETRA TECH	CONTRACT NUMBER 2630 / OWNER NUMBER WE57
CHECKED BY N. BALSAMO	DATE 08/12/11	DISTRIBUTION OF ZONE 4 SOIL COCs UNDER INDUSTRIAL/COMMERCIAL SCENARIO LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR / DATE 02/04/11
COST/SCHEDULE-AREA			APPROVED BY — / DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 6-3 / REV 0

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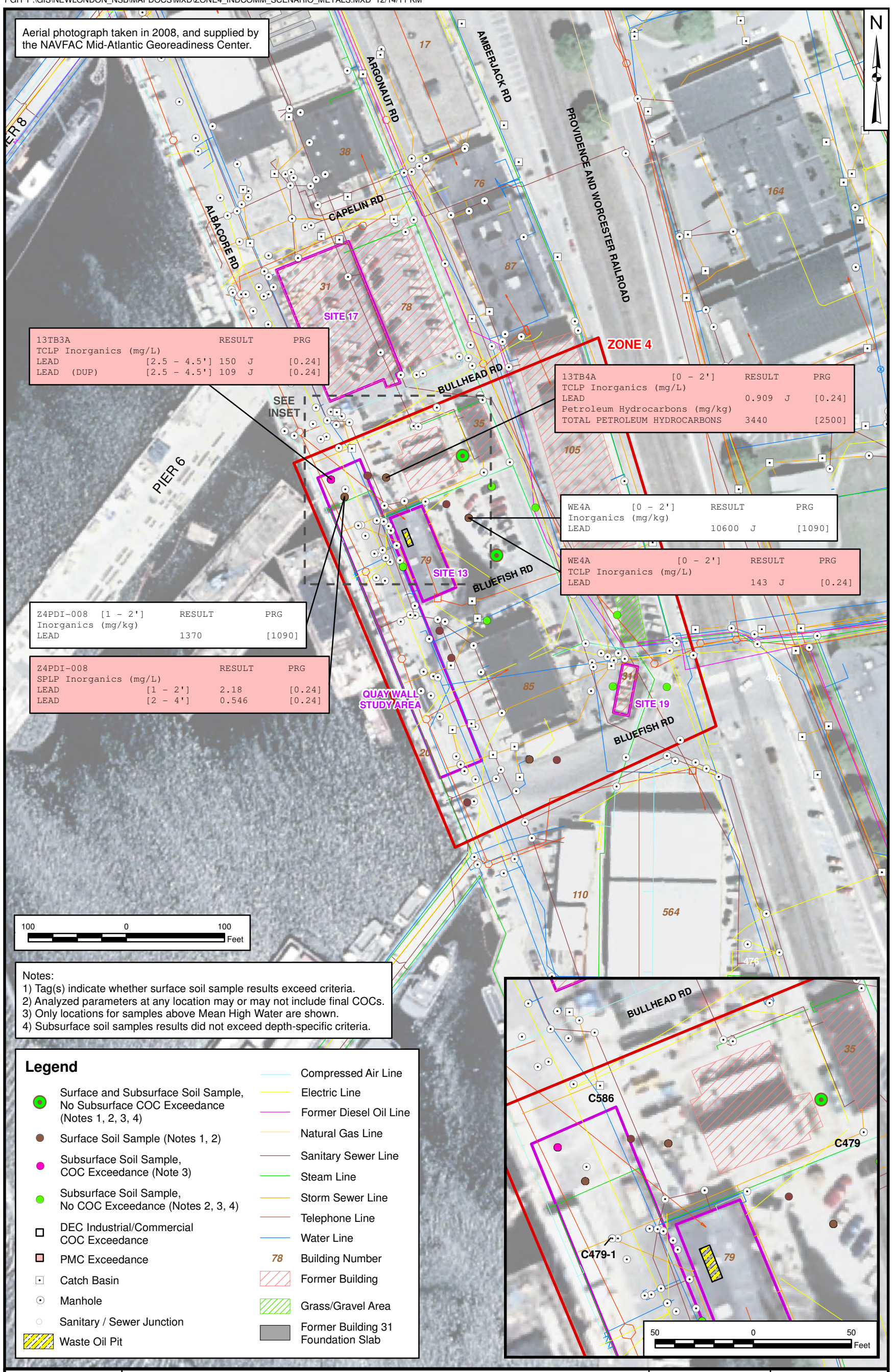

DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	OWNER NUMBER
J. ENGLISH	02/01/11		2630	WE57
CHECKED BY	DATE	DISTRIBUTION OF ZONE 4 SOIL COCs UNDER INDUSTRIAL/COMMERCIAL SCENARIO LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY	DATE
N. BALSAMO	12/14/11		CAR	02/04/11
COST/SCHEDULE-AREA			APPROVED BY	DATE
			—	—
SCALE			DRAWING NO.	REV
AS NOTED			FIGURE 6-3	0

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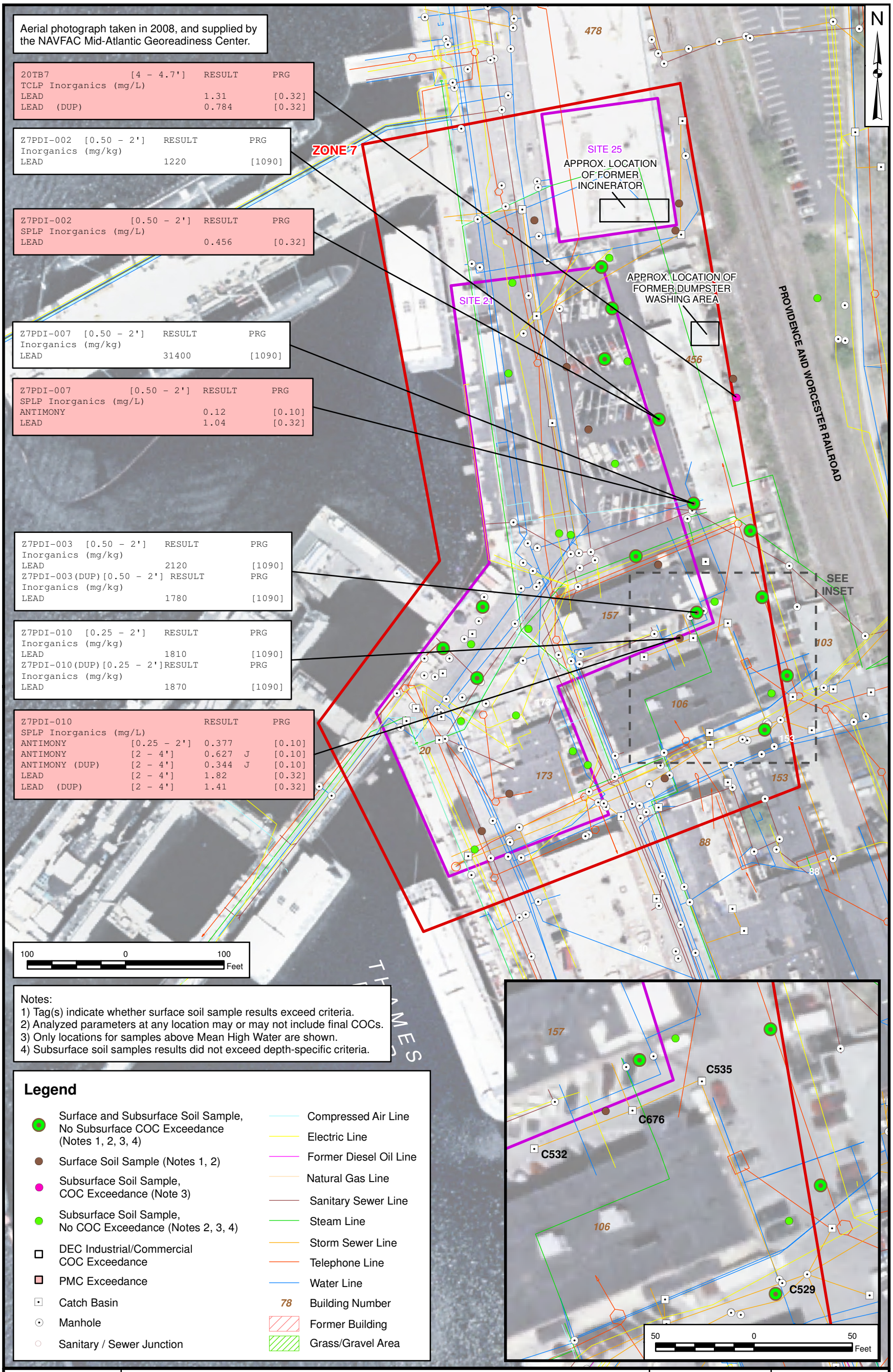

Notes:
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3) Only locations for samples above Mean High Water are shown.
4) Subsurface soil samples results did not exceed depth-specific criteria.

Legend

- Surface and Subsurface Soil Sample, No Subsurface COC Exceedance (Notes 1, 2, 3, 4)
- Surface Soil Sample (Notes 1, 2)
- Subsurface Soil Sample, COC Exceedance (Note 3)
- Subsurface Soil Sample, No COC Exceedance (Notes 2, 3, 4)
- DEC Industrial/Commercial COC Exceedance
- PMC Exceedance
- Catch Basin
- Manhole
- Sanitary / Sewer Junction
- Compressed Air Line
- Electric Line
- Former Diesel Oil Line
- Natural Gas Line
- Sanitary Sewer Line
- Steam Line
- Storm Sewer Line
- Telephone Line
- Water Line
- 78 Building Number
- Former Building
- Grass/Gravel Area

DRAWN BY J. ENGLISH	DATE 02/01/11	TETRA TECH	CONTRACT NUMBER 2630 / OWNER NUMBER WE57
CHECKED BY N. BALSAMO	DATE 12/9/11	DISTRIBUTION OF ZONE 7 SOIL COCs UNDER INDUSTRIAL/COMMERCIAL SCENARIO LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR / DATE 02/04/10
COST/SCHEDULE-AREA			APPROVED BY — / DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 6-4 / REV 0

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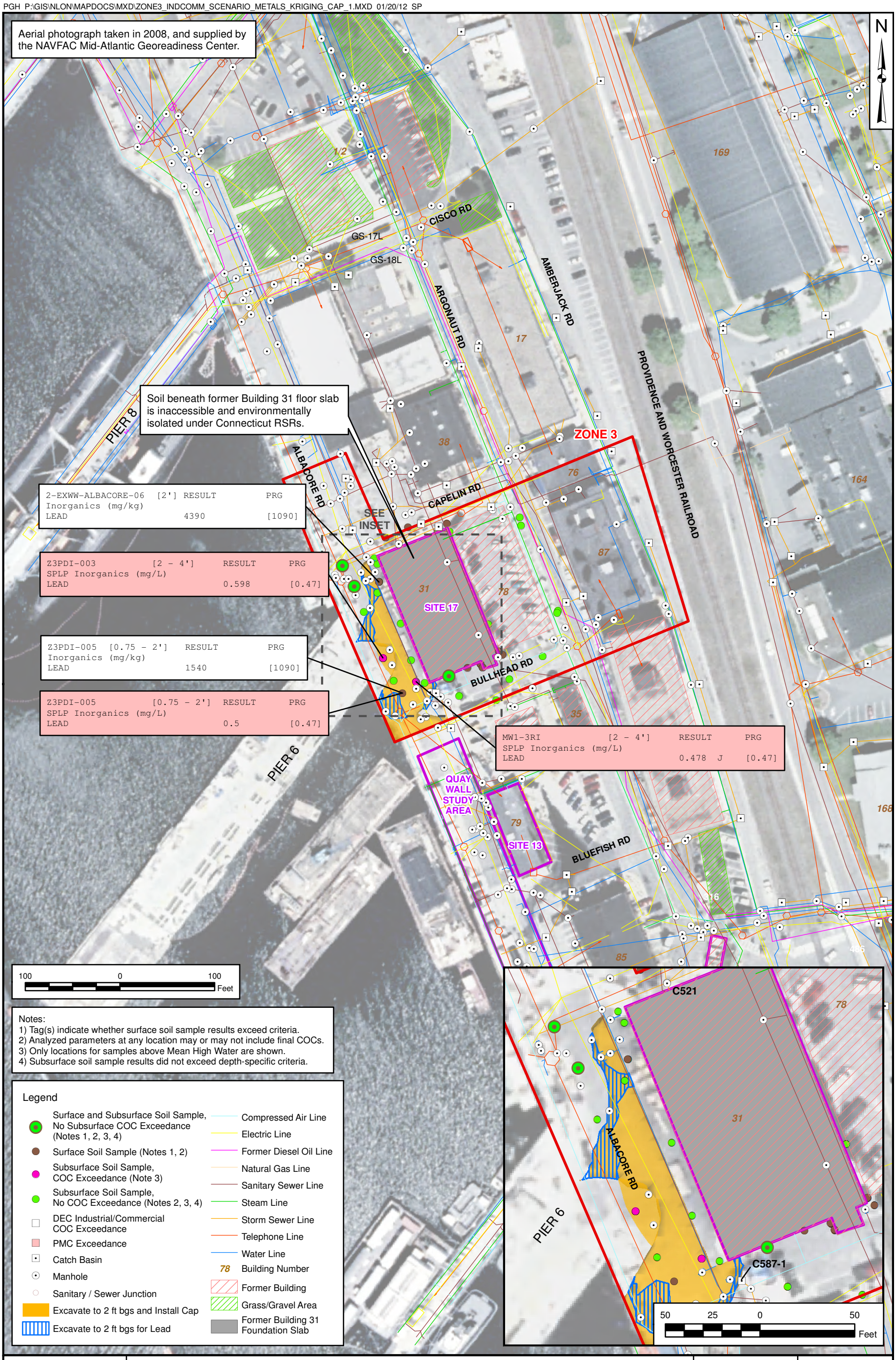

Notes:
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2) Analyzed parameters at any location may or may not include final COCs.
3) Only locations for samples above Mean High Water are shown.
4) Subsurface soil sample results did not exceed depth-specific criteria.

Legend

- Surface and Subsurface Soil Sample, No Subsurface COC Exceedance (Notes 1, 2, 3, 4)
- Surface Soil Sample (Notes 1, 2)
- Subsurface Soil Sample, COC Exceedance (Note 3)
- Subsurface Soil Sample, No COC Exceedance (Notes 2, 3, 4)
- DEC Industrial/Commercial COC Exceedance
- PMC Exceedance
- Catch Basin
- Manhole
- Sanitary / Sewer Junction
- Excavate to 2 ft bgs and Install Cap
- Excavate to 2 ft bgs for Lead
- Compressed Air Line
- Electric Line
- Former Diesel Oil Line
- Natural Gas Line
- Sanitary Sewer Line
- Steam Line
- Storm Sewer Line
- Telephone Line
- Water Line
- 78 Building Number
- Former Building
- Grass/Gravel Area
- Former Building 31 Foundation Slab

DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	02/02/11		2630	WE57
CHECKED BY	DATE	ZONE 3 AREAS OF SOIL TO BE CAPPED UNDER ALTERNATIVE S-3.3	APPROVED BY	DATE
N. BALSAMO	01/20/12	LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM	CAR	02/04/11
REVISED BY	DATE	NSB-NLON, GROTON, CONNECTICUT	APPROVED BY	DATE
S. PAXTON	01/20/12		—	—
SCALE			DRAWING NO.	REV
AS NOTED			FIGURE 6 - 6	0

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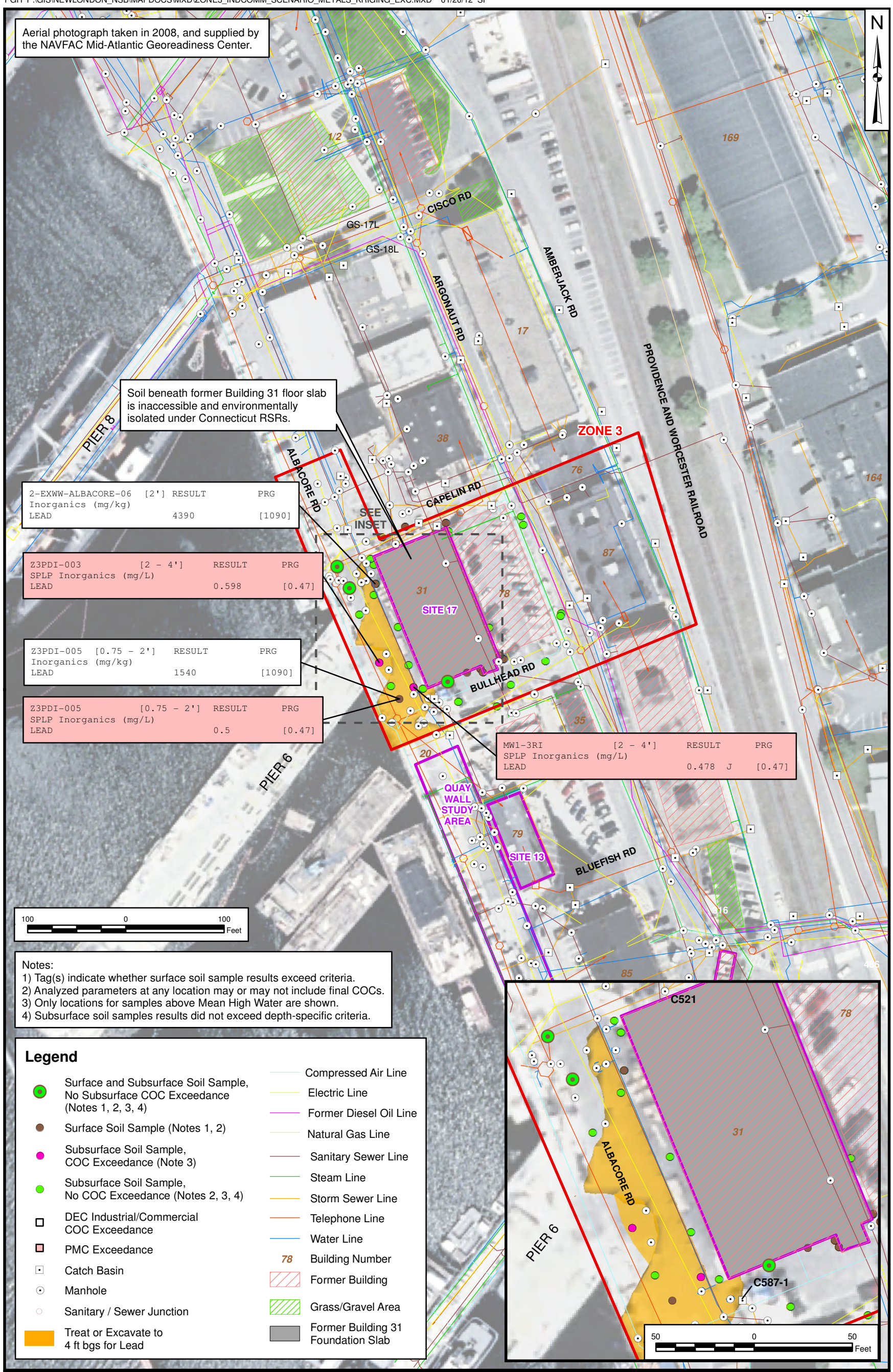

DRAWN BY J. ENGLISH	DATE 02/02/11	TETRA TECH	CONTRACT NUMBER 2630	OWNER NUMBER WE57
CHECKED BY N. BALSAMO	DATE 01/20/12	ZONE 3 AREAS OF SOIL TO BE IN-SITU TREATED OR EXCAVATED UNDER ALTERNATIVES S-3.4 OR S-3.5B LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR	DATE 08/25/11
COST/SCHEDULE-AREA			APPROVED BY —	DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 6-7	REV 0

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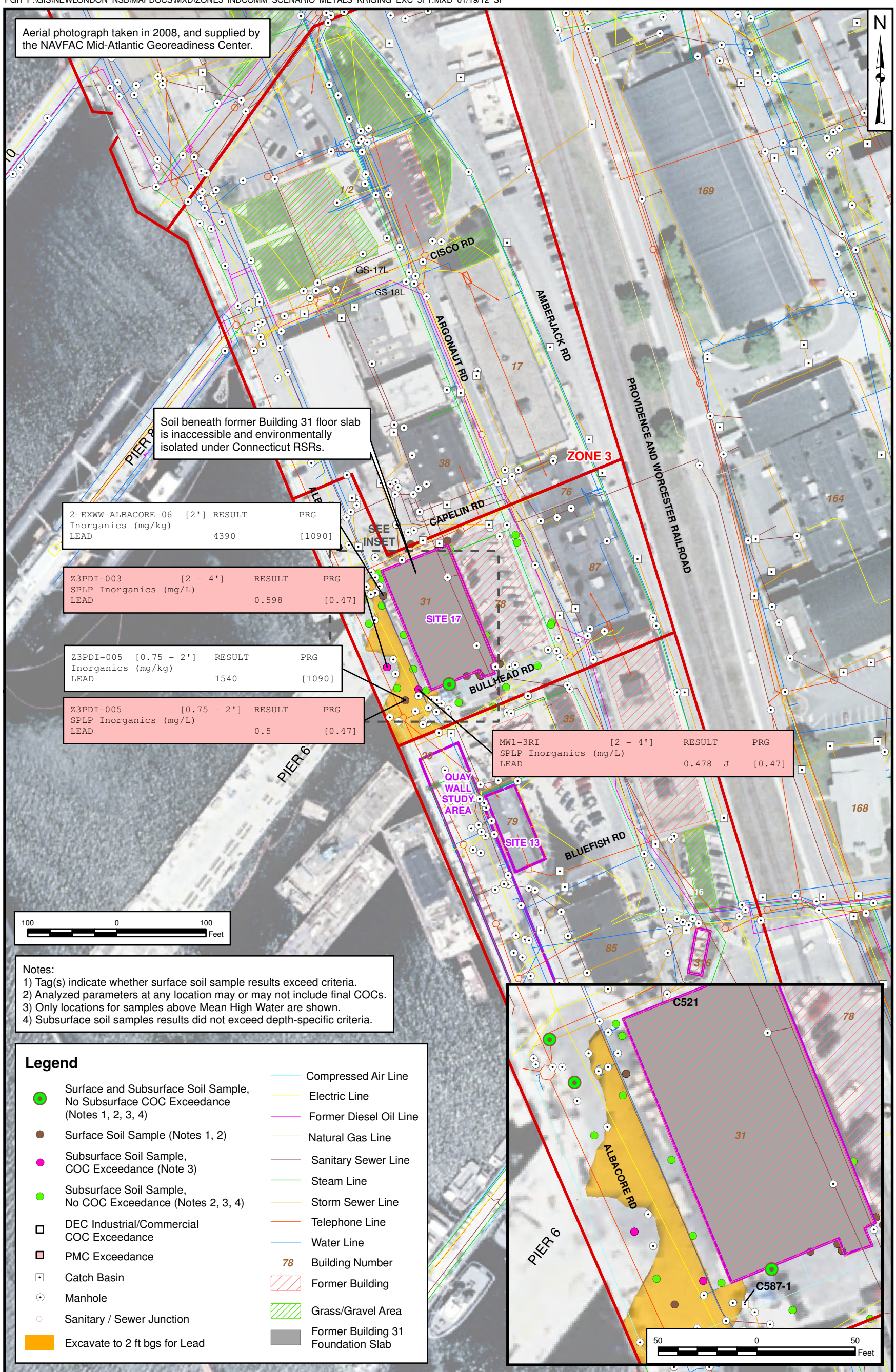

DRAWN BY J. ENGLISH	DATE 02/02/11	TETRA TECH	CONTRACT NUMBER 2630	OWNER NUMBER WE57
CHECKED BY N. BALSAMO	DATE 01/19/12	ZONE 3 AREAS OF SOIL TO BE EXCAVATED UNDER ALTERNATIVE S-3.5A LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR	DATE 02/04/11
COST/SCHEDULE-AREA			APPROVED BY —	DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 6-8	REV 0

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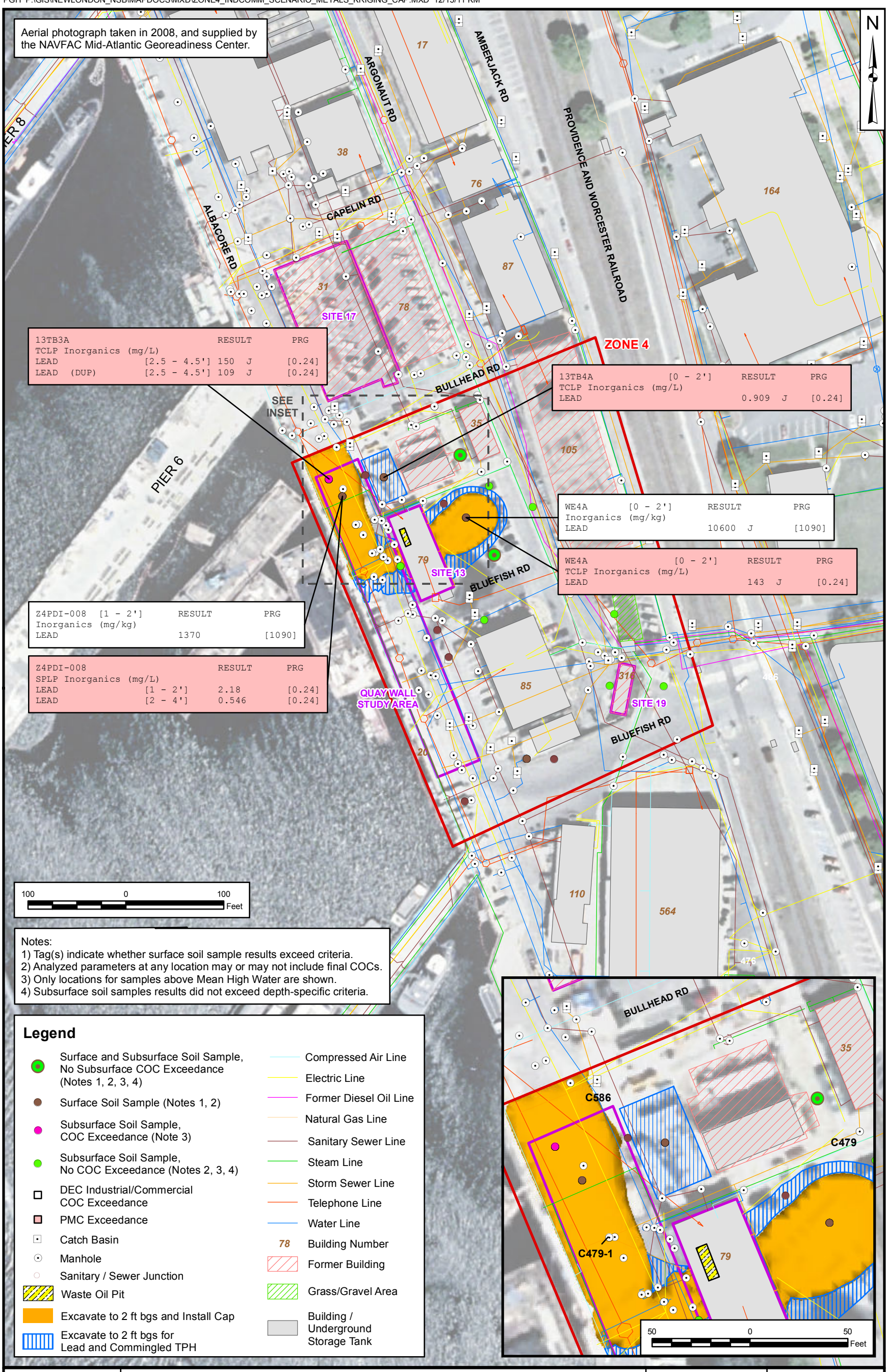

Notes:
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3) Only locations for samples above Mean High Water are shown.
4) Subsurface soil samples results did not exceed depth-specific criteria.

Legend

- Surface and Subsurface Soil Sample, No Subsurface COC Exceedance (Notes 1, 2, 3, 4)
- Surface Soil Sample (Notes 1, 2)
- Subsurface Soil Sample, COC Exceedance (Note 3)
- Subsurface Soil Sample, No COC Exceedance (Notes 2, 3, 4)
- DEC Industrial/Commercial COC Exceedance
- PMC Exceedance
- Catch Basin
- Manhole
- Sanitary / Sewer Junction
- Waste Oil Pit
- Excavate to 2 ft bgs and Install Cap
- Excavate to 2 ft bgs for Lead and Commingled TPH
- Compressed Air Line
- Electric Line
- Former Diesel Oil Line
- Natural Gas Line
- Sanitary Sewer Line
- Steam Line
- Storm Sewer Line
- Telephone Line
- Water Line
- 78 Building Number
- Former Building
- Grass/Gravel Area
- Building / Underground Storage Tank

DRAWN BY J. ENGLISH	DATE 02/02/11	TETRA TECH	CONTRACT NUMBER 2630 / OWNER NUMBER WE57
CHECKED BY N. BALSAMO	DATE 12/15/11	ZONE 4 AREAS OF SOIL TO BE CAPPED UNDER ALTERNATIVE S-4.3 LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR / DATE 02/04/11
COST/SCHEDULE-AREA			APPROVED BY — / DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 6-9 / REV 0

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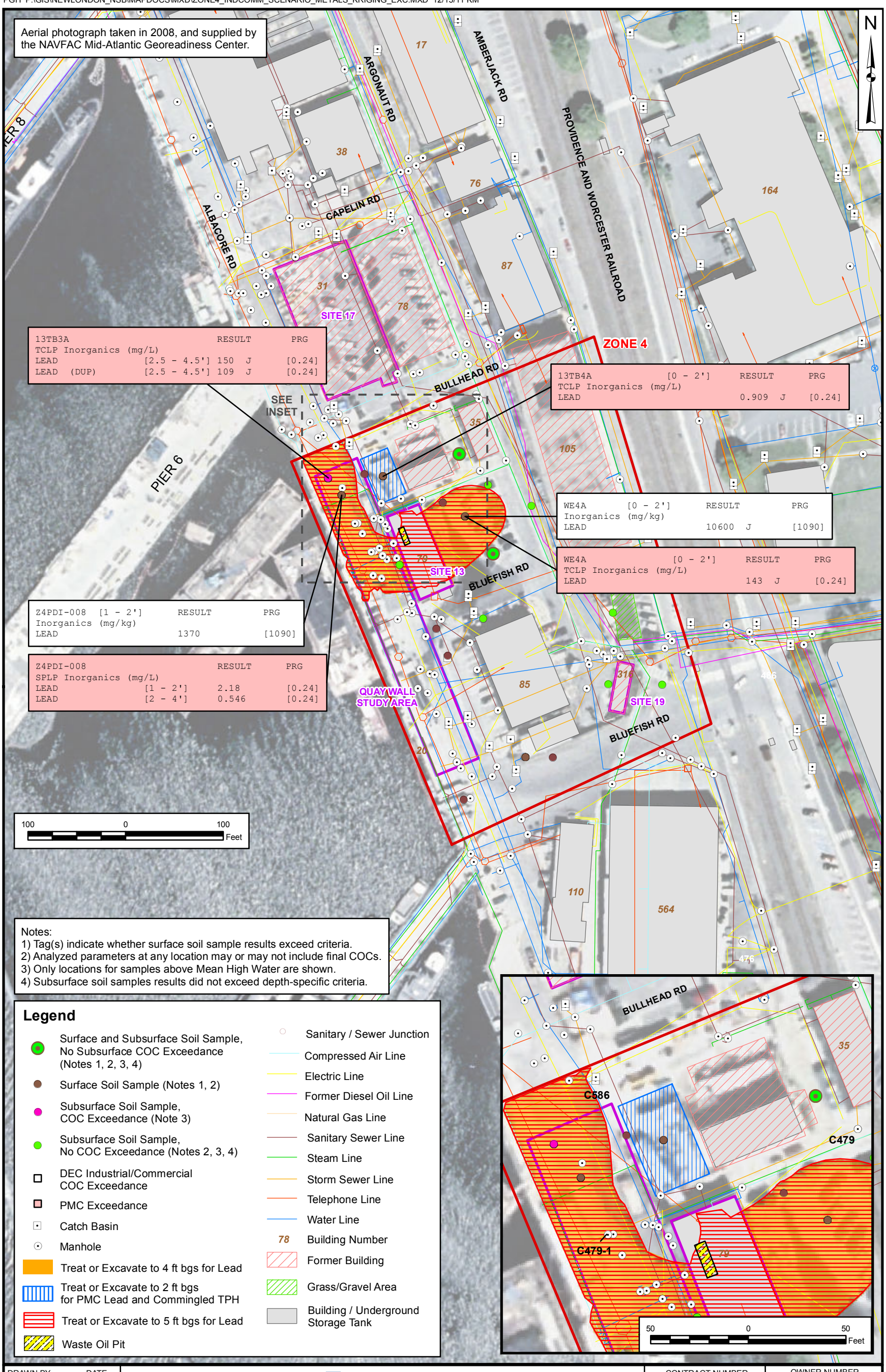

DRAWN BY J. ENGLISH DATE 02/02/11	TETRA TECH	CONTRACT NUMBER 2630	OWNER NUMBER WE57
CHECKED BY N. BALSAMO 12/15/11 08/12/11	ZONE 4 AREAS OF SOIL TO BE IN-SITU TREATED OR EXCAVATED UNDER ALTERNATIVES S-4.4 AND S-4.5B LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR	DATE 02/04/11
COST/SCHEDULE-AREA		APPROVED BY —	DATE —
SCALE AS NOTED		DRAWING NO. FIGURE 6-10	REV 0

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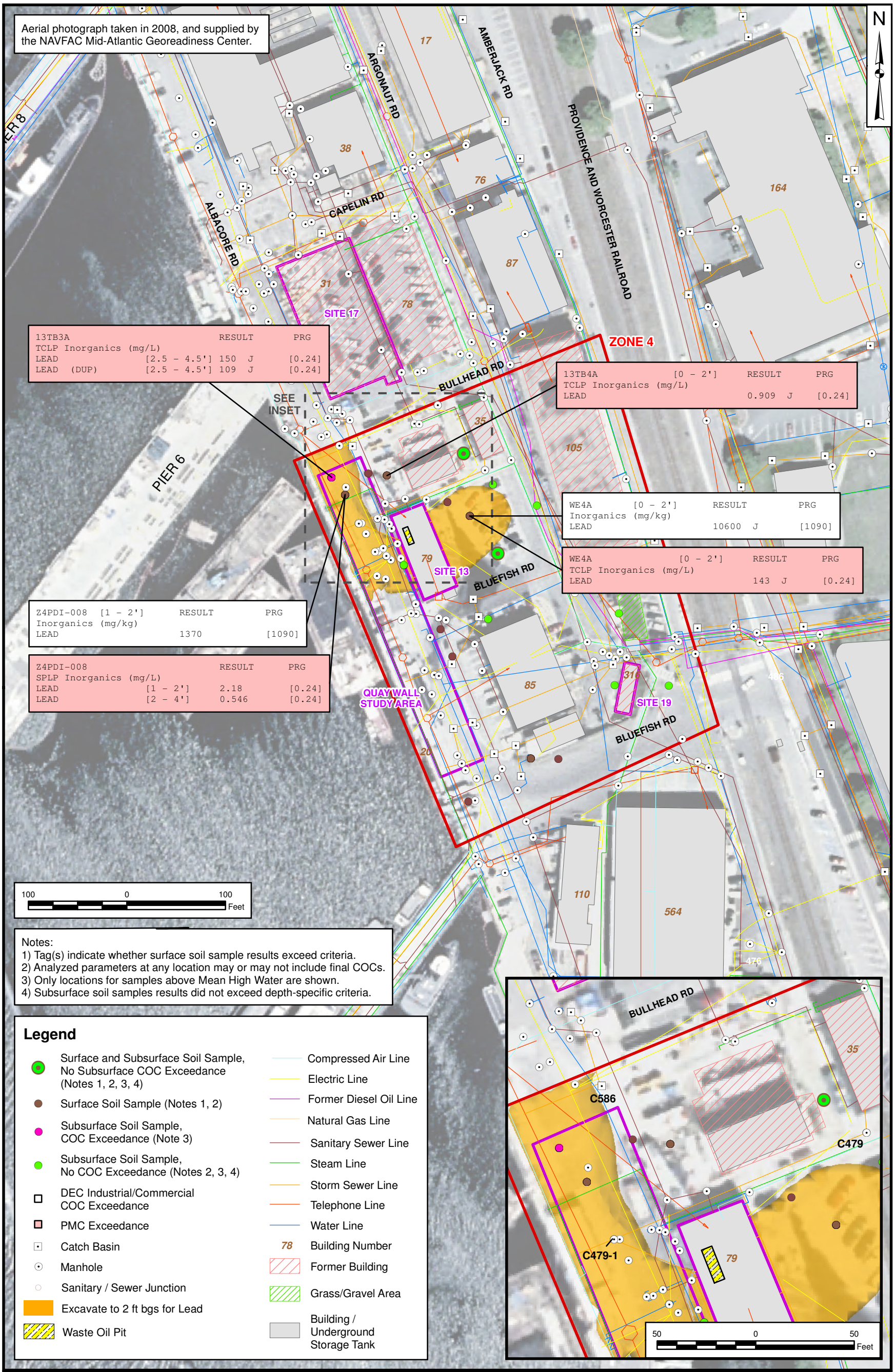

DRAWN BY J. ENGLISH	DATE 02/02/11	TETRA TECH	CONTRACT NUMBER 2630	OWNER NUMBER WE57
CHECKED BY N. BALSAMO	DATE 12/23/11	ZONE 4 AREAS OF SOIL TO BE EXCAVATED UNDER ALTERNATIVE S-4.5A LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR	DATE 02/04/11
COST/SCHEDULE-AREA			APPROVED BY —	DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 6-11	REV 0

PGH P:\GIS\NLON\MAPDOCS\MXD\ZONE7_LUC_2010.MXD 10/26/11 SP

DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
S. PAXTON	08/13/11		3271	WE67
CHECKED BY	DATE	LIMIT OF LAND USE CONTROLS FOR ZONE 7 UNDER ALTERNATIVE S-7.2	APPROVED BY	DATE
N. BALSAMO	10/26/11		—	—
REVISED BY	DATE	LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM	APPROVED BY	DATE
S. PAXTON	10/26/11	NSB-NLON, GROTON, CONNECTICUT	—	—
SCALE			FIGURE NO.	REV
AS NOTED			FIGURE 6-12	0

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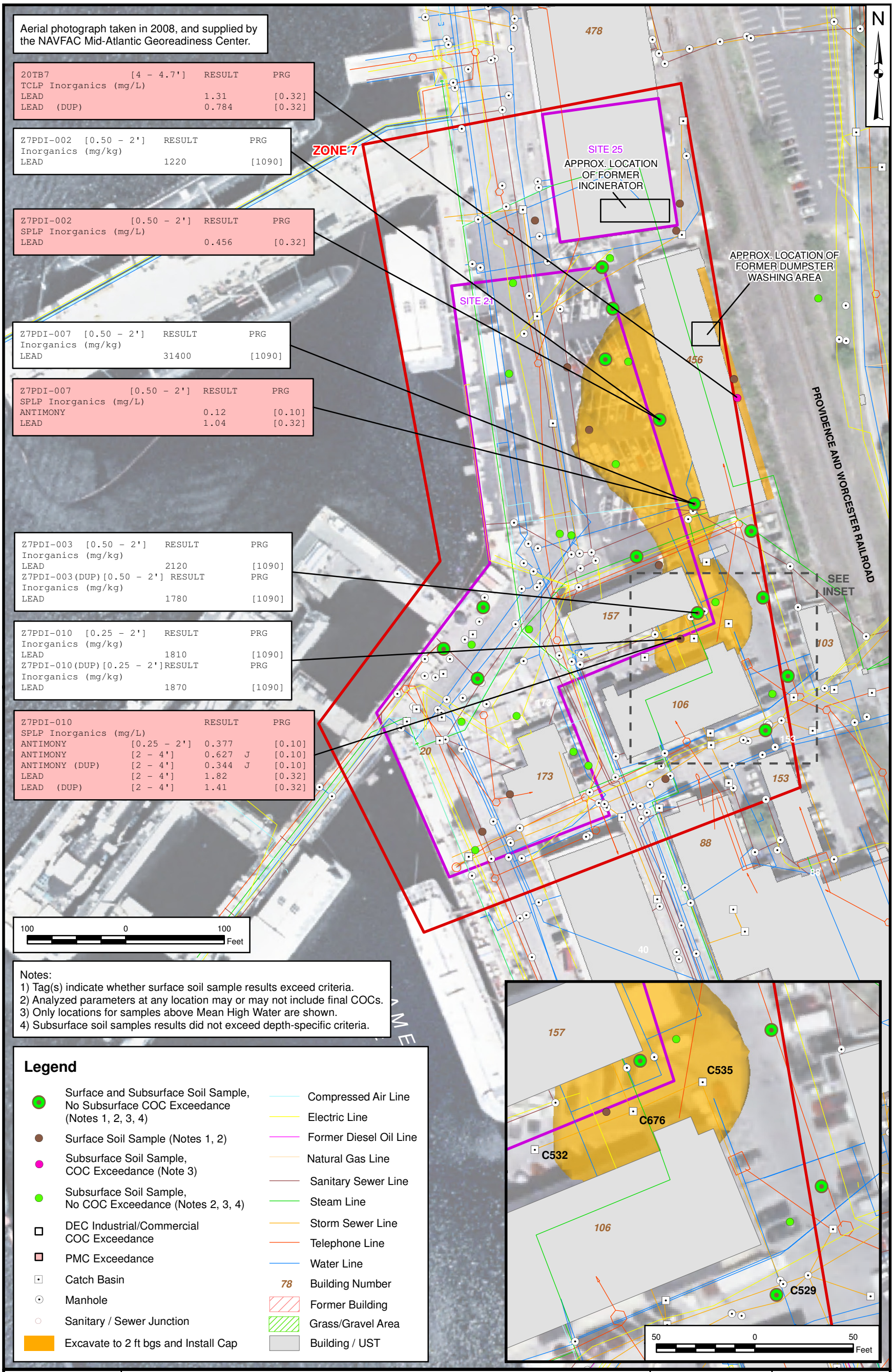

DRAWN BY J. ENGLISH	DATE 02/02/11	TETRA TECH	CONTRACT NUMBER 2630 / OWNER NUMBER WE57
CHECKED BY N. BALSAMO	DATE 12/9/11	ZONE 7 AREAS OF SOIL TO BE CAPPED UNDER ALTERNATIVE S-7.3 LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR / DATE 02/04/10
COST/SCHEDULE-AREA			APPROVED BY — / DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 6-13 / REV 0

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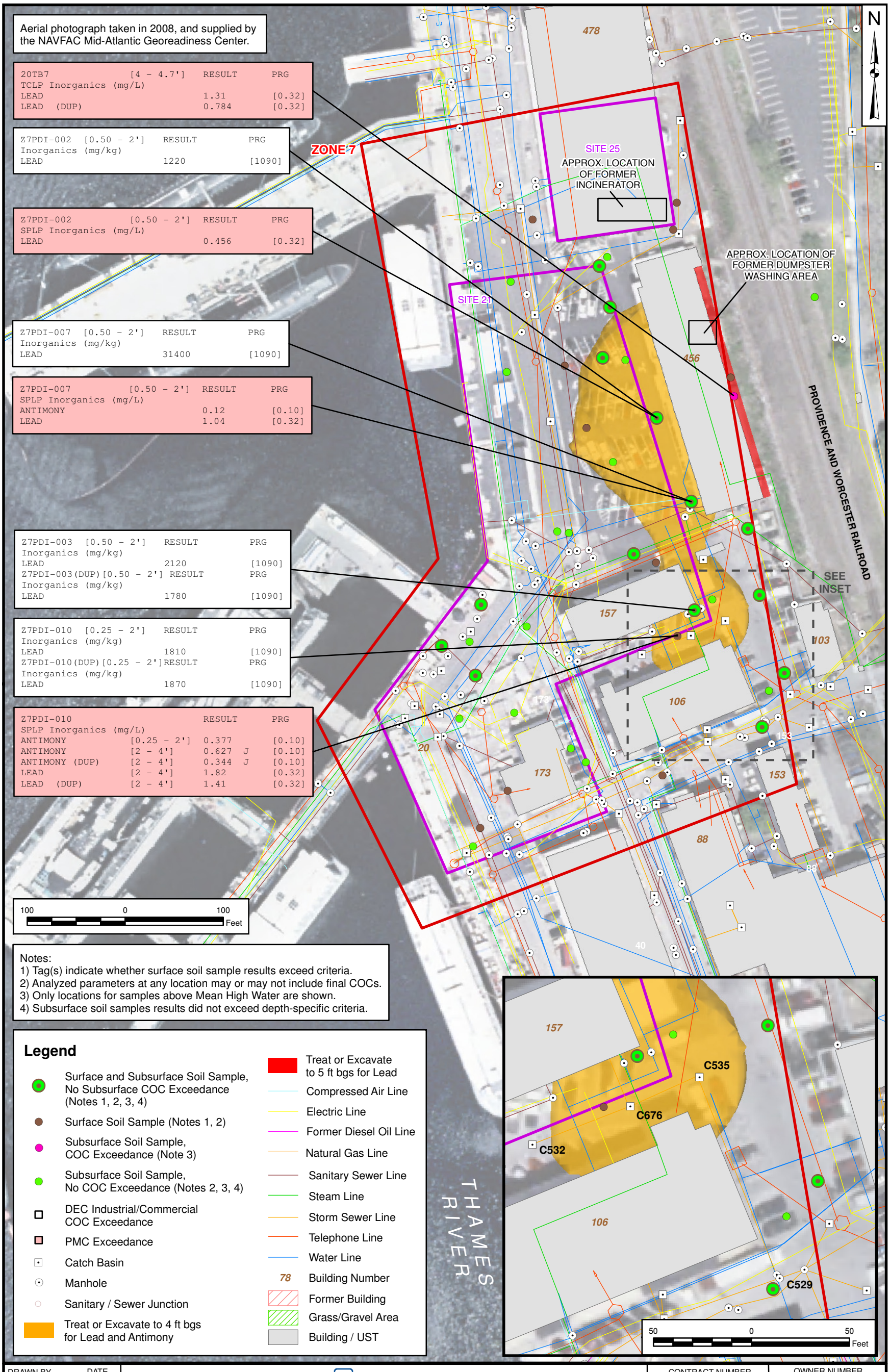
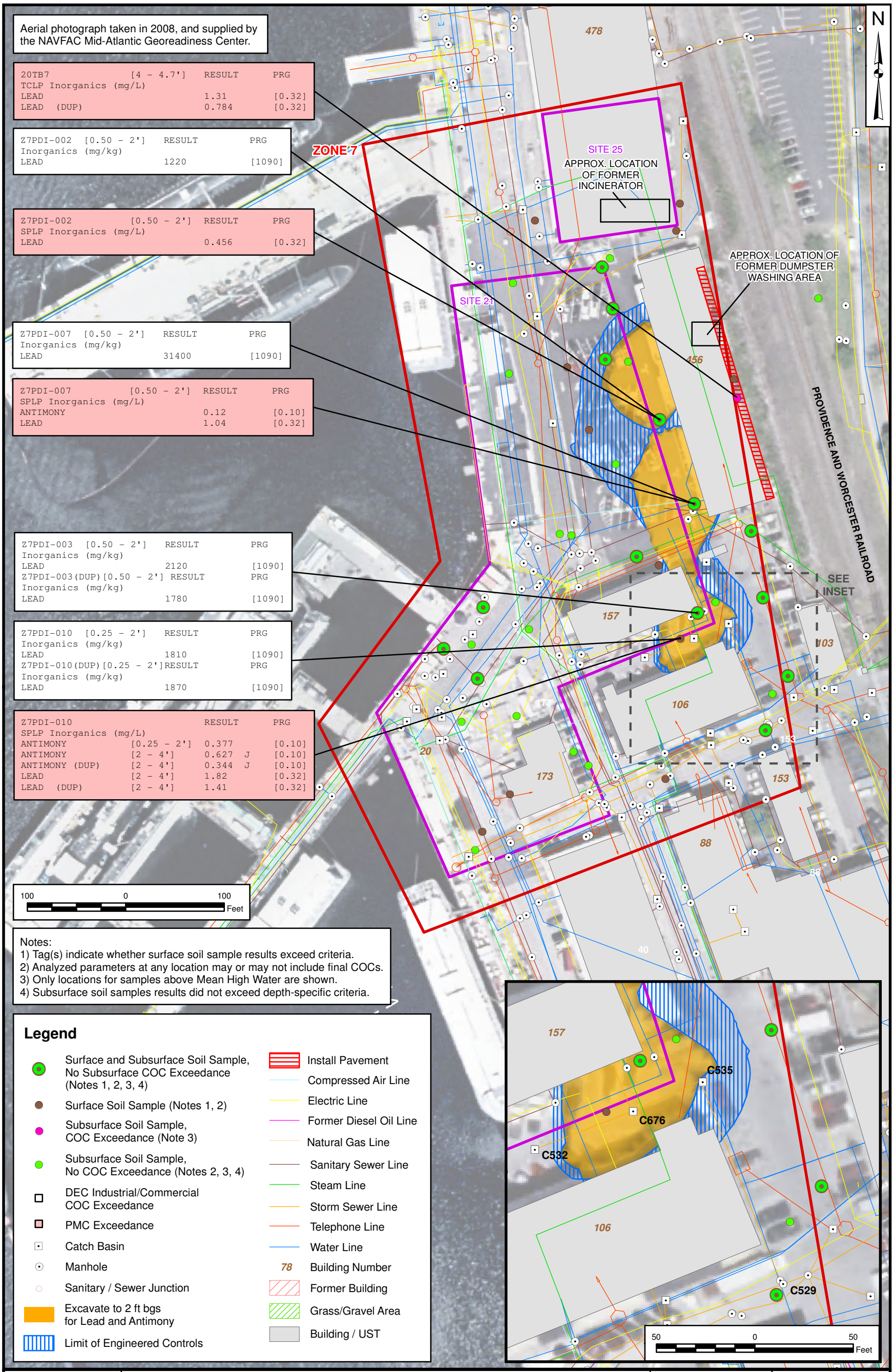


DRAWN BY J. ENGLISH	DATE 02/02/11	TETRA TECH	CONTRACT NUMBER 2630 / OWNER NUMBER WE57
CHECKED BY N. BALSAMO	DATE 12/9/11	ZONE 7 AREAS OF SOIL TO BE IN-SITU TREATED OR EXCAVATED UNDER ALTERNATIVES S-7.4 OR S-7.5B LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR / DATE 02/04/10
COST/SCHEDULE-AREA			APPROVED BY — / DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 6-14 / REV 0

PGH P:\GIS\NEWLONDON_NSB\MAPDOCS\MXD\ZONE7_INDCOMM_SCENARIO_METALS_KRIGING.MXD 12/9/11 KM



Notes:
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3) Only locations for samples above Mean High Water are shown.
4) Subsurface soil samples results did not exceed depth-specific criteria.

Legend

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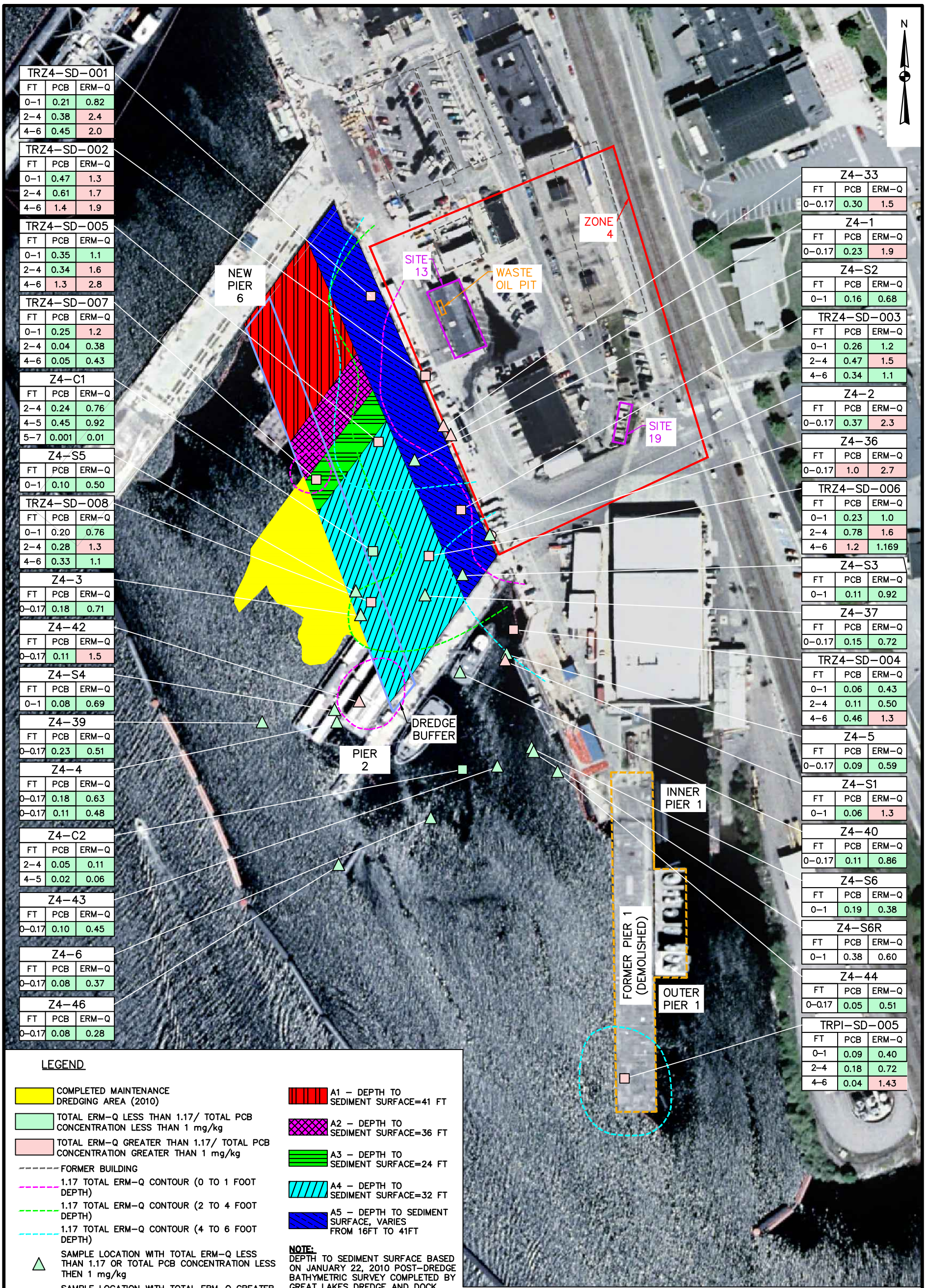
- Surface Soil Sample (Notes 1, 2)
- Subsurface Soil Sample, COC Exceedance (Note 3)
- Subsurface Soil Sample, No COC Exceedance (Notes 2, 3, 4)
- DEC Industrial/Commercial COC Exceedance
- PMC Exceedance
- Catch Basin
- Manhole
- Sanitary / Sewer Junction
- Excavate to 2 ft bgs for Lead and Antimony
- Limit of Engineered Controls
- Install Pavement
- Compressed Air Line
- Electric Line
- Former Diesel Oil Line
- Natural Gas Line
- Sanitary Sewer Line
- Steam Line
- Storm Sewer Line
- Telephone Line
- Water Line
- 78 Building Number
- Former Building
- Grass/Gravel Area
- Building / UST

DRAWN BY J. ENGLISH	DATE 02/02/11	TETRA TECH	CONTRACT NUMBER 2630 / OWNER NUMBER WE57
CHECKED BY N. BALSAMO	DATE 12/9/11	ZONE 7 AREAS OF SOIL TO BE EXCAVATED UNDER ALTERNATIVE S-7.5A LOWER SUBASE SOIL AND GROUNDWATER PDI COMPLETION REPORT AND FS ADDENDUM NSB-NLON, GROTON, CONNECTICUT	APPROVED BY CAR / DATE 02/04/10
COST/SCHEDULE-AREA			APPROVED BY — / DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 6-15 / REV 0



TRZ4-SD-001		
FT	PCB	ERM-Q
0-1	0.21	0.82
2-4	0.38	2.4
4-6	0.45	2.0

TRZ4-SD-002		
FT	PCB	ERM-Q
0-1	0.47	1.3
2-4	0.61	1.7
4-6	1.4	1.9

TRZ4-SD-005		
FT	PCB	ERM-Q
0-1	0.35	1.1
2-4	0.34	1.6
4-6	1.3	2.8

TRZ4-SD-007		
FT	PCB	ERM-Q
0-1	0.25	1.2
2-4	0.04	0.38
4-6	0.05	0.43

Z4-C1		
FT	PCB	ERM-Q
2-4	0.24	0.76
4-5	0.45	0.92
5-7	0.001	0.01

Z4-S5		
FT	PCB	ERM-Q
0-1	0.10	0.50

TRZ4-SD-008		
FT	PCB	ERM-Q
0-1	0.20	0.76
2-4	0.28	1.3
4-6	0.33	1.1

Z4-3		
FT	PCB	ERM-Q
0-0.17	0.18	0.71

Z4-42		
FT	PCB	ERM-Q
0-0.17	0.11	1.5

Z4-S4		
FT	PCB	ERM-Q
0-1	0.08	0.69

Z4-39		
FT	PCB	ERM-Q
0-0.17	0.23	0.51

Z4-4		
FT	PCB	ERM-Q
0-0.17	0.18	0.63
0-0.17	0.11	0.48

Z4-C2		
FT	PCB	ERM-Q
2-4	0.05	0.11
4-5	0.02	0.06

Z4-43		
FT	PCB	ERM-Q
0-0.17	0.10	0.45

Z4-6		
FT	PCB	ERM-Q
0-0.17	0.08	0.37

Z4-46		
FT	PCB	ERM-Q
0-0.17	0.08	0.28

Z4-33		
FT	PCB	ERM-Q
0-0.17	0.30	1.5

Z4-1		
FT	PCB	ERM-Q
0-0.17	0.23	1.9

Z4-S2		
FT	PCB	ERM-Q
0-1	0.16	0.68

TRZ4-SD-003		
FT	PCB	ERM-Q
0-1	0.26	1.2
2-4	0.47	1.5
4-6	0.34	1.1

Z4-2		
FT	PCB	ERM-Q
0-0.17	0.37	2.3

Z4-36		
FT	PCB	ERM-Q
0-0.17	1.0	2.7

TRZ4-SD-006		
FT	PCB	ERM-Q
0-1	0.23	1.0
2-4	0.78	1.6
4-6	1.2	1.169

Z4-S3		
FT	PCB	ERM-Q
0-1	0.11	0.92

Z4-37		
FT	PCB	ERM-Q
0-0.17	0.15	0.72

TRZ4-SD-004		
FT	PCB	ERM-Q
0-1	0.06	0.43
2-4	0.11	0.50
4-6	0.46	1.3

Z4-5		
FT	PCB	ERM-Q
0-0.17	0.09	0.59

Z4-S1		
FT	PCB	ERM-Q
0-1	0.06	1.3

Z4-40		
FT	PCB	ERM-Q
0-0.17	0.11	0.86

Z4-S6		
FT	PCB	ERM-Q
0-1	0.19	0.38

Z4-S6R		
FT	PCB	ERM-Q
0-1	0.38	0.60

Z4-44		
FT	PCB	ERM-Q
0-0.17	0.05	0.51

TRPI-SD-005		
FT	PCB	ERM-Q
0-1	0.09	0.40
2-4	0.18	0.72
4-6	0.04	1.43

LEGEND

- COMPLETED MAINTENANCE DREDGING AREA (2010)
- TOTAL ERM-Q LESS THAN 1.17/ TOTAL PCB CONCENTRATION LESS THAN 1 mg/kg
- TOTAL ERM-Q GREATER THAN 1.17/ TOTAL PCB CONCENTRATION GREATER THAN 1 mg/kg
- FORMER BUILDING
- 1.17 TOTAL ERM-Q CONTOUR (0 TO 1 FOOT DEPTH)
- 1.17 TOTAL ERM-Q CONTOUR (2 TO 4 FOOT DEPTH)
- 1.17 TOTAL ERM-Q CONTOUR (4 TO 6 FOOT DEPTH)
- SAMPLE LOCATION WITH TOTAL ERM-Q LESS THAN 1.17 OR TOTAL PCB CONCENTRATION LESS THEN 1 mg/kg
- SAMPLE LOCATION WITH TOTAL ERM-Q GREATER THAN 1.17 OR TOTAL PCB CONCENTRATION GREATER THEN 1 mg/kg
- ONLY SURFACE SAMPLE COLLECTED
- MULTIPLE DEPTHS COLLECTED

- A1 – DEPTH TO SEDIMENT SURFACE=41 FT
- A2 – DEPTH TO SEDIMENT SURFACE=36 FT
- A3 – DEPTH TO SEDIMENT SURFACE=24 FT
- A4 – DEPTH TO SEDIMENT SURFACE=32 FT
- A5 – DEPTH TO SEDIMENT SURFACE, VARIES FROM 16FT TO 41FT

NOTE:
DEPTH TO SEDIMENT SURFACE BASED ON JANUARY 22, 2010 POST-DREDGE BATHYMETRIC SURVEY COMPLETED BY GREAT LAKES DREDGE AND DOCK COMPANY (DEPTHS BASED ON MLLW)

0 120 240
SCALE: 1" = 120'

UNITS:

-DEPTH PRESENTED IN FEET
-ERM-Q VALUE IS UNITLESS
-PCB CONCENTRATION PRESENTED IN MG/KG

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GROTON, CONNECTICUT

DEPTH TO SEDIMENT SURFACE IN ZONE 4 AND DISTRIBUTION OF CONTAMINATED SEDIMENT IN ZONE 4 AND OUTER PIER 1

SCALE: 1"=120'

DATE:	8/29/11
PROJECT NO.:	112G03271
DESIGNED BY:	
DRAWN BY:	ND
CHECKED BY:	CAR
SHEET: 1 OF 1	

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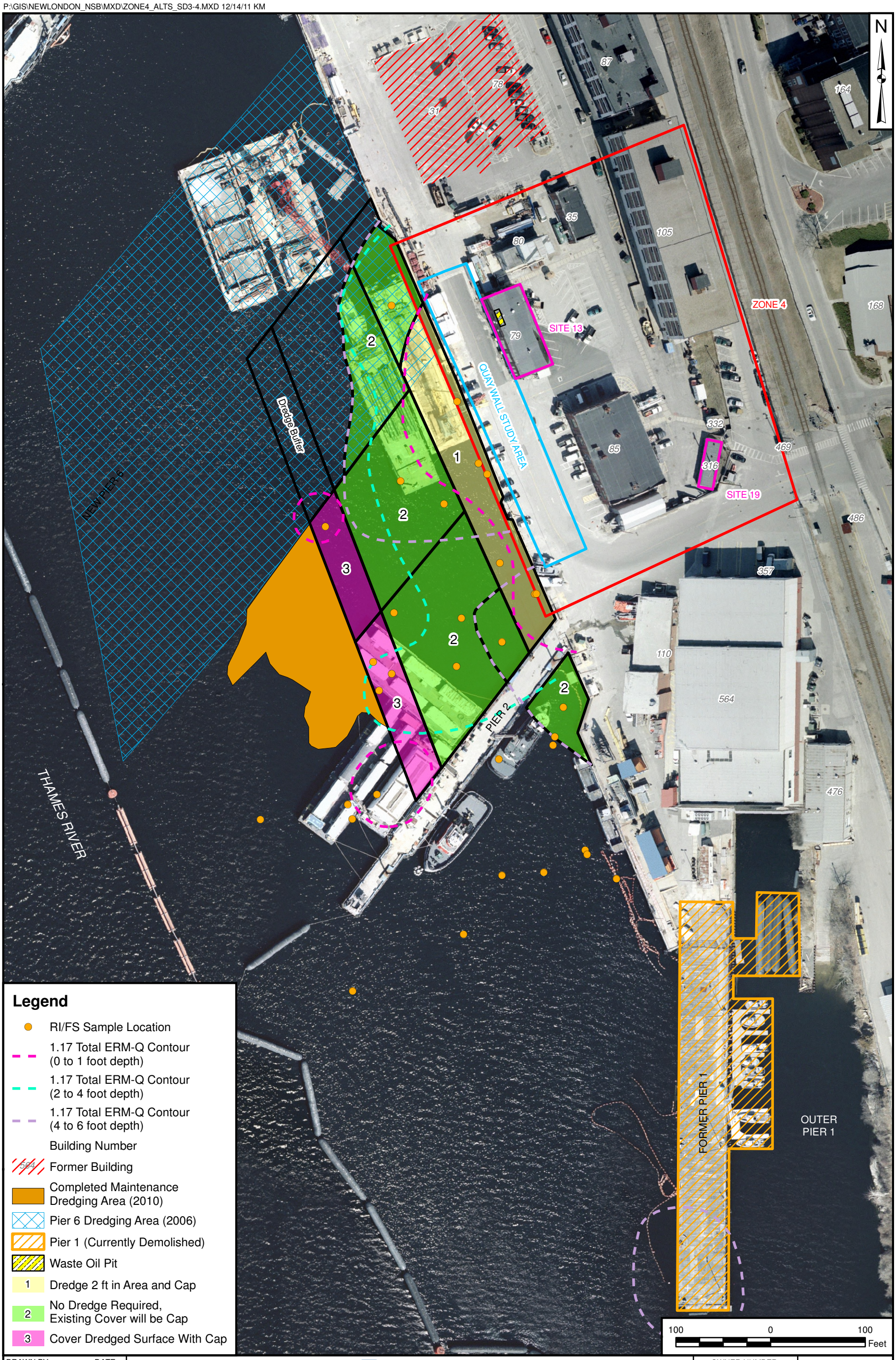
FIGURE 6-16

R:\3512\Figures\3512FG003.dwg PIT CARLY.KRAMER 12/14/2011 12:26:40 PM

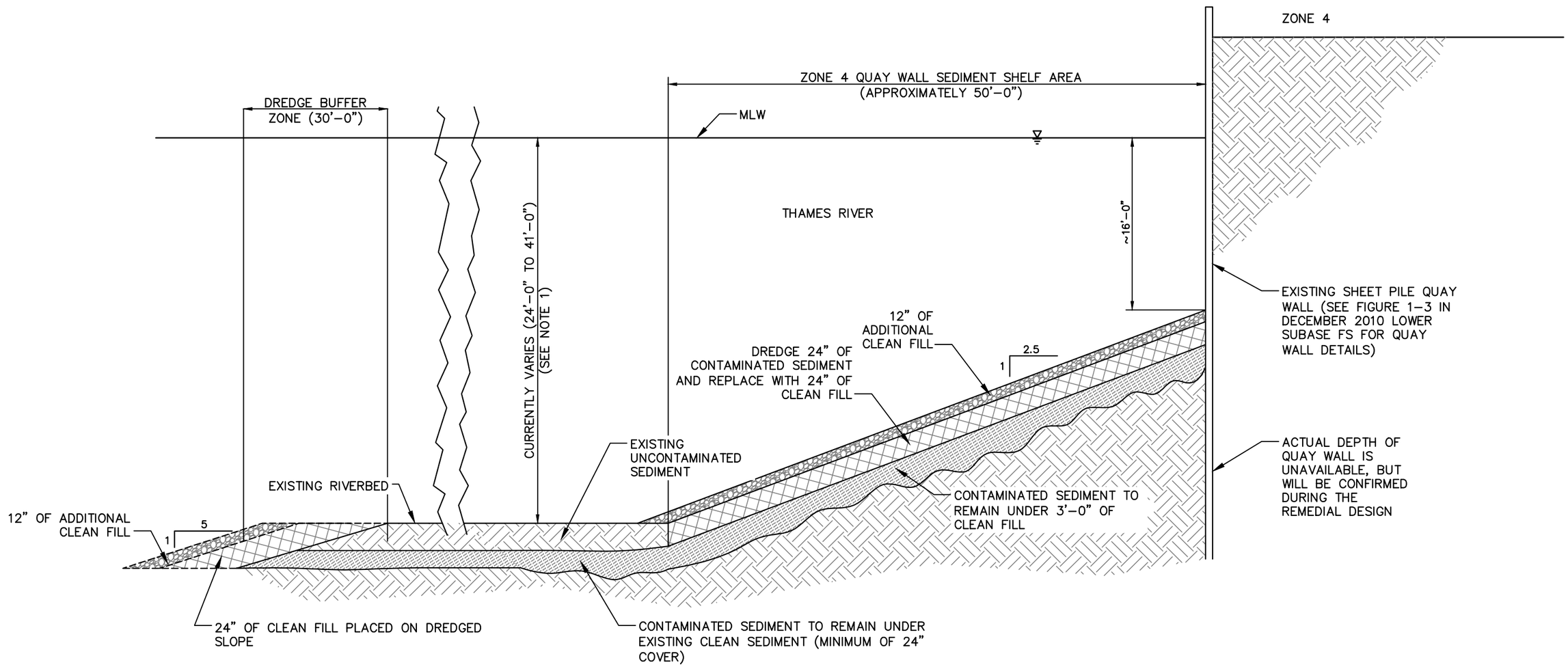
P:\GIS\NEWLONDON_NSB\MXD\ZONE4_ALTS_SD3-4.MXD 12/14/11 KM



Legend

- RI/FS Sample Location
- 1.17 Total ERM-Q Contour (0 to 1 foot depth)
- 1.17 Total ERM-Q Contour (2 to 4 foot depth)
- 1.17 Total ERM-Q Contour (4 to 6 foot depth)
- Building Number
- 564 Former Building
- Completed Maintenance Dredging Area (2010)
- Pier 6 Dredging Area (2006)
- Pier 1 (Currently Demolished)
- Waste Oil Pit
- 1 Dredge 2 ft in Area and Cap
- 2 No Dredge Required, Existing Cover will be Cap
- 3 Cover Dredged Surface With Cap

DRAWN BY K. MOORE	DATE 8/26/11	TETRA TECH	OWNER NUMBER 3271 / CTO NUMBER WE67
CHECKED BY N. BALSAMO	DATE 12/14/11	ZONE 4 AREAS OF SEDIMENT TO BE DREDGED AND CAPPED ALTERNATIVES SD-3 AND SD-4 LOWER SUBASE NSB - NLON, GROTON, CONNECTICUT	APPROVED BY CAR / DATE 8/26/11
REVISED BY K. MOORE	DATE 12/14/11		APPROVED BY — / DATE —
SCALE AS NOTED			FIGURE NO. FIGURE 6-17 / REV 0



NOTE:

1. DEPTH OF WATER AT THE END OF THE QUAY WALL SEDIMENT SHELF IS IDEALLY 36'–0" TO ALLOW FOR OPERATIONS; HOWEVER, THE CURRENT DEPTH WITHIN ZONE 4 VARIES FROM 24'–0" TO 41'–0". DREDGING WILL ONLY BE REQUIRED TO REMOVE CONTAMINATED SEDIMENT IN THOSE AREAS REQUIRING CAPPING. THEREFORE, THE RESULTING DEPTH OF WATER IN SOME AREAS OF ZONE 4 WILL BE LESS THAN 36'–0".

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NSB–NLON
GROTON, CONNECTICUT

TYPICAL CROSS–SECTION OF ZONE 4 ALTERNATIVES SD–3 AND SD–4 LOWER SUBASE FEASIBILITY STUDY

SCALE: NOT TO SCALE

DATE:	8/29/11
PROJECT NO.:	112G03271
DESIGNED BY:	
DRAWN BY:	ND
CHECKED BY:	CAR
SHEET: -- OF	1

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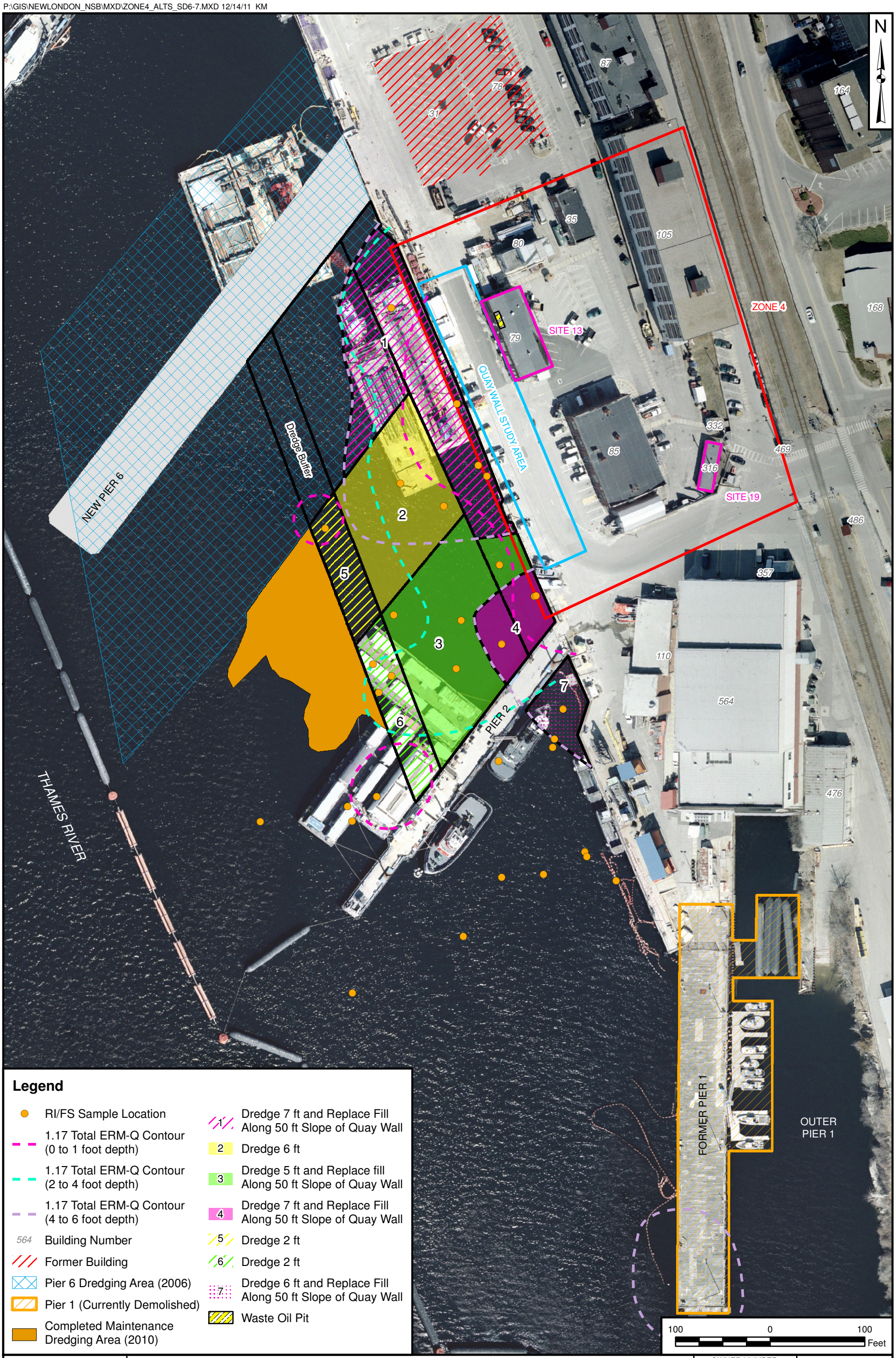
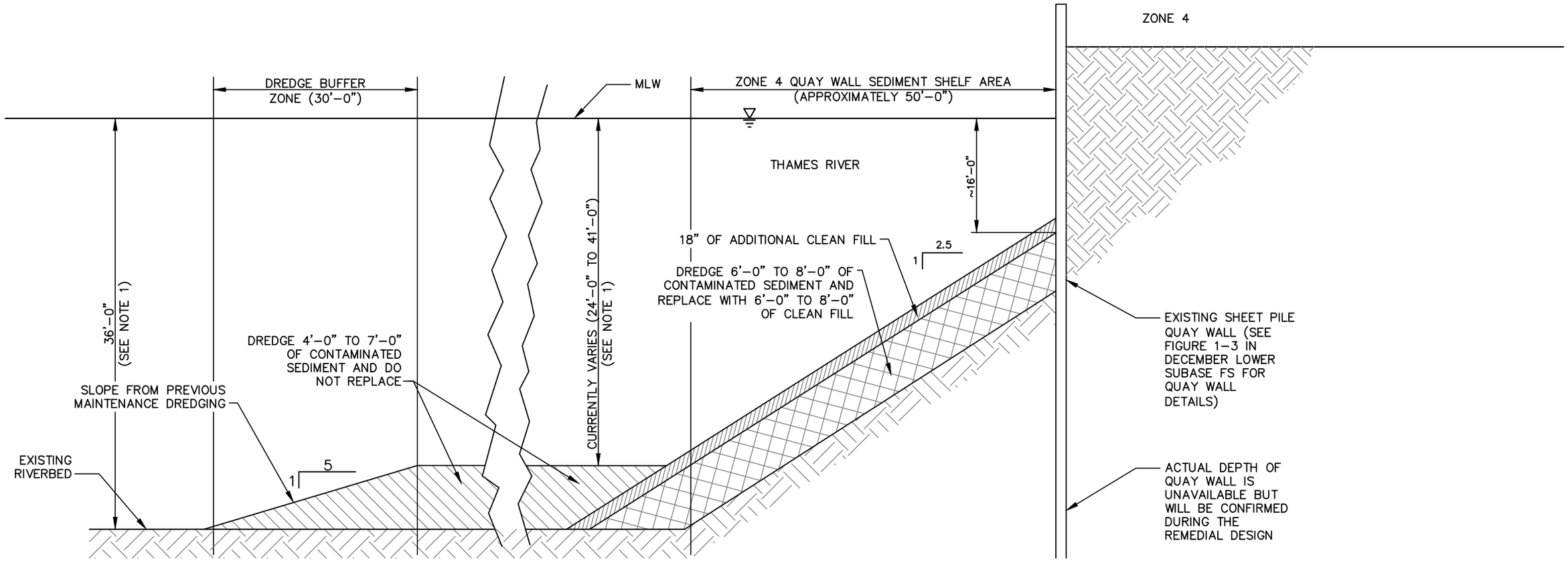
FIGURE 6–18

P:\GIS\NEWLONDON_NSB\MXD\ZONE4_ALTS_SD6-7.MXD 12/14/11 KM



DRAWN BY K. MOORE — DATE 8/26/11	TETRA TECH	OWNER NUMBER 3271	CTO NUMBER WE67
CHECKED BY N. BALSAMO — DATE 12/14/11	ZONE 4 AREAS OF SEDIMENT TO BE DREDGED ALTERNATIVES SD-6, SD-7, AND SD-8 LOWER SUBASE NSB - NLON, GROTON, CONNECTICUT	APPROVED BY CAR — DATE 8/26/11	
REVISED BY K. MOORE — DATE 12/14/11		APPROVED BY — — DATE —	
SCALE AS NOTED		FIGURE NO. FIGURE 6-19	REV 0



NOTE:

1. DEPTH OF WATER AT THE END OF THE QUAY WALL SEDIMENT SHELF IS IDEALLY 36'–0" TO ALLOW FOR OPERATIONS; HOWEVER, THE CURRENT DEPTH WITHIN ZONE 4 VARIES FROM 24'–0" TO 41'–0" AND DREDGING WILL ONLY BE REQUIRED TO REMOVE CONTAMINATED SEDIMENT. THEREFORE, THE RESULTING DEPTH OF WATER IN SOME AREAS OF ZONE 4 WILL BE LESS THAN 36'–0".

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GROTON, CONNECTICUT

TYPICAL CROSS–SECTION OF ZONE 4 ALTERNATIVES SD–6, SD–7, AND SD–8 LOWER SUBASE FEASIBILITY STUDY

SCALE: NOT TO SCALE

DATE:	8/29/11
PROJECT NO.:	112G03271
DESIGNED BY:	
DRAWN BY:	ND
CHECKED BY:	CAR
SHEET: –– OF	1

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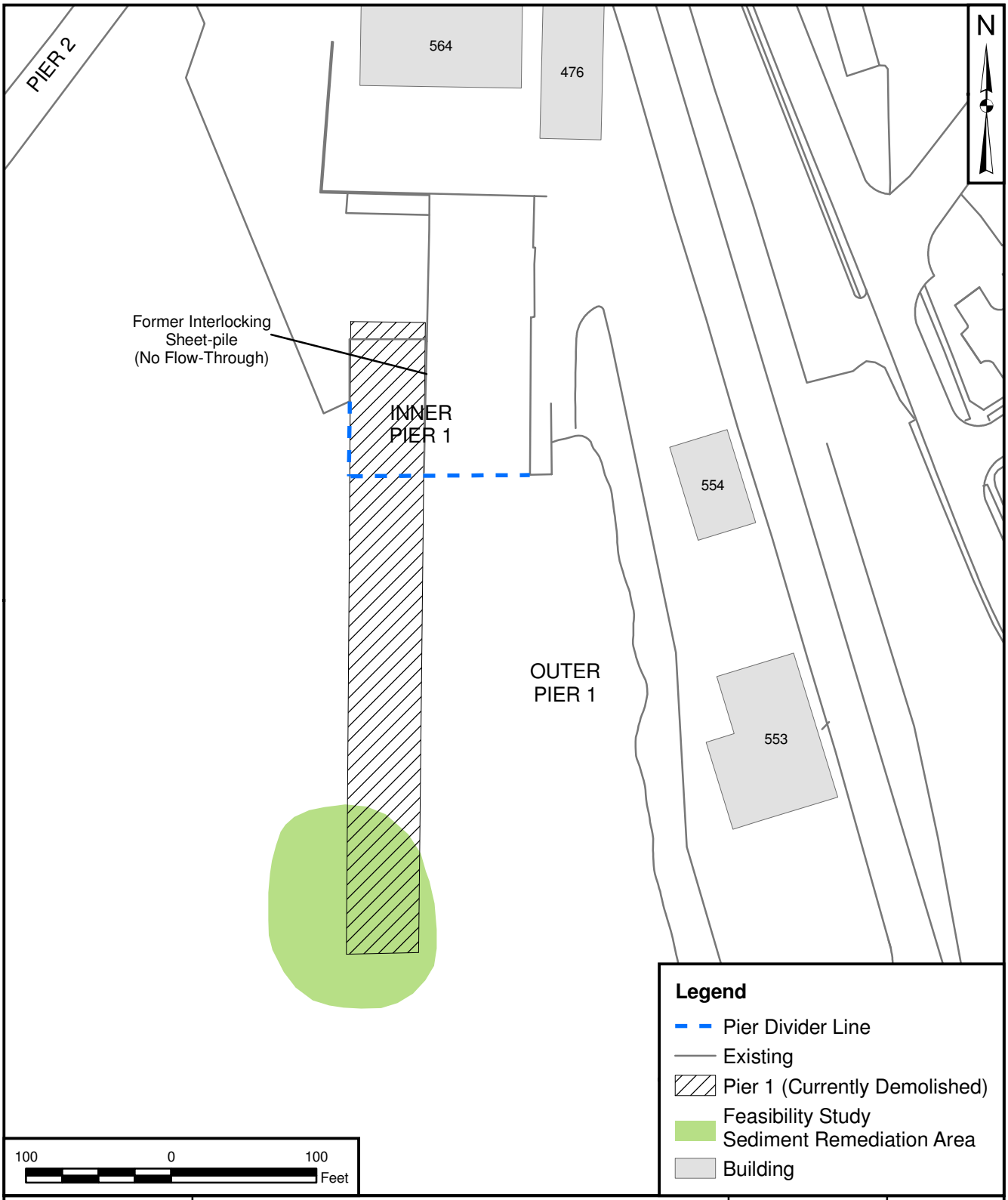
FIGURE 6–20

PGH P:\GIS\NEWLONDON_NSB\MXD\PIER1_DREDGED_SEDIMENT.MXD 8/29/11 KM



DRAWN BY K. MOORE	DATE 8/29/11	TETRA TECH	CONTRACT NUMBER WE67	OWNER NUMBER 3271
CHECKED BY C. RICH	DATE 8/29/11	OUTER PIER 1 AREA OF SEDIMENT TO BE MAINTAINED UNDER SEDIMENT COVER FOR ALTERNATIVES SD-3, SD-4, AND SD-8 AND TO BE DREDGED UNDER ALTERNATIVE SD-6 AND SD-7 LOWER SUBASE FEASIBILITY STUDY NSB - NLON, GROTON, CONNECTICUT	APPROVED BY CAR	DATE 8/29/11
REVISED BY ___	DATE ___		APPROVED BY ___	DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 6-21	REV 0

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