# Second Five - Year Review Report

For

# CERCLA Sites at Naval Submarine Base New London

Groton, Connecticut

## Naval Facilities Engineering Command Mid-Atlantic

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

**Contract Task Order 038**

December 2006

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REVISION 1
DECEMBER 2006

# SECOND FIVE-YEAR REVIEW REPORT
# FOR
# CERCLA SITES AT
# NAVAL SUBMARINE BASE - NEW LONDON
# GROTON, CONNECTICUT

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

**Submitted to:**
**Naval Facilities Engineering Command Mid-Atlantic**
**9742 Maryland Avenue**
**Norfolk, Virginia 23511-3095**

**Submitted by:**
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**CONTRACT NUMBER N62472-03-D-0057**
**CONTRACT TASK ORDER 038**

**DECEMBER 2006**


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## Navy Five-Year Review Signature Cover

### Key Review Information

| **Site Identification** | | | |
|---|---|---|---|
| Site Name: Naval Submarine Base New London | | | EPA ID: *CTD980906515* |
| Region: 1 | State: CT | City/County: Groton/New London | |
| **Site Status** | | | |
| NPL Status: Final | | | |
| Remediation Status (under construction, operating, complete): Under Construction and Operating | | | |
| Multiple OU's* (highlight): [redacted] N | | Number of Sites/OUs: 23/12 | |
| Construction Completion Date: To be determined | | | |
| Has site been put into reuse? (highlight): [redacted] N | | | |
| **Review Status** | | | |
| Lead Agency (EPA, State, Tribe, Other Federal Agency): Naval Facilities Engineering Command, Mid-Atlantic | | | |
| Author Name: Valdis Jurka | | Author Title: Remedial Project Manager | |
| Author Affiliation: Department of the Navy, Naval Facilities Engineering Command, Mid-Atlantic | | | |
| Review Period: December 2001 to December 2006 | | Date(s) of Site Inspection: April 4, 2006 | |
| Type of review:<br>[redacted] Pre-SARA<br>Non-NPL Remedial Action Site NPL - Removal Only<br>Regional Discretion NPL State/Tribe-Lead | | | Review Number (1, 2, etc)<br>2 |
| Triggering Action Event: Initiation of the remedial action for Site 2 - Area A Landfill (OU1) | | | |
| Trigger Action Date: *December, 1996* | | | |
| Due Date: *December, 2006* | | | |

* OU refers to Operable Unit

**Issues:**

Deficiencies were noted for Site 2 during the review process and they are as follows: (1) Vegetation continues to grow along the edge of the asphalt covering the plateau, in cracks in the asphalt, and in the riprap covering the sideslopes. The root systems of the vegetation could penetrate the cap system. (2) Sediment, debris, and vegetation clog portions of the drainage channels. If the material is not removed, it may result in surface water overtopping the channels and flowing across the cap system. (3) Two catch basins near the gate at Thresher Avenue are completely blocked with silt and debris. Surface water runoff typically collected by these catch basins is flowing across the landfill and discharging into Channel C. It appears that the offsite runoff is contributing to the debris buildup in Channel C. These catch basins should be cleaned out to minimize any further impacts to Channel C. (4) Heavy equipment continues to be improperly stored on the cap resulting in minor damage to the asphalt. The damage mainly consists of holes/penetrations in the asphalt which may allow surface water to enter the cap drainage layer. This could result in further deterioration of the asphalt during freeze-thaw cycles and underlying cap components. (5) Stored items (concrete barriers, treated timbers, etc.) are blocking access to the monitoring wells. The wells cannot be inspected, maintained, or used for the groundwater monitoring program. Barriers should be placed around the monitoring wells to maintain access to them and restrict storage of items on top of them. (6) Longitudinal cracks continue to form in the asphalt. Many of the cracks have been sealed, but if the new cracks are not sealed, surface water will penetrate the asphalt and further deteriorate the asphalt during freeze-thaw cycles. (7) Monitoring wells that are not part of the groundwater monitoring program have not been maintained or properly abandoned. Two monitoring wells were found to be unprotected (i.e., no protective cover or j-plug), providing a direct conduit to the groundwater aquifer beneath the site. (8) The small depression discovered in the riprap along the toe of the landfill at the northwestern corner during the first five-year review was still evident during the second five-year review. It appears that surface water runoff is channeled through this area which may be causing erosion of material underlying the riprap. If the situation is not addressed, the long-term impact could be that the cap system is impacted in this location. (9) Debris (concrete rubble and furniture) has been dumped on the site. The site was not intended to be used for waste disposal. It is unlikely that the debris will impact the functionality of the cap system, but it should be removed and disposed at an approved off-site disposal facility (i.e., municipal landfill). (10) The gas vents do not have screens on them. The screens will prevent habitation of animals in the vents and prevent unwanted material (e.g., trash) from being deposited in them.

Several deficiencies were noted for Sites 3 and 7 during the review process and they are as follows. (1) New London Instruction 5090.18B was last updated in 2003 and it does not include the latest information from the Land Use Control Remedial Design for Sites 3 and 7 groundwater. The Instruction should be updated to include all relevant information. (2) Maintenance of the existing monitoring wells was not completed and a monitoring well abandonment program was not prepared or implemented. (3) An ESD was not prepared for the contaminated soil encapsulated at Stream 4 in Site 3.

The following O&M deficiencies were noted for Site 6 during the review process: (1) Jersey barriers along the western portion of the site cause water to pond on the cap. (2) The asphalt has a small amount of cracks and depressions. Some depressions are being monitored to determine whether the problem is progressive or stable. (3) Monitoring wells and dedicated sampling equipment should be maintained. (4) Monitoring wells that are not part of the groundwater monitoring program have not been maintained or properly abandoned.

The following minor deficiencies were noted for Site 8 during the review process: (1) Gas vents did not have screens. (2) The sprinkler system was is need of repair. (3) Monitoring wells and dedicated sampling equipment should be maintained. (4) Monitoring wells that are not part of the groundwater monitoring program have not been maintained or properly abandoned. (5) Hazardous material was not properly stored in locked storage lockers.

For Sites 14, 15, and 20 it was identified during the review process that a well abandonment program should be developed and implemented for the monitoring wells at those sites.

**Recommendations and Follow-Up Actions:**

Sites 1 and 4 were not included in this review, as recommended in the First Five-Year Review Report.

Sites 14, 15, 16, 18, and 20 should not be included in future five-year reviews. NFA decision documents have been prepared for these sites and no additional actions under CERCLA are required. Monitoring wells at Sites 14, 15, and 20 should be properly abandoned.

The recommendations and actions required for Site 2 are as follows: (1) Continue O&M of the site and address the noted O&M deficiencies. (2) Install screens on all gas vents and add an additional jersey barrier for two of the gas vents. (3) Continue the monitoring program, but reduce sampling frequency to annually and further optimize the analytical parameter list, as appropriate. Develop and implement a well abandonment program to eliminate wells that are no longer required for the monitoring program. (4) Develop and implement an equipment storage plan that would organize storage, provide safe methods for storage of equipment on the cap, and eliminate storage of equipment on top of active monitoring wells. (5) Select an appropriate remedial action for the groundwater OU and document the remedy in a Proposed Plan and ROD. (6) Enforce the New London Instruction 5090.18C and at least yearly monitoring of Institutional Control compliance with the monitoring reports incorporated into future five-year reviews. Consider further restricting access to the site to eliminate dumping of waste on the site. (7) Complete RI/FS process for the Area A Wetland and determine the appropriate remedial action(s). (8) Amend O&M Manual to remove federal AWQC.

The recommendations and actions required for Site 3 are as follows: (1) Continue implementation of the Groundwater Monitoring Plan. (2) Conduct the removal action for Site 3 – NSA. (3) Continue to enforce New London Instruction 5090.18C and at least yearly monitoring of Institutional Control compliance with the monitoring reports incorporated into future five-year reviews. (4) Maintain the existing monitoring well network and/or properly abandon unnecessary monitoring wells. (5) Prepare an ESD for the contaminated soil encapsulated at Stream 4.

The recommendations and actions required for Site 6 are as follows: (1) Continue O&M of the site and address the noted O&M deficiencies. (2) Continue the monitoring program, but reduce sampling frequency to every two years and further optimize the analytical parameter list, as appropriate. Develop and implement a well abandonment program to eliminate wells that are no longer required for the monitoring program. (3) Develop and implement an equipment storage plan that would prevent storage of equipment on top of active monitoring well(s). (4) Address ponding and sediment buildup due to the jersey barriers. (5) Continue to enforce New London Instruction 5090.18C and at least yearly monitoring of Institutional Control compliance with the monitoring reports incorporated into future five-year reviews. If the site use changes to yacht club parking, enforcement of New London Instruction 5090.18C should be continued. (6) Amend O&M Manual to remove federal AWQC.

The recommendations and actions required for Site 7 are as follows: (1) Prepare and issue the completion report for the soil remedial action. (2) Continue implementation of the Groundwater Monitoring Plan. (3) Continue to enforce New London Instruction 5090.18C and at least yearly monitoring of Institutional Control compliance with the monitoring reports incorporated into future five-year reviews. (4) Maintain the existing monitoring well network and/or properly abandon unnecessary monitoring wells.

The recommendations and actions required for Site 8 are as follows: (1) Continue O&M of the site and address the noted O&M deficiencies. (2) Install screens on every gas vent and add locks on the gates of the fencing around two of the gas vents. (3) Continue the Monitoring Program, but reduce sampling frequency to annually and optimize the analytical parameter list, as appropriate. (4) Develop and implement a well abandonment program to eliminate wells that are no longer required for the Monitoring Program. (5) Conduct an inspection of the drains leading into the box culvert (video or by other means).

(6) Select an appropriate remedial action for the groundwater OU and document the remedy in a Proposed Plan and ROD. (7) Continue to enforce New London Instruction 5090.18C and at least yearly monitoring of Institutional Control compliance with the monitoring reports incorporated into future five-year reviews. (8) Amend O&M Manual to remove federal AWQC.

It is recommended that an NFA PRAP and ROD be completed for Site 9 soil. It is recommended that the decision for the groundwater OU be addressed under Site 23 (Tank Farm).

It is recommended that the FS for the Lower Subase [i.e., Zone 1 (Sites 10 and 11), Zone 2, 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)] be completed to determine the appropriate remedial actions for the zones that are protective of human health and the environment. Appropriate decision documents should be prepared after the FS is completed to document the selected remedial alternatives.

It is recommended that the results of the sampling and analysis program of the groundwater collection system be reviewed and evaluated in an RI Update to determine if preparation of an FS for the groundwater OU at Site 23 - Tank Farm is required. Either an FS or an NFA Proposed Plan and ROD should be prepared depending on the results of the evaluation.

It is recommended that New London Instruction 5090.18C be enforced across NSB-NLON.

**Protectiveness Statement(s):**

Remedial actions to address immediate or potential future threats from exposure to soil and sediment have been implemented at Sites 1, 2 (Area A Landfill), 3, 4, 6, 7, 8, 9, 14, 15, and 20 at NSB-NLON. The remedial actions that were completed at Sites 1 (OU1), 4 (OU10), 7 (OU8), 9, 14 (OU8), 15 (OU6), and 20 (OU7) are protective of human health and the environment. The remedial actions taken at Sites 2 (OU1), 3 (OU3), 6 (OU2), and 8 (OU5) are currently protective of human health and the environment because the cap systems that were installed provide barriers to the waste stored in the landfills or remaining contaminated soil which eliminate direct contact and minimize infiltration of precipitation through the waste and contaminant migration to the underlying groundwater. In order for these remedies to be protective in the long-term, groundwater monitoring, operation and maintenance, and/or land use controls must be maintained at the sites. Groundwater monitoring programs are ongoing at the Sites 2, 6, and 8 to monitor contaminant trends and confirm the protectiveness of the soil remedial actions completed at the sites. An operations and maintenance program has been implemented by the Navy at these sites. The Navy has also instituted an IR Site Use Restriction Instruction that restricts ground surface disturbance of soils and any subsurface disturbance of soils and/or groundwater at IR sites.

Final remedies have not been selected for the groundwater at Sites 2 (Area A Landfill) (Part of OU9) and 8 (OU5); therefore, a protectiveness determination cannot be made at this time. Groundwater monitoring is currently being conducted to monitor contaminant trends and confirm the protectiveness of the soil remedial actions completed at the sites. Final remedies will be selected for the groundwater when sufficient data has been collected under the monitoring programs.

The selected remedy of groundwater monitoring and land use controls is currently being implemented for the groundwater at Sites 3 and 7 (Part of OU9). The remedy is expected to be protective of human health and the environment when concentrations decrease to below the remedial goals by natural processes, and in the interim, exposure to the contaminated groundwater is being restricted with land use controls to minimize unacceptable risks.

The Navy is continuing CERCLA investigations at Sites 10, 11, 13, 17, 19, 21, 24, and 25. All of the media at these sites are included in OU4. A time-critical removal action was completed at Site 17 to address lead-contaminated soil underneath and adjacent to the building. The action involved excavation and on-site solidification of most of the contaminated soil; however, some contaminated soil was left untreated because of access issues. A protectiveness determination for these sites cannot be made until

final remedies are selected and implemented. It is expected that remedies for these sites will be selected and construction begun prior to the completion of the Third Five-Year Review.

The Navy is also continuing CERCLA investigations at Sites 2 (Area A Wetland) (OU12) and Site 23 (Part of OU9). A protectiveness determination for these sites cannot be made until final remedies are selected and implemented. It is expected that remedies for these sites will be selected and construction begun prior to the completion of the Third Five-Year Review.

Investigations found that no contamination was present in the soil at Sites 16 and 18 (OU11) or the groundwater at Sites 14, 15, 18, and 20 (Part of OU9) that would result in immediate or potential future threats and NFA RODs were subsequently prepared for these sites. The selected remedies are protective of human health and the environment.

**Other Comments:**

In accordance with Navy guidance, the five-year review completed for NSB-NLON included all relevant CERCLA/IRP sites, regardless of whether decision documents have been prepared for the sites. It is believed that inclusion of all of the sites in this Second Five-Year Review Report will simplify preparation of future five-year review reports.

**Next Review:**

The next five-year review of NSB-NLON sites will be completed by December 2011.

Signature of U.S. Department of the Navy and Date

Mark S. Ginda, CAPT, USN
Commanding Officer
Naval Submarine Base – New London

12/20/06
Date

# TABLE OF CONTENTS

**SECTION** **PAGE NO.**

**NAVY FIVE-YEAR REVIEW SIGNATURE COVER ..... iii**

**ACRONYMS ..... xxi**

**1.0 INTRODUCTION ..... 1-1**
1.1 PURPOSE ..... 1-1
1.2 OVERVIEW OF NSB-NLON ..... 1-3
1.2.1 Land Use ..... 1-3
1.2.2 History and Site Chronology ..... 1-3
1.2.3 Site Information ..... 1-5
1.3 FIVE-YEAR REVIEW PROCESS ..... 1-6
1.4 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND SITE-SPECIFIC ACTION LEVEL CHANGES ..... 1-7
1.5 REPORT ORGANIZATION ..... 1-11

**2.0 SITE 2 – AREA A LANDFILL (OU1 AND OU9) AND AREA A WETLAND (OU12) ..... 2-1**
2.1 HISTORY AND SITE CHRONOLOGY ..... 2-1
2.2 BACKGROUND ..... 2-2
2.2.1 Area A Landfill ..... 2-2
2.2.2 Area A Wetland ..... 2-4
2.3 REMEDIAL ACTIONS ..... 2-5
2.3.1 Remedy Selection ..... 2-6
2.3.2 Remedy Implementation ..... 2-7
2.3.3 System Operations/Operation and Maintenance ..... 2-9
2.4 PROGRESS SINCE LAST REVIEW ..... 2-10
2.5 FIVE-YEAR REVIEW PROCESS ..... 2-13
2.5.1 Document Review ..... 2-13
2.5.2 Data Review ..... 2-14
2.5.3 ARAR and Site-Specific Action Level Changes ..... 2-19
2.5.4 Site Inspection ..... 2-20
2.5.5 Site Interviews ..... 2-22
2.6 ASSESSMENT ..... 2-22
2.7 ISSUES ..... 2-25
2.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 2-25
2.9 PROTECTIVENESS STATEMENT ..... 2-26

**3.0 SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA (OU3 AND OU9) ..... 3-1**
3.1 HISTORY AND SITE CHRONOLOGY ..... 3-1
3.2 BACKGROUND ..... 3-2
3.2.1 Area A Downstream Watercourses ..... 3-2
3.2.2 OBDA ..... 3-5
3.3 REMEDIAL ACTIONS ..... 3-6
3.3.1 Remedy Selection ..... 3-6
3.3.2 Remedy Implementation ..... 3-10
3.3.3 System Operations/Operation and Maintenance ..... 3-12
3.4 PROGRESS SINCE LAST REVIEW ..... 3-16

# TABLE OF CONTENTS (Continued)

**SECTION** **PAGE NO.**

3.5 FIVE-YEAR REVIEW PROCESS ..... 3-17
3.5.1 Document Review ..... 3-17
3.5.2 Data Review ..... 3-18
3.5.3 ARAR and Site-Specific Action Level Changes ..... 3-18
3.5.4 Site Inspection ..... 3-19
3.5.5 Site Interviews ..... 3-20
3.6 ASSESSMENT ..... 3-20
3.7 ISSUES ..... 3-22
3.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 3-23
3.9 PROTECTIVENESS STATEMENT ..... 3-23

**4.0 SITE 6 – DEFENSE REUTILIZATION AND MARKETING OFFICE (OU2) ..... 4-1**
4.1 HISTORY AND SITE CHRONOLOGY ..... 4-1
4.2 BACKGROUND ..... 4-2
4.3 REMEDIAL ACTIONS ..... 4-4
4.3.1 Remedy Selection ..... 4-5
4.3.2 Remedy Implementation ..... 4-7
4.3.3 System Operations/Operation and Maintenance ..... 4-8
4.4 PROGRESS SINCE LAST REVIEW ..... 4-9
4.5 FIVE-YEAR REVIEW FINDINGS ..... 4-11
4.5.1 Document Review ..... 4-11
4.5.2 Data Review ..... 4-11
4.5.3 ARAR and Site-Specific Action Level Changes ..... 4-16
4.5.4 Site Inspection ..... 4-17
4.5.5 Site Interviews ..... 4-18
4.6 ASSESSMENT ..... 4-18
4.7 ISSUES ..... 4-21
4.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 4-21
4.9 PROTECTIVENESS STATEMENT ..... 4-22

**5.0 SITE 7 – TORPEDO SHOPS (OU8 AND OU9) ..... 5-1**
5.1 HISTORY AND SITE CHRONOLOGY ..... 5-1
5.2 BACKGROUND ..... 5-2
5.3 REMEDIAL ACTIONS ..... 5-5
5.3.1 Remedy Selection ..... 5-5
5.3.2 Remedy Implementation ..... 5-10
5.3.3 System Operations/Operation and Maintenance ..... 5-11
5.4 PROGRESS SINCE LAST REVIEW ..... 5-11
5.5 FIVE-YEAR REVIEW PROCESS ..... 5-12
5.5.1 Document Review ..... 5-12
5.5.2 Data Review ..... 5-12
5.5.3 ARAR and Site-Specific Action Level Changes ..... 5-13
5.5.4 Site Inspection ..... 5-13
5.5.5 Site Interviews ..... 5-14
5.6 ASSESSMENT ..... 5-14
5.7 ISSUES ..... 5-16
5.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 5-16
5.9 PROTECTIVENESS STATEMENT ..... 5-16

# TABLE OF CONTENTS (Continued)

**SECTION** **PAGE NO.**

**6.0 SITE 8 – GOSS COVE LANDFILL (OU5) ..... 6-1**
6.1 HISTORY AND SITE CHRONOLOGY ..... 6-1
6.2 BACKGROUND ..... 6-2
6.3 REMEDIAL ACTIONS ..... 6-6
6.3.1 Remedy Selection ..... 6-6
6.3.2 Remedy Implementation ..... 6-9
6.3.3 System Operations/Operation and Maintenance ..... 6-10
6.4 PROGRESS SINCE LAST REVIEW ..... 6-11
6.5 FIVE-YEAR REVIEW PROCESS ..... 6-13
6.5.1 Document Review ..... 6-13
6.5.2 Data Review ..... 6-14
6.5.3 ARAR and Site-Specific Action Level Changes ..... 6-19
6.5.4 Site Inspection ..... 6-20
6.5.5 Site Interviews ..... 6-21
6.6 ASSESSMENT ..... 6-21
6.7 ISSUES ..... 6-24
6.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 6-24
6.9 PROTECTIVENESS STATEMENT ..... 6-25

**7.0 SITE 9 – OT-5 ..... 7-1**
7.1 HISTORY AND SITE CHRONOLOGY ..... 7-1
7.2 BACKGROUND ..... 7-1
7.3 REMEDIAL ACTIONS ..... 7-3
7.3.1 Remedy Selection ..... 7-3
7.3.2 Remedy Implementation ..... 7-3
7.4 PROGRESS SINCE LAST REVIEW ..... 7-4
7.5 FIVE-YEAR REVIEW PROCESS ..... 7-4
7.5.1 Document and Analytical Data Review ..... 7-5
7.5.2 ARAR and Site-Specific Action Level Changes ..... 7-5
7.5.3 Site Inspection ..... 7-5
7.5.4 Site Interviews ..... 7-5
7.6 ASSESSMENT ..... 7-5
7.7 ISSUES ..... 7-7
7.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 7-7
7.9 PROTECTIVENESS STATEMENT ..... 7-7

**8.0 SITE 10 – LOWER SUBASE - FUEL STORAGE TANKS AND TANK 54-H (OU 4) ..... 8-1**
8.1 HISTORY AND SITE CHRONOLOGY ..... 8-1
8.2 BACKGROUND ..... 8-1
8.3 REMEDIAL ACTIONS ..... 8-4
8.3.1 Remedy Selection ..... 8-4
8.3.2 Remedy Implementation ..... 8-4
8.4 PROGRESS SINCE LAST REVIEW ..... 8-4
8.5 FIVE-YEAR REVIEW PROCESS ..... 8-5
8.5.1 Document Review ..... 8-5
8.5.2 Data Review ..... 8-5
8.5.3 ARAR and Site-Specific Action Level Changes ..... 8-5
8.5.4 Site Inspection ..... 8-6
8.5.5 Site Interviews ..... 8-6

# TABLE OF CONTENTS (Continued)

**SECTION** **PAGE NO.**

8.6 ASSESSMENT ..... 8-6
8.7 ISSUES ..... 8-6
8.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 8-6
8.9 PROTECTIVENESS STATEMENT ..... 8-7

**9.0 SITE 11 – LOWER SUBASE – POWER PLANT OIL TANKS (OU4) ..... 9-1**
9.1 HISTORY AND SITE CHRONOLOGY ..... 9-1
9.2 BACKGROUND ..... 9-1
9.3 REMEDIAL ACTIONS ..... 9-4
9.3.1 Remedy Selection ..... 9-4
9.3.2 Remedy Implementation ..... 9-4
9.4 PROGRESS SINCE LAST REVIEW ..... 9-4
9.5 FIVE-YEAR REVIEW PROCESS ..... 9-5
9.5.1 Document Review ..... 9-5
9.5.2 Data Review ..... 9-5
9.5.3 ARAR and Site-Specific Action Level Changes ..... 9-5
9.5.4 Site Inspection ..... 9-6
9.5.5 Site Interviews ..... 9-6
9.6 ASSESSMENT ..... 9-6
9.7 ISSUES ..... 9-6
9.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 9-6
9.9 PROTECTIVENESS STATEMENT ..... 9-7

**10.0 SITE 13 – LOWER SUBASE – BUILDING 79 WASTE OIL PIT (OU4) ..... 10-1**
10.1 HISTORY AND SITE CHRONOLOGY ..... 10-1
10.2 BACKGROUND ..... 10-1
10.3 REMEDIAL ACTIONS ..... 10-6
10.3.1 Remedy Selection ..... 10-6
10.3.2 Remedy Implementation ..... 10-6
10.4 PROGRESS SINCE LAST REVIEW ..... 10-6
10.5 FIVE-YEAR REVIEW PROCESS ..... 10-7
10.5.1 Document Review ..... 10-7
10.5.2 Data Review ..... 10-7
10.5.3 ARAR and Site-Specific Action Level Changes ..... 10-7
10.5.4 Site Inspection ..... 10-7
10.5.5 Site Interviews ..... 10-7
10.6 ASSESSMENT ..... 10-8
10.7 ISSUES ..... 10-8
10.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 10-8
10.9 PROTECTIVENESS STATEMENT ..... 10-8

**11.0 SITE 14 – OVERBANK DISPOSAL AREA NORTHEAST (OBDANE) (OU8 AND OU9) ..... 11-1**
11.1 HISTORY AND SITE CHRONOLOGY ..... 11-1
11.2 BACKGROUND ..... 11-2
11.3 REMEDIAL ACTIONS ..... 11-3
11.3.1 Remedy Selection ..... 11-3
11.3.2 Remedy Implementation ..... 11-4
11.3.3 System Operations/Operation and Maintenance ..... 11-4

# TABLE OF CONTENTS (Continued)

**SECTION** **PAGE NO.**

11.4 PROGRESS SINCE LAST REVIEW ..... 11-4
11.5 FIVE-YEAR REVIEW PROCESS ..... 11-5
11.5.1 Document Review ..... 11-5
11.5.2 Data Review ..... 11-5
11.5.2 ARAR and Site-Specific Action Level Changes ..... 11-5
11.5.3 Site Inspection and Site Interviews ..... 11-5
11.6 ASSESSMENT ..... 11-6
11.7 ISSUES ..... 11-7
11.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 11-7
11.9 PROTECTIVENESS STATEMENT ..... 11-7

**12.0 SITE 15 – SPENT ACID STORAGE AND DISPOSAL AREA (OU6 AND OU9) ..... 12-1**
12.1 HISTORY AND SITE CHRONOLOGY ..... 12-1
12.2 BACKGROUND ..... 12-1
12.3 REMEDIAL ACTIONS ..... 12-4
12.3.1 Remedy Selection ..... 12-4
12.3.2 Remedy Implementation ..... 12-4
12.3.3 System Operations/O&M ..... 12-4
12.4 PROGRESS SINCE LAST REVIEW ..... 12-4
12.5 FIVE-YEAR REVIEW PROCESS ..... 12-5
12.5.1 Document Review ..... 12-5
12.5.2 Data Review ..... 12-5
12.5.3 ARAR and Site-Specific Action Level Changes ..... 12-6
12.5.4 Site Inspection ..... 12-6
2.5.5 Site Interviews ..... 12-6
12.6 ASSESSMENT ..... 12-6
12.7 ISSUES ..... 12-7
12.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 12-7
12.9 PROTECTIVENESS STATEMENT ..... 12-7

**13.0 SITE 16 – HOSPITAL INCINERATORS (OU11) ..... 13-1**
13.1 HISTORY AND SITE CHRONOLOGY ..... 13-1
13.2 BACKGROUND ..... 13-1
13.3 REMEDIAL ACTIONS ..... 13-3
13.3.1 Remedy Selection ..... 13-3
13.3.2 Remedy Implementation ..... 13-3
13.3.3 System Operations/O&M ..... 13-3
13.4 PROGRESS SINCE LAST REVIEW ..... 13-3
13.5 FIVE-YEAR REVIEW PROCESS ..... 13-3
13.5.1 Document Review ..... 13-4
13.5.2 Data Review ..... 13-4
13.5.3 ARAR and Site-Specific Action Level Changes ..... 13-4
13.5.4 Site Inspection ..... 13-4
13.5.5 Site Interviews ..... 13-4
13.6 ASSESSMENT ..... 13-4
13.7 ISSUES ..... 13-5
13.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 13-5
13.9 PROTECTIVENESS STATEMENT ..... 13-5

# TABLE OF CONTENTS (Continued)

**SECTION** **PAGE NO.**

**14.0 SITE 17 – LOWER SUBASE - HAZARDOUS MATERIALS/SOLVENT STORAGE AREA – BUILDING 31 (OU4) ..... 14-1**
14.1 HISTORY AND SITE CHRONOLOGY ..... 14-1
14.2 BACKGROUND ..... 14-1
14.3 REMEDIAL ACTIONS ..... 14-4
14.3.1 Remedy Selection ..... 14-4
14.3.2 Remedy Implementation ..... 14-5
14.4 PROGRESS SINCE LAST REVIEW ..... 14-5
14.5 FIVE-YEAR REVIEW PROCESS ..... 14-6
14.5.1 Document Review ..... 14-6
14.5.2 Data Review ..... 14-6
14.5.3 ARAR and Site-Specific Action Level Changes ..... 14-6
14.5.4 Site Inspection ..... 14-6
14.5.5 Site Interviews ..... 14-6
14.6 ASSESSMENT ..... 14-7
14.7 ISSUES ..... 14-7
14.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 14-7
14.9 PROTECTIVENESS STATEMENT ..... 14-7

**15.0 SITE 18 – SOLVENT STORAGE AREA – BUILDING 33 (OU11 AND OU9) ..... 15-1**
15.1 HISTORY AND SITE CHRONOLOGY ..... 15-1
15.2 BACKGROUND ..... 15-1
15.3 REMEDIAL ACTIONS ..... 15-2
15.3.1 Remedy Selection ..... 15-2
15.3.2 Remedy Implementation ..... 15-2
15.3.3 System Operations/O&M ..... 15-3
15.4 PROGRESS SINCE LAST REVIEW ..... 15-3
15.5 FIVE-YEAR REVIEW PROCESS ..... 15-3
15.5.1 Document Review ..... 15-3
15.5.2 Data Review ..... 15-4
15.5.3 ARAR and Site-Specific Action Level Changes ..... 15-4
15.5.4 Site Inspection ..... 15-4
15.5.5 Site Interviews ..... 15-4
15.6 ASSESSMENT ..... 15-4
15.7 ISSUES ..... 15-5
15.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 15-5
15.9 PROTECTIVENESS STATEMENT ..... 15-5

**16.0 SITE 19 – LOWER SUBASE – SOLVENT STORAGE AREA – BUILDING 316 (OU4) ..... 16-1**
16.1 HISTORY AND SITE CHRONOLOGY ..... 16-1
16.2 BACKGROUND ..... 16-1
16.3 REMEDIAL ACTIONS ..... 16-4
16.3.1 Remedy Selection ..... 16-4
16.3.2 Remedy Implementation ..... 16-4
16.4 PROGRESS SINCE LAST REVIEW ..... 16-4

# TABLE OF CONTENTS (Continued)

**SECTION** **PAGE NO.**

16.5 FIVE-YEAR REVIEW PROCESS ..... 16-5
16.5.1 Document Review ..... 16-5
16.5.2 Data Review ..... 16-5
16.5.3 ARAR and Site-Specific Action Level Changes ..... 16-5
16.5.4 Site Inspection ..... 16-5
16.5.5 Site Interviews ..... 16-5
16.6 ASSESSMENT ..... 16-6
16.7 ISSUES ..... 16-6
16.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 16-6
16.9 PROTECTIVENESS STATEMENT ..... 16-6

**17.0 SITE 20 – AREA A WEAPONS CENTER (OU7 AND OU9) ..... 17-1**
17.1 HISTORY AND SITE CHRONOLOGY ..... 17-1
17.2 BACKGROUND ..... 17-2
17.3 REMEDIAL ACTIONS ..... 17-3
17.3.1 Remedy Selection ..... 17-3
17.3.2 Remedy Implementation ..... 17-5
17.3.3 System Operations/O&M ..... 17-6
17.4 PROGRESS SINCE LAST REVIEW ..... 17-6
17.5 FIVE-YEAR REVIEW PROCESS ..... 17-7
17.5.1 Document Review ..... 17-7
17.5.2 Data Review ..... 17-7
17.5.3 ARAR and Site-Specific Action Level Changes ..... 17-7
17.5.4 Site Inspection and Site Interviews ..... 17-7
17.6 ASSESSMENT ..... 17-7
17.7 ISSUES ..... 17-8
17.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 17-9
17.9 PROTECTIVENESS STATEMENT ..... 17-9

**18.0 SITE 21 – LOWER SUBASE – BERTH 16 (OU4) ..... 18-1**
18.1 HISTORY AND SITE CHRONOLOGY ..... 18-1
18.2 BACKGROUND ..... 18-1
18.3 REMEDIAL ACTIONS ..... 18-4
18.3.1 Remedy Selection ..... 18-4
18.3.2 Remedy Implementation ..... 18-4
18.4 PROGRESS SINCE LAST REVIEW ..... 18-5
18.5 FIVE-YEAR REVIEW PROCESS ..... 18-5
18.5.1 Document Review ..... 18-5
18.5.2 Data Review ..... 18-6
18.5.3 ARAR and Site-Specific Action Level Changes ..... 18-6
18.5.4 Site Inspection ..... 18-6
18.5.5 Site Interviews ..... 18-6
18.6 ASSESSMENT ..... 18-6
18.7 ISSUES ..... 18-7
18.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 18-7
18.9 PROTECTIVENESS STATEMENT ..... 18-7

# TABLE OF CONTENTS (Continued)

**SECTION** **PAGE NO.**

**19.0 SITE 22 – LOWER SUBASE – PIER 33 (OU4) ..... 19-1**
19.1 HISTORY AND SITE CHRONOLOGY ..... 19-1
19.2 BACKGROUND ..... 19-1
19.3 REMEDIAL ACTIONS ..... 19-4
19.3.1 Remedy Selection ..... 19-4
19.3.2 Remedy Implementation ..... 19-4
19.4 PROGRESS SINCE LAST REVIEW ..... 19-4
19.5 FIVE-YEAR REVIEW PROCESS ..... 19-5
19.5.1 Document Review ..... 19-5
19.5.2 Data Review ..... 19-5
19.5.3 ARAR and Site-Specific Action Level Changes ..... 19-5
19.5.4 Site Inspection ..... 19-6
19.5.5 Site Interviews ..... 19-6
19.6 ASSESSMENT ..... 19-6
19.7 ISSUES ..... 19-6
19.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 19-6
19.9 PROTECTIVENESS STATEMENT ..... 19-7

**20.0 SITE 23 – TANK FARM (OU9) ..... 20-1**
20.1 HISTORY AND SITE CHRONOLOGY ..... 20-1
20.2 BACKGROUND ..... 20-2
20.3 REMEDIAL ACTIONS ..... 20-5
20.3.1 Remedy Selection ..... 20-5
20.3.2 Remedy Implementation ..... 20-6
20.4 PROGRESS SINCE LAST REVIEW ..... 20-6
20.5 FIVE-YEAR REVIEW PROCESS ..... 20-6
20.5.1 Document Review ..... 20-7
20.5.2 Data Review ..... 20-7
20.5.3 ARAR and Site-Specific Action Level Changes ..... 20-7
20.5.4 Site Inspection ..... 20-7
20.5.5 Site Interviews ..... 20-7
20.6 ASSESSMENT ..... 20-8
20.7 ISSUES ..... 20-8
20.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 20-8
20.9 PROTECTIVENESS STATEMENT ..... 20-8

**21.0 SITE 24 – LOWER SUBASE – CENTRAL PAINT ACCUMULATION AREA (OU4) ..... 21-1**
21.1 HISTORY AND SITE CHRONOLOGY ..... 21-1
21.2 BACKGROUND ..... 21-1
21.3 REMEDIAL ACTIONS ..... 21-4
21.3.1 Remedy Selection ..... 21-4
21.3.2 Remedy Implementation ..... 21-4
21.4 PROGRESS SINCE LAST REVIEW ..... 21-4
21.5 FIVE-YEAR REVIEW PROCESS ..... 21-5
21.5.1 Document Review ..... 21-5
21.5.2 Data Review ..... 21-5
21.5.3 ARAR and Site-Specific Action Level Changes ..... 21-5
21.5.4 Site Inspection ..... 21-5
21.5.5 Site Interviews ..... 21-5

# TABLE OF CONTENTS (Continued)

**SECTION** **PAGE NO.**

21.6 ASSESSMENT ..... 21-5
21.7 ISSUES ..... 21-6
21.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 21-6
21.9 PROTECTIVENESS STATEMENT ..... 21-6

**22.0 SITE 25 – LOWER SUBASE – CLASSIFIED MATERIALS INCINERATOR (OU4) ..... 22-1**
22.1 HISTORY AND SITE CHRONOLOGY ..... 22-1
22.2 BACKGROUND ..... 22-1
22.3 REMEDIAL ACTIONS ..... 22-4
22.3.1 Remedy Selection ..... 22-4
22.3.2 Remedy Implementation ..... 22-5
22.4 PROGRESS SINCE LAST REVIEW ..... 22-5
22.5 FIVE-YEAR REVIEW PROCESS ..... 22-5
22.5.1 Document Review ..... 22-5
22.5.2 Data Review ..... 22-6
22.5.3 ARAR and Site-Specific Action Level Changes ..... 22-6
22.5.4 Site Inspection ..... 22-6
22.5.5 Site Interviews ..... 22-6
22.6 ASSESSMENT ..... 22-6
22.7 ISSUES ..... 22-7
22.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS ..... 22-7
22.9 PROTECTIVENESS STATEMENT ..... 22-7

**23.0 CONCLUSIONS AND RECOMMENDATIONS ..... 23-1**
23.1 PROTECTIVENESS STATEMENT ..... 23-1
23.2 NEXT REVIEW ..... 23-1
23.2.1 Continued Reviews ..... 23-2
23.2.2 Discontinue Reviews ..... 23-2

**REFERENCES ..... R-1**

**APPENDICES**

**A LANDFILL INSPECTION REPORT CHECKLISTS**
**A.1 AREA A LANDFILL**
**A.2 DRMO**
**A.3 GOSS COVE LANDFILL**

**B FIVE-YEAR REVIEW SITE PHOTOGRAPHS**

**C FIVE-YEAR REVIEW INSPECTION CHECK LISTS**
**C.1 AREA A LANDFILL**
**C.2 DRMO**
**C.3 GOSS COVE LANDFILL**

**D SOPA (ADMIN) NEW LONDON INSTRUCTION 5090.18C INSTALLATION RESTORATION SITE USE RESTRICTIONS AT NAVAL SUBMARINE BASE NEW LONDON**

# TABLES

**NUMBER**

2-1 Chemical-Specific Applicable or Relevant and Appropriate Requirements, Advisories, and Guidance, Site 2 - Area A Landfill OU1
2-2 Location-Specific Applicable or Relevant and Appropriate Requirements, Advisories, and Guidance, Site 2 - Area A Landfill OU1
2-3 Action-Specific Applicable or Relevant and Appropriate Requirements, Advisories, and Guidance, Site 2 - Area A Landfill OU1
2-4 Comparison of Monitoring Criteria, Site 2 - Area A Landfill OU1
2-5 Deficiencies Identified for Site 2 - Area A Landfill OU1
3-1 Summary of Remedial Goals for Site 3 Soil and Sediment, Site 3 - Area A Downstream Watercourses/OBDA
3-2 Summary of Remedial Goals for Site 3 Groundwater, Site 3 - Area A Downstream Watercourses/OBDA
3-3 Chemical-Specific ARARs and TBCs for Site 3 Soil and Sediment, Site 3 - Area A Downstream Watercourses/OBDA
3-4 Location-Specific ARARs and TBCs for Site 3 Soil and Sediment, Site 3 - Area A Downstream Watercourses/OBDA
3-5 Action-Specific ARARs and TBCs for Site 3 Soil and Sediment, Site 3 - Area A Downstream Watercourses/OBDA
3-6 Chemical-Specific ARARs and TBCs for Site 3 Groundwater, Site 3 - Area A Downstream Watercourses/OBDA
3-7 Action-Specific ARARs and TBCs for Site 3 Groundwater, Site 3 - Area A Downstream Watercourses/OBDA
3-8 Deficiencies Identified for Site 3 - Area A Downstream Watercourses/OBDA
4-1 Chemical-Specific Applicable or Relevant and Appropriate Requirements, Advisories, and Guidance, Site 6 - Defense Reutilization and Marketing Office
4-2 Location-Specific Applicable or Relevant and Appropriate Requirements, Advisories, and Guidance, Site 6 - Defense Reutilization and Marketing Office
4-3 Action-Specific Applicable or Relevant and Appropriate Requirements, Advisories, and Guidance, Site 6 - Defense Reutilization and Marketing Office
4-4 Comparison of Primary Monitoring Criteria, Site 6 - Defense Reutilization and Marketing Office
4-5 Comparison of Secondary Criteria, Site 6 - Defense Reutilization and Marketing Office
4-6 Site 6 Deficiencies, Site 6 - Defense Reutilization and Marketing Office
5-1 Summary of Remedial Goals for Site 7 Soil, Site 7 - Torpedo Shops
5-2 Summary of Remedial Goals for Site 7 Groundwater, Site 7 - Torpedo Shops
5-3 Chemical-Specific ARARs and TBCs for Site 7 Soil, Site 7 - Torpedo Shops
5-4 Action-Specific ARARs and TBCs for Site 7 Soil, Site 7 - Torpedo Shops
5-5 Chemical-Specific ARARs and TBCs for Site 7 Groundwater, Site 7 - Torpedo Shops
5-6 Action-Specific ARARs and TBCs for Site 7 Groundwater, Site 7 - Torpedo Shops
6-1 Chemical-Specific Applicable or Relevant and Appropriate Requirements, Advisories, and Guidance, Site 8 - Goss Cove Landfill
6-2 Location-Specific Applicable or Relevant and Appropriate Requirements, Advisories, and Guidance, Site 8 - Goss Cove Landfill
6-3 Action-Specific Applicable or Relevant and Appropriate Requirements, Advisories, and Guidance, Site 8 - Goss Cove Landfill
6-4 Comparison of Primary Monitoring Criteria, Site 8 - Goss Cove Landfill
6-5 Comparison of Secondary Monitoring Criteria, Site 8 - Goss Cove Landfill
6-6 Site 8 Deficiencies, Site 8 - Goss Cove Landfill
23-1 Issues Identified During the Second Five-Year Review

# FIGURES

**NUMBER**

1-1 Facility Location Map
1-2 Site Location Map
2-1 Site Plan for Site 2 - Area A Landfill and Wetland
2-2 Site Map, Site 2 - Area A Landfill and Wetland
2-3 COPC Exceedances of Monitoring Criteria, Year 2 Groundwater Sampling, Site 2 - Area A Landfill
2-4 COPC Exceedances of Monitoring Criteria, Year 2 Surface Water Sampling, Site 2 - Area A Landfill
2-5 COPC Exceedances of Monitoring Criteria, Year 3 Groundwater Sampling, Site 2 - Area A Landfill
2-6 COPC Exceedances of Monitoring Criteria, Year 3 Surface Water Sampling, Site 2 - Area A Landfill
2-7 COPC Exceedances of Monitoring Criteria, Year 4 Groundwater Sampling, Site 2 - Area A Landfill and Wetland
2-8 COPC Exceedances of Monitoring Criteria, Year 4 Surface Water Sampling, Site 2 - Area A Landfill and Wetland
2-9 COPC Exceedances of Monitoring Criteria, Year 5 Groundwater Sampling, Site 2 - Area A Landfill and Wetland
2-10 COPC Exceedances of Monitoring Criteria, Year 5 Surface Water Sampling, Site 2 - Area A Landfill and Wetland
2-11 COPC Exceedances of Monitoring Criteria, Year 6 Groundwater Sampling, Site 2 - Area A Landfill and Wetland
2-12 COPC Exceedances of Monitoring Criteria, Year 6 Surface Water Sampling, Site 2 - Area A Landfill and Wetland
3-1 Site Map, Site 3 - Area A Downstream Watercourses/OBDA
4-1 Site Plan for Site 6 - DRMO
4-2 COPC Exceedances of Monitoring Criteria, Year 3 Groundwater Sampling, Site 6 - DRMO
4-3 COPC Exceedances of Monitoring Criteria, Year 4 Groundwater Sampling, Site 6 - DRMO
4-4 COPC Exceedances of Monitoring Criteria, Year 5 Groundwater Sampling, Site 6 - DRMO
4-5 COPC Exceedances of Monitoring Criteria, Year 6 Groundwater Sampling, Site 6 - DRMO
4-6 COPC Exceedances of Monitoring Criteria, Year 7 Groundwater Sampling, Site 6 - DRMO
5-1 Site Plan for Site 7 - Torpedo Shops
6-1 Site Plan for Site 8 - Goss Cove Landfill
6-2 COPC Exceedances of Monitoring Criteria, Year 1 Groundwater Sampling, Site 8 - Goss Cove Landfill
6-3 COPC Exceedances of Monitoring Criteria, Year 2 Groundwater Sampling, Site 8 - Goss Cove Landfill
6-4 COPC Exceedances of Monitoring Criteria, Year 3 Groundwater Sampling, Site 8 - Goss Cove Landfill
6-5 COPC Exceedances of Monitoring Criteria, Year 4 Groundwater Sampling, Site 8 - Goss Cove Landfill
7-1 Site Plan Site 9 - OU-5 and Tank 54-H
8-1 Site Map, Site 10 - Fuel Storage Tanks
9-1 Site Map, Site 11 - Power Plant Oil Tanks
10-1 Site Map, Site 13 - Building 79 Waste Oil Pit
11-1 Site Map, Site 14 - OBDANE
12-1 Site Map, Site 15 - Spent Acid Storage and Disposal Area
13-1 Site Map, Site 16 - Hospital Incinerators
14-1 Site Map, Site 17 - Hazardous Materials Solvent Storage Area (Building 31)

# FIGURES (Continued)

**NUMBER**

15-1 Site Map, Site 18 - Solvent Storage Area (Building 33)
16-1 Site Map, Site 19 - Solvent Storage Area (Building 316)
17-1 Site Map, Site 20 - Area A Weapons Center
18-1 Site Map, Site 21 - Berth 16 and Site 25 - Classified Material Incinerator
19-1 Site Map, Site 22 - Pier 33
20-1 Site Map, Site 23 - Tank Farm
21-1 Site Map, Site 24 - Central Paint Accumulation Area A (Building 174)

# ACRONYMS

| | |
|---|---|
| ARAR | Applicable or Relevant and Appropriate Requirement |
| AS/SVE | Air sparging/soil vapor extraction |
| AST | Above-ground storage tank |
| Atlantic | Atlantic Environmental Services, Inc. |
| AVS | Acid volatile sulfide |
| AWQC | Ambient Water Quality Criterion |
| B&RE | Brown and Root Environmental |
| BAF | Bioaccumulation factor |
| BEHP | bis(2-Ethylhexyl) phthalate |
| BGOURI | Basewide Groundwater Operable Unit Remedial Investigation |
| bgs | Below ground surface |
| BTEX | benzene, toluene, ethylbenzene, and xylenes |
| CBU | Construction Battalion Unit |
| CERCLA | Comprehensive Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| CGS | Connecticut General Statutes |
| cm/sec | Centimeters/second |
| CMP | Corrugated metal pipe |
| COC | Chemical of concern |
| COD | Chemical oxygen demand |
| COPC | Chemical of potential concern |
| CPAH | Carcinogenic polynuclear aromatic hydrocarbon |
| CQA | Construction Quality Assurance |
| CQC | Construction Quality Control |
| CSF | Cancer slope factor |
| CTDEP | Connecticut Department of Environmental Protection |
| CTE | Central tendency exposure |
| DCE | Dichloroethene |
| DDD | p,p'-Dichlorodiphenyl dichloroethane |
| DDE | p,p'-Dichlorodiphenyl dichloroethylene |
| DDT | p,p'-Dichlorodiphenyl trichloroethane |
| DDTR | DDT and its derivatives (e.g., DDD, and DDE) |
| DGI | Data Gap Investigation |
| DoD | Department of Defense |
| DRMO | Defense Reutilization and Marketing Office |

| | |
|---|---|
| ECC | Environmental Chemical Corporation |
| ECOC | Ecological contaminant of concern |
| EE/CA | Engineering Evaluation/Cost Analysis |
| EFANE | Engineering Field Activity Northeast |
| ELUR | Environmental Land Use Restriction |
| E. O. | Executive Order |
| ERA | Ecological Risk Assessment |
| ER-L | Effects range-low |
| ER-M | Effects range-medium |
| ERM | Environmental Resource Management |
| ESD | Explanation of Significant Difference |
| ESQD | Explosive Safety Quantity Distance |
| FAC | Facultative |
| FACW | Facultative wetland |
| FFA | Federal Facilities Agreement |
| FFDC | Federal Food, Drug, and Cosmetics |
| FFS | Focused Feasibility Study |
| FR | Federal Register |
| FS | Feasibility Study |
| FWEC | Foster Wheeler Environmental Corporation |
| GCL | Geosynthetic clay liner |
| GMR | Groundwater Monitoring Report |
| GZA | Goldberg-Zoino & Associates |
| HASP | Health and Safety Plan |
| HHRA | Human health risk assessment |
| HI | Hazard Index |
| HNUS | Halliburton NUS Corporation |
| HQ | Hazard Quotient |
| IAS | Initial Assessment Study |
| IEUBK | Integrated Exposure Uptake Biokinetic |
| ILCR | incremental lifetime cancer risk |
| IR | Installation Restoration |
| IRA | Interim remedial action |
| IRP | Installation Restoration Program |
| $K_{oc}$ | organic carbon partition coefficent |
| LDPE | Low-density polyethylene |
| LIR | Landfill Inspection Report |

| | |
|---|---|
| LLDPE | Linear low-density polyethylene |
| LOAEL | lowest-observed adverse-effect level |
| MCL | Maximum Contaminant Level |
| MQA | Material Quality Assurance |
| MWR | Morale, Welfare, and Recreation |
| NACIP | Navy Assessment and Control of Installation Pollutants |
| NAVD 88 | North American Vertical Datum of 1988 |
| NCP | National Contingency Plan |
| NEESA | Naval Energy and Environmental Support Activity |
| NESHAP | National Emissions Standards for Hazardous Air Pollutants |
| NESO | Naval Environmental Support Office |
| NEX | Naval Exchange |
| NFA | No further action |
| NMOC | Non-methane organic compounds |
| NOAA | National Oceanographic and Atmospheric Administration |
| NOAEL | No-observed-adverse-effects level |
| NPDES | National Pollution Discharge Elimination System |
| NPL | National Priorities List |
| NSA | New Source Area |
| NSB-NLON | Naval Submarine Base - New London |
| NTCRA | Non-time critical removal action |
| O&M | Operation and maintenance |
| OBDA | Overbank Disposal Area |
| OBDANE | Overbank Disposal Area Northeast |
| OBL | Obligate wetland |
| OME | Ontario Ministry of the Environment |
| ORP | Oxidation-reduction potential |
| OSWER | Office of Solid Waste and Emergency Response |
| OT | Oil tank |
| OU | Operable unit |
| OVA | Organic vapor analyzer |
| PAH | Polynuclear aromatic hydrocarbon |
| PCB | Polychlorinated biphenyl |
| PCE | Tetrachloroethene |
| PPE | Personal protective equipment |
| PRAP | Proposed Remedial Action Plan |
| PRG | Preliminary Remediation Goal |

| | |
|---|---|
| QA | Quality assurance |
| QC | Quality control |
| RAB | Restoration Advisory Board |
| RAC | Remedial Action Contractor |
| RAO | Remedial action objective |
| RBC | Risk-Based Concentration |
| RCRA | Resource Conservation and Recovery Act |
| RCSA | Regulations of Connecticut State Agencies |
| RfD | Reference dose |
| RFI | RCRA Facility Investigation |
| RI | Remedial Investigation |
| RME | Reasonable maximum exposure |
| ROD | Record of Decision |
| RSR | Remediation Standard Regulations (Connecticut) |
| SAIC | Science Applications International Corporation |
| SASDA | Spent Acid Storage and Disposal Area |
| SEM | Simultaneous extracted metals |
| SVOC | Semivolatile organic compound |
| SWMU | Solid Waste Management Unit |
| SWPC | Surface Water Protection Criteria |
| TAL | Target Analyte List |
| TBC | To be considered |
| TCE | Trichloroethene |
| TCL | Target Compound List |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TCRA | Time-critical removal action |
| TDS | Total dissolved solids |
| TIE | Toxicity Identification Evaluation |
| TOC | Total organic carbon |
| TPH | Total petroleum hydrocarbons |
| TSCA | Toxic Substances Control Act |
| TSS | Total suspended solids |
| TtEMI | Tetra Tech EMI, Inc. |
| TtNUS | Tetra Tech NUS, Inc. |
| TtFW | Tetra Tech Foster Wheeler, Inc. |
| USEPA | United States Environmental Protection Agency |
| UST | Underground storage tank |

| | |
|---|---|
| VOC | Volatile organic compound |
| WQC | Water quality criterion |
| WQS | Water quality standard |
| WQSV | Water-quality screening value |

# 1.0 INTRODUCTION

The Navy, in conjunction with the United States Environmental Protection Agency (USEPA) Region I and Connecticut Department of Environmental Protection (CTDEP), conducted the second five-year review of the remedial actions implemented at the Naval Submarine Base-New London (NSB-NLON) in New London County, Connecticut. The National Superfund electronic database identification number for NSB-NLON is CTD980906515.

This Second Five-Year Review Report was prepared by Tetra Tech NUS, Inc. (TtNUS) for Engineering Field Activity Northeast (EFANE) Naval Facilities Engineering Command under Contract Task Order 038 of Contract Number N62472-03-D00057. TtNUS conducted the five-year review of the completed, ongoing, and pending remedial actions at 21 of the 23 Installation Restoration Program (IRP) sites at NSB-NLON from February through June 2006. Two sites (Site 1 – CBU Drum Storage Area and Site 4 – Rubble Fill at Bunker A-86) were not included in the second five-year review based on the recommendations of the First Five-Year Review Report. A general site location map of NSB-NLON is shown on Figure 1-1 and the locations of the sites are shown on Figure 1-2.

## 1.1 PURPOSE

The purpose of the five-year review is to evaluate the implementation and performance of the remedies at the sites to determine whether the remedies are protective of human health and the environment. The methods, findings, and conclusions of the reviews are documented in five-year review reports. In addition, five-year review reports identify deficiencies found during the review, if any, and provide recommendations to address them.

This five-year review is required by statute. The Navy must implement five-year reviews consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA Section §121(c), as amended, states

> If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented.

The NCP Part 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR) states

> If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

This is the second five-year review of NSB-NLON. The triggering action for this review was the initiation of the remedial action for Site 2 - Area A Landfill and Wetlands (soil), which began in December 1996. Because hazardous substances remain at the site above levels that allow for unrestricted use and unlimited exposure, subsequent five-year reviews are required.

As discussed in the USEPA Comprehensive Five-Year Review Guidance (USEPA, 2001), a five-year review determines whether the remedy at a site is protective of human health and the environment. When a remedial action is still under construction, a five-year review determines whether immediate threats have been addressed and whether the remedy is expected to be protective when all remedial actions are completed. In addition, a five-year review identifies any deficiencies and recommends steps to correct them. To do this, the technical assessment conducted during a five-year review examines the three questions shown below.

- Question A: Is the remedy functioning as intended by the decision documents?

- Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

These questions will be answered for the sites at NSB-NLON where a remedy has been implemented or is currently being implemented in Sections 2.0 through 22.0. To answer these questions, this five-year review included several steps. The review included a review of documents, discussions with personnel associated with the sites, and a site inspection of NSB-NLON. This report also includes the findings of the review of newly promulgated standards, and changes in the standards that were identified as applicable or relevant and appropriate requirements (ARARs), to be considereds (TBCs), and the factors used to develop site-specific, risk-based levels at the time the Record of Decision (ROD) was signed. This information was reviewed to determine if changes since the time of the ROD may call into question the protectiveness of the remedy. It was determined that recalculation of risk or a risk assessment was not necessary to determine whether a remedy protects human health and the environment, as will be discussed in later sections. Where applicable, monitoring and sampling data and the documentation of

operation and maintenance (O&M) were also examined and the information is included in the subsequent site-specific sections.

## 1.2 OVERVIEW OF NSB-NLON

NSB-NLON currently provides base command for submarine activities in the Atlantic Ocean. It 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. The following sections provide the physical and geologic conditions at NSB-NLON as well as a history and chronology.

### 1.2.1 Land Use

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

Currently, NSB-NLON consists of over 300 buildings on 687 acres of land (Atlantic, 1992). The density of buildings is high along the central bedrock high, in the southern valley, and along the Thames River. In the northern valley are streams, a wetland, and a golf course. The northern bedrock high is not heavily developed except along the southern face at the Area A Weapons Center and the Torpedo Shops. The top and northern faces of the northern ridge are wooded, undeveloped areas.

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

### 1.2.2 History and Site Chronology

Important NSB-NLON historical events and relevant dates in the site chronology are listed in the following table. The identified events are illustrative, not comprehensive.

| *Event* | *Date* |
|---|---|
| State of Connecticut donates 112-acres on the east bank of the Thames River to the Navy | 1867 |
| Navy officially designates property as a Navy Yard | 1868 |
| Navy designates site as a Submarine Base | 1916 |
| Six piers and 81 buildings were added | World War I |
| Submarine school established | 1917 |
| Submarine Medical Center founded | 1918 |
| 180 buildings built and land acquired adjacent to site | 1935 to 1945 |
| Medical Research Laboratory was established | 1946 |
| Submarine School became largest tenant | 1968 |
| Naval Submarine Support Facility established | 1974 |
| Naval Undersea Medical Institute established | 1975 |
| First environmental study for investigation of oil contamination of groundwater | 1979 |
| Navy initiated the Naval Assessment and Control of Installation Pollutants (NACIP) Program | 1980 |
| Initial Assessment Study completed | 1983 |
| U.S. Department of Defense (DOD) developed the IR Program which was the catalyst for environmental investigations at NSB-NLON | 1986 |
| Inclusion of NSB-NLON on the Federal Agency Hazardous Waste Compliance Docket | 1988 |
| USEPA proposes that NSB-NLON be added to the National Priorities List (NPL) | 1989 |
| Placed on the NPL | August 1990 |
| Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) completed | 1992 |
| Phase I Remedial Investigation (RI) completed | 1992 |
| Federal Facilities Agreement (FFA) signed | 1995 |
| Initiation of the remedial action for Site 2 - Area A Landfill soil | December 1996 |
| Phase II RI completed | 1997 |
| First Five-Year Review Report completed | 2001 |
| Basewide Groundwater OU RI (BGOURI) completed | January 2002 |
| BGOURI Update/Feasibility Study (FS) completed | July 2004 |
| Final Operation and Maintenance Manual - Volumes I, II, III, IV, and V | January 2006 |

Investigations were initiated at NSB-NLON by the Navy Environmental Support Office (NESO) in 1979 to identify the source and extent of oil that was found in soils along the Thames River at three sites on the Lower Subase. NESO drilled and sampled 16 soil borings and piezometers. Envirodyne Engineers, Inc. completed an Initial Assessment Study (IAS) in 1982, as part of the NACIP program. The IAS recommended that various actions and studies be conducted at several sites for further characterization. A Phase I RI was completed in 1992 by Atlantic Environmental Services, Inc. for 11 sites.

Additional investigations, including but not limited to the Phase II RI (B&RE, 1997a), Lower Subase RI (TtNUS, 1999b), BGOURI (TtNUS, 2002a), BGOURI Update/Feasibility Study (TtNUS, 2004), and several Focused Feasibility Studies (FFSs), Feasibility Studies (FSs), and Engineering Evaluation/Cost Analyses (EE/CAs) have been completed to further evaluate sites at NSB-NLON. In addition, numerous decision documents have been signed and remedial actions completed for soil and groundwater at IRP sites at NSB-NLON. In 2006, the Operation and Maintenance (O&M) Manual for IR Program Sites at NSB-NLON was finalized. Additional information regarding the investigations, decision documents, and remedial actions is presented in Sections 2.0 through 22.0.

### 1.2.3 Site Information

This five-year review report addresses 21 of the 23 IRP sites at NSB-NLON undergoing investigation and remediation under CERCLA. Two sites (Site 1 – CBU Drum Storage Area and Site 4 – Rubble Fill at Bunker A-86) were not included in the second five-year review based on the recommendations of the First Five-Year Review Report which indicated reviews of these sites were not longer required. A No Further Action (NFA) decision document for soil was completed for Site 1 in July 1996. A NFA ROD for soil at Site 4 was completed in June 1998 after a removal action was completed in 1997. The sites included in the review and the rationale for including them are provided below. The operable units (OUs) associated with the sites and media are also provided.

The CERCLA remedial process continued through RODs for the following sites and media:

- Site 2 - Area A Landfill soil (OU1)
- Site 3 - Area A Downstream/Overbank Disposal Area (OBDA) soil and sediment (OU3) and groundwater (OU9)
- Site 6 - Defense Reutilization and Marketing Office (DRMO) soil and groundwater (OU2)
- Site 7 - Torpedo Shops soil (OU8) and groundwater (OU9)
- Site 8 - Goss Cove Landfill soil (OU5)
- Site 14 - Overbank Disposal Area Northeast (OBANE) soil (OU8) and groundwater (OU9)
- Site 15 - Spent Acid Storage and Disposal Area (SASDA) soil (OU6) and groundwater (OU9)
- Site 16 - Hospital Incinerators (OU11)
- Site 18 - Solvent Storage Area - Building 33 soil (OU11) and groundwater (OU9)
- Site 20 - Area A Weapons Center soil (OU7) and groundwater (OU9)

RODs were completed for soil at Site 2 in September 1995, for soil and sediment at Site 3 in March 1998, for soil and groundwater at Site 6 in March 1998, and for soil and sediment at Site 8 in September 1999. A remedy of excavation and off-site disposal for Site 7 soil, as recommended in the OU8 ROD (2004),

was completed in 2006. A NFA ROD for soil at Site 15 was completed in September 1997. A final ROD recommending NFA for soil at Sites 16 and 18 was signed in 2004. A non-time-critical removal action at Site 14 and a remedial action at Site 20 were both completed in 2001. The soil ROD for OU8 recommended NFA for Site 14 soil (2004). In addition, the interim groundwater ROD for OU9 (2004) recommends NFA as the final remedy for groundwater at Sites 14, 15, 16, 18, and 20.

Five-year reviews were also conducted at the following sites. Removal actions or interim remedial actions (IRAs) have been completed at these sites, but all of the sites are still being evaluated under CERCLA.

- Site 9 – Oil Tank (OT)-5
- Site 10 – Fuel Storage Tanks and Tank 54-H (OU4)
- Site 11 – Power Plant Oil Tanks (OU4)
- Site 13 – Building 79 Waste Oil Pit (OU4)
- Site 17 – Hazardous Materials/Solvent Storage Area – Building 31 (OU4)
- Site 23 – Tank Farm groundwater (OU9)

Five-year reviews were also conducted at the following sites. No removal actions or interim remedial actions have been conducted and no decision documents have been prepared for these sites. CERCLA investigation activities are ongoing at these sites.

- Site 2 – Area A Wetland sediment (OU12)
- Site 19 – Solvent Storage Area – Building 316 (OU4)
- Site 21 – Berth 16 (OU4)
- Site 22 – Pier 33 (OU4)
- Site 24 – Central Point Accumulation Area – Building 174 (OU4)
- Site 25 – Classified Material Incinerator (OU4)

## 1.3 FIVE-YEAR REVIEW PROCESS

The NSB-NLON five-year review was led by Mark Evans, the Navy Remedial Project Manager. The following team members assisted in the review:

- Kymberlee Keckler, USEPA Region I Remedial Project Manager
- Mark Lewis, CTDEP Remedial Project Manager
- Richard Conant, NSB-NLON IRP Coordinator
- Corey Rich, TtNUS Project Manager (Navy CLEAN contractor)

- Robert Tess, ECC Project Manager (Navy O&M contractor)
- Greg Kemp, Gannett Fleming (USEPA Region I contractor)

The five-year review consisted of the following activities: a review of relevant documents, site inspections, and limited interviews. The final report will be placed in the Information Repositories and Administrative Record File for NSB-NLON. Most project documentation can be found at the following Information Repository locations:

- Groton Public Library (860) 441-6750
  52 Newtown Road, Groton, CT 06340

- Bill Library (860) 464-9912
  718 Colonel Ledyard Highway, Ledyard, CT 06399

Notice of the preparation of the Second Five-Year Review Report for NSB-NLON and a summary of the final Second Five-Year Review Report will be provided to the Restoration Advisory Board (RAB) at a future meeting (tentatively, March 2007). A notice of availability of the final Second Five-Year Review report will be provided to the public in the New London The Day newspaper. The notice will indicate that the Navy made available copies of the report in the Information Repositories listed above.

## 1.4 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND SITE-SPECIFIC ACTION LEVEL CHANGES

The second five-year review is being conducted for two purposes:

- To determine if the remedial actions are being implemented as specified in the RODs to protect human health and the environment.

- To determine if there have been changes in the ARARs or site-specific action levels that call into question the protectiveness of the remedy.

The chemical-specific ARARs that were identified in each of the RODs were reviewed, as were new federal and state regulations that have been promulgated. This section describes the overall impacts of the new or changed ARARs on the risk posed to human health or the environment. It was determined that recalculation of risk or risk assessments was not necessary to determine whether a remedy protects human health and the environment.

The human health risk assessments (HHRAs) for the sites were conducted primarily following the USEPA Human Health Evaluation Manual and supplemental documents (USEPA, 1989, 1991; 1992a) and USEPA Region I Risk Updates, Numbers 2, 3, 4, and 5 (USEPA 1994b; 1995b; 1996b; 1999b). Since the human health risk assessments were prepared USEPA has issued new guidance documents (USEPA, 2001b; 2002a; 2002b; 2004a; 2004b; 2005b; and 2005c). The new guidance documents do not impact the conclusions of the original human health risk assessments. Future HHRAs and five-year reviews will consider the most recent USEPA guidance. If updated carcinogenicity risk assessments become available, the Navy and regulators will determine whether an evaluation should be conducted as part of a future five-year review to assess whether adjustments to the target cleanup levels for remedial actions are needed in order for the remedies to remain protective of human health. If it is concluded that there are unacceptable risks, the target cleanup levels will be adjusted to address the risks so that the remedial actions are protective of human health.

The benchmarks used to select chemicals of potential concern (COPCs) for direct contact with soil and sediment included USEPA Region III Risk-Based Concentrations (RBCs), USEPA Region IX Preliminary Remedial Goals (PRGs), and Connecticut Remediation Standard Regulations (RSRs). In addition, USEPA Soil Screening Levels for the protection of migration from soil to groundwater and soil to air and Connecticut RSRs for pollutant mobility and volatilization from soil to indoor air were used to select COPCs for soil migration pathways. The USEPA Region III RBCs are usually updated twice a year and the USEPA Region IX PRGs are usually updated once a year. The CTDEP RSRs were issued in 1996 (CTDEP, 1996), additional RSRs were issued in 1999 (CTDEP, 1999b), and proposed revisions to the volatilization in criteria were issued in 2003 (CTDEP, 2003).

The benchmarks used to select COPCs for groundwater included USEPA Region III RBCs, USEPA Region IX PRGs, USEPA Maximum Contaminant Levels (MCLs), Connecticut MCLs, and CTDEP Groundwater Protection Criteria. In addition, CTDEP RSRs for surface water protection and migration from groundwater to indoor air were used to select COPCs for groundwater migration pathways.

The benchmarks used to select COPCs for surface water included USEPA Ambient Water Quality Criteria (AWQC) and Connecticut Water Quality Standards (WQSs). The USEPA AWQC were last updated in 2006 (USEPA, 2006), and the Connecticut WQSs were last updated in December 2002 (CTDEP, 2002).

Groundwater and surface water at Site 2 are being monitored to evaluate the effectiveness of the remedy for soil. The primary monitoring criteria for the Site 2 are the CTDEP SWPC. The SWPC were updated in April, 1999 (CTDEP, 1999) but the SWPC for the chemicals of concern (COCs) at Site 2 have not changed. The secondary monitoring criteria for Site 2 are the lower of the Federal AWQC and the Connecticut WQS. As noted above and discussed in Section 2 these criteria have been updated since

the final Groundwater Monitoring Plan for Site 2 was issued. The changes in the AWQC and WQS do not impact the protectiveness of the remedy for Site 2.

At Site 6 CTDEP WQSs published in 1992 were used as ARARs in the Interim and Final ROD. As discussed in Section 4 these ARARs have been updated since the Interim ROD for Site 6 was signed. The changes in the ARARs do not impact the effectiveness of the final selected remedy for Site 6.

A ROD has not been signed for groundwater at Site 8 although groundwater monitoring is being conducted to evaluate the effectiveness of the selected soil remedy. The groundwater monitoring criteria were based on site-specific SWPC developed in 1999 and CTDEP SWPC and volatilization criteria published in 1996 (CTDEP, 1999; CTDEP, 1996). As noted in Section 6 the site-specific SWPC were revised in January 2006.

At Sites 3, 7, 14, 15, 18, and 20 Federal MCLs and CTDEP drinking water/groundwater quality criteria were used as ARARs in the ROD. There have been no changes in the ARARs for these sites. However, the MCL for arsenic changed from 50 µg/L to 10 µg/L in January 2000 and EPA Region I issued new guidance for evaluating risks associated with manganese in November 1996. USEPA revised the oral reference dose for manganese in the IRIS database in May 1995. In November 1996 USEPA Region I issued guidance for evaluating exposures to manganese in soil and groundwater using the revised IRIS oral reference dose. The USEPA Region I guidance for manganese has been used in all human health risk assessments prepared for NSB-NLON since November 1996.

The ecological risk assessments for the sites were conducted primarily following USEPA Ecological Risk Assessment (ERA) guidance documents from 1992 (Framework for Ecological Risk Assessment) (USEPA, 1992b) and 1994 (Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Review Draft) (USEPA, 1994). The 1994 ERA guidance did not change significantly when it was updated in 1997 as an interim final document (USEPA, 1997). The risk assessments also re-evaluated some of the conservative assumptions used to obtain a "screening-level" risk, which corresponds to the Step 3a evaluation in the Navy Policy for Conducting Ecological Risk Assessments (Navy, 1999). Therefore, the risk assessment methodology has not changed significantly over the last five years.

At sites where food-chain modeling was conducted, exposure factors were obtained from the Wildlife Exposure Factors Handbook (USEPA, 1993b). This document is still the primary source for exposure factors in current ecological risk assessments. Also, many of the wildlife toxicity data were obtained from the Toxicological Benchmarks for Wildlife: 1994 Revision (Opresko et al., 1994). This document was updated in 1996 (Sample et al., 1996); however, many of the values did not change. Some of the

uncertainty factors that were applied to the toxicity data are currently not standard practice, but most of the uncertainty factors were removed when the less conservative exposure scenarios were presented. USEPA recently published Ecological Soil Screening Levels (Eco SSLs) for a few chemicals (USEPA, 2005). The Eco SSLs were developed for the following receptors; plants, invertebrates, mammals, and birds. Some of the exposure factors and toxicity data for mammals and birds in the Eco SSL document are different than those in the documents mentioned above but the differences are not expected to cause significant changes to the overall results of the risk assessments.

The benchmarks that were used to select ecological contaminants of concern (ECOCs) were obtained from different sources because there is no single document that contains criteria for all the chemicals that are typically detected in the media. The following paragraphs briefly discuss the primary sources of benchmarks that were used in the ERAs and whether or not they have been updated.

The primary source of surface water benchmarks was the Connecticut chronic WQSs. These criteria were last updated in December 2002 (CTDEP, 2002). Many of the WQSs are based on the USEPA AWQC, which were updated in 2006 (USEPA, 2006). Therefore, it is likely that the Connecticut WQSs will be updated in the future to reflect the changes in the USEPA AWQC. Other surface water benchmarks were based on the Ecotox Thresholds (USEPA, 1996a). Several of the values in the Ecotox Thresholds were updated (Suter and Tsao, 1996) since the publication of the Ecotox Thresholds. Toxicity data from the literature were used as benchmarks for chemicals that were not listed in the above documents.

The primary sources of sediment benchmarks were site-specific benchmarks that were based on equilibrium partitioning, using site-specific total organic carbon values, surface water benchmarks, and chemical-specific organic carbon partition coefficient (Koc) values. Because some of the surface water benchmarks were updated, some of the sediment benchmarks will change. Other sediment benchmarks that were used included the Effects Range-Low (ER-L) values (Long et al., 1995), the Sediment Quality Guidelines from the Ontario Ministry of Environment (OME, 1992), and the Washington State Freshwater Apparent Effects Thresholds (Washington State, 1994). The ER-L values have not been updated and are still being used as sediment benchmarks in current ERAs. The OME (OME, 1992) and Washington State (1994) documents were updated in 1993 (OME, 1993) and 1997 (Cubbage et al., 1997), respectively. Several of the values were revised in the updates.

For soil, benchmarks for plants were primarily obtained from Will and Suter (1994), and benchmarks for soil invertebrates were primarily derived from ECOSAR (USEPA, 1994a). The Will and Suter document was updated by Efroymson et al., (1997a). Also, Efroymson et al., (1997b) developed a screening benchmark document for earthworms that is currently being used for soil benchmarks. The plant

benchmarks in Efroymson et al. (1997a) are very similar to those in Will and Suter (1994). Efroymson et al. (1997b) has some earthworm benchmarks for chemicals that did not have values for ECOSAR. USEPA recently published Ecological Soil Screening Levels (Eco SSLs) for a few chemicals (USEPA, 2005). The Eco SSLs were developed for the following receptors; plants, invertebrates, mammals, and birds. In many cases, the plant and invertebrates values are similar to or greater than the plant and invertebrates benchmarks discussed above.

In general, most of the changes in the updated documents are not expected to significantly change the overall conclusions of the ERAs. Some of the benchmarks are lower in the updated documents, and some of the values are higher. Therefore, different chemicals may be retained as ECOCs during the screening if it was conducted at present. However, the decision to remediate a site is typically not based on screening benchmarks, because of the conservative nature of the benchmarks. A decision to remediate a site or decision on cleanup levels typically consists of other factors such as the collection of site-specific biological data (i.e., toxicity tests, biological surveys). The site-specific data would not be changed because of updates in the screening benchmarks.

## 1.5 REPORT ORGANIZATION

This report has been organized with the intent of meeting the general format requirements specified in the Comprehensive Five-Year Review Guidance document (USEPA, 2001a), and summarizing the results of the five-year review for the 21 IRP sites in a cohesive and comprehensive manner. Section 1.0 gives an overview of NSB-NLON and five-year review process, as well as a discussion of changes in ARARs and site-specific action levels. Sections 2.0 through 22.0 summarize the five-year reviews conducted for each of the individual sites. Section 23.0 provides a general summary, conclusions, and protectiveness statement for NSB-NLON. This section also identifies when the next five-year review is required and the other tasks that should be performed as part of that five-year review. Five appendices are included in this report. Appendix A contains inspection report checklists completed for O&M activities. Appendix B contains photographs of the sites. Appendix C contains the five-year review inspection checklists. Appendix D contains the NSB-NLON Land Use Restriction Instruction [SOPA (ADMIN) New London Instruction 5090.18C (Navy, 2006)].

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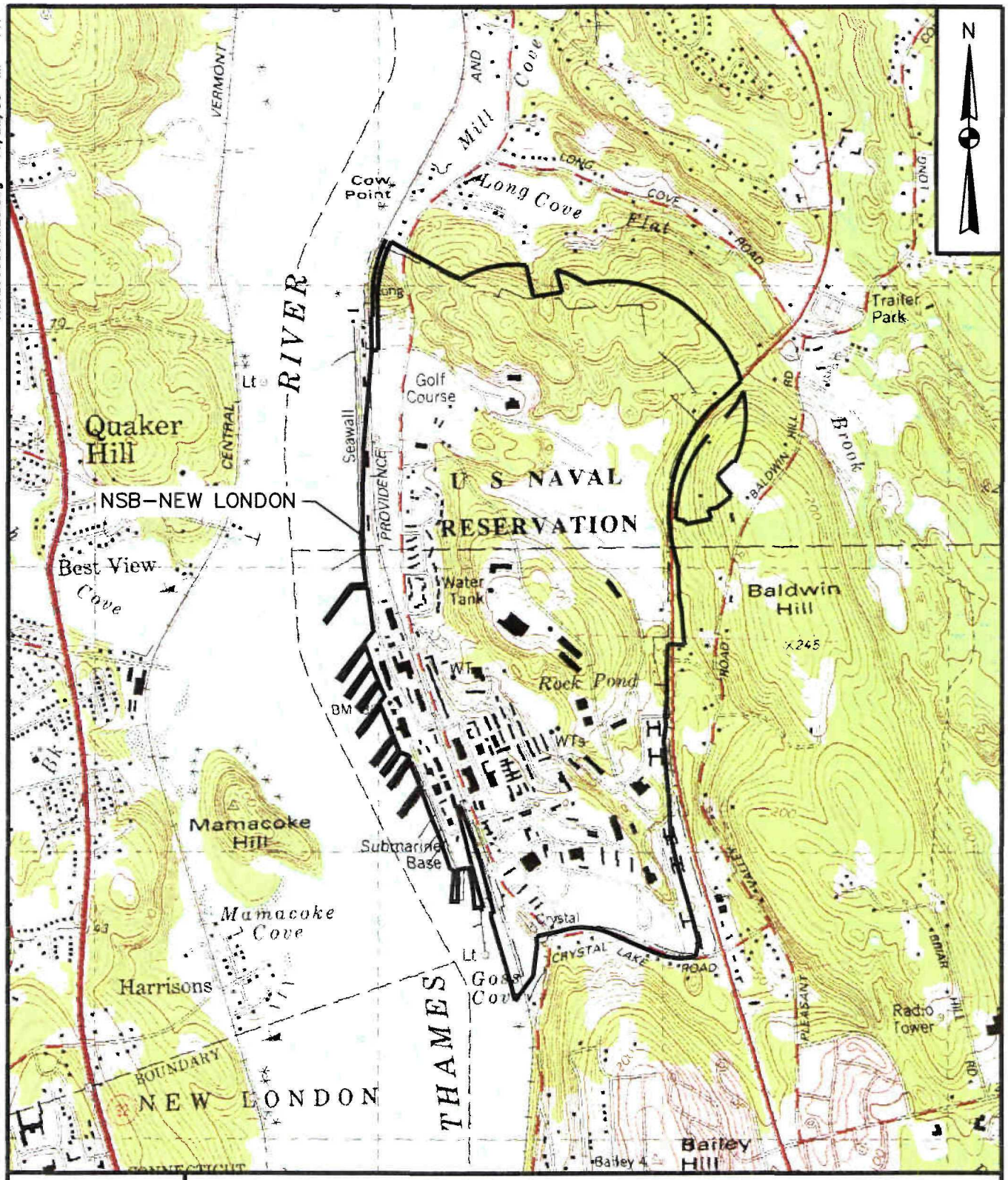

0 2000 4000
GRAPHIC SCALE IN FEET

SOURCE: USGS QUADRANGLE MAP UNCASVILLE, CONNECTICUT, 1984

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|---|---|---|---|
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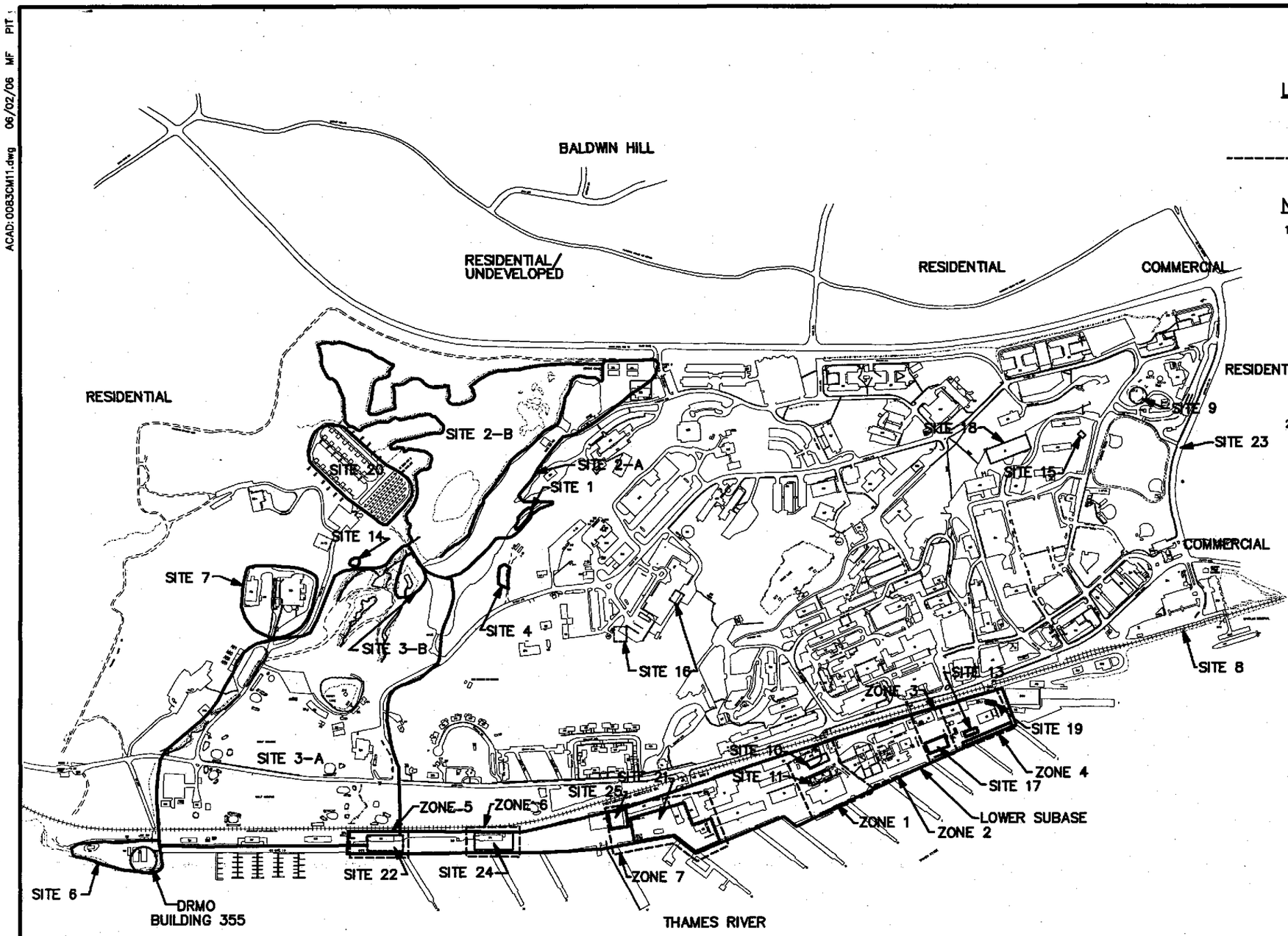
| CHECKED BY | DATE | FACILITY LOCATION MAP<br>NSB-NLON<br>GROTON, CONNECTICUT | OWNER NO. 038 |
| REVISED BY | DATE | | APPROVED BY / DATE |
| SCALE AS NOTED | | | DRAWING NO. FIGURE 1-1 / REV. 0 |

FORM CADD NO. TTNUS-AV.DWG – REV 1 –9/10/98

ACAD: 0083CM11.dwg 06/02/06 MF PIT 1




## LEGEND:

--------- LOWER SUBASE REMEDIAL INVESTIGATION ZONE BOUNDARY

## NOTES:

1. SITE AND STUDY AREA LOCATIONS WERE TAKEN FROM THE FOLLOWING REPORTS:
   - FEDERAL FACILITY AGREEMENT UNDER CERCLA 120, NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT
   - FINAL INITIAL ASSESSMENT STUDY (ENVIRODYNE, MARCH 1983)
   - HYDROGEOLOGIC INVESTIGATION UNDERGROUND STORAGE TANKS OT-4, OT-7, OT-8, OT-9, AND 54-H (FUSS & O'NEILL, SEPTEMBER 1989)
   - PHASE I REMEDIAL INVESTIGATION (ATLANTIC, AUGUST 1992)
   - SITE CHARACTERIZATION REPORT FOR OT-10, BUILDING 325, AND BUILDING 89 (HNUS, APRIL 1995)
   - DRAFT FINAL SUPPLEMENT TO INITIAL ASSESSMENT STUDY (NAVAL FACILITIES ENGINEERING SERVICE CENTER, APRIL 1995)
   - REMOVAL SITE EVALUATION FOR QUAY WALL (HNUS, MAY 1995)
2. SITE AND STUDY AREA BOUNDRIES ARE APPROXIMATE.

SITE 1 – CONSTRUCTION BATTALION UNIT (CBU) DRUM STORAGE AREA
SITE 2 – (A) AREA A LANDFILL AND (B) AREA A WETLAND
SITE 3 – (A) AREA A DOWNSTREAM WATER COURSES AND (B) OVERBANK DISPOSAL AREA (OBDA)
SITE 4 – RUBBLE FILL AREA AT BUNKER A-86
SITE 6 – DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO)
SITE 7 – TORPEDO SHOPS
SITE 8 – GOSS COVE LANDFILL
SITE 9 – OILY WASTEWATER TANK (OT-5)
SITE 10 – LOWER SUBASE-FUEL STORAGE TANKS AND TANK 54-H
SITE 11 – LOWER SUBASE-POWER PLANT OIL TANKS
SITE 13 – LOWER SUBASE-BUILDING 79 WASTE OIL PIT
SITE 14 – OVERBANK DISPOSAL AREA NORTHEAST (OBDANE)
SITE 15 – SPENT ACID STORAGE AND DISPOSAL AREA (SASDA)
SITE 16 – HOSPITAL INCINERATORS
SITE 17 – HAZARDOUS MATERIALS/SOLVENT STORAGE AREA (BUILDING 31)
SITE 18 – SOLVENT STORAGE AREA (BUILDING 33)
SITE 19 – SOLVENT STORAGE AREA (BUILDING 318)
SITE 20 – AREA A WEAPONS CENTER
SITE 21 – BERTH 16
SITE 22 – PIER 33
SITE 23 – FUEL FARM
SITE 24 – CENTRAL PAINT ACCUMULATION AREA (BUILDING 174)
SITE 25 – LOWER SUBASE-CLASSIFIED MATERIALS INCINERATOR

0 800 1600
GRAPHIC SCALE IN FEET

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

| | | | |
|---|---|---|---|
| DRAWN BY MF | DATE 5/19/06 | Tetra Tech NUS, Inc. | SITE LOCATION MAP NSB-NLON GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

CONTRACT NO. 0083
OWNER NO. 038
APPROVED BY CAR DATE 6/9/06
DRAWING NO. FIGURE 1-2 REV. 0

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

# 2.0 SITE 2 – AREA A LANDFILL (OU1 AND OU9) AND AREA A WETLAND (OU12)

Site 2 under the Navy's IRP includes the Area A Landfill and Area A Wetland. Both parts of Site 2 are addressed in this section; however, they are reviewed independently because decision documents and remedial actions are being completed independently.

This five-year review of the Area A Landfill portion of Site 2 is required by statute because hazardous substances, pollutants, or contaminants remain on site that do not allow for unlimited use or unrestricted exposure. A remedial action for the Area A Landfill soil OU (OU1) was completed in September 1997. The site has been monitored since the remedial action was completed to assess its effectiveness. As of this second 5-year review, the groundwater OU, a portion of OU9, has been monitored for 5 years and the landfill cap has been inspected annually for 3 years. Data collected during the monitoring and inspection programs are evaluated within this report.

No decision documents have been prepared for the Area A Wetland portion of Site 2. The sediment in the Area A Wetland was designated as OU12. This site is still being investigated under CERCLA. The need for remedial actions at the Area A Wetland will be determined in the future.

## 2.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 2 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

**AREA A LANDFILL**

| Event | Date |
|---|---|
| Landfill operations. | 1957 to 1973 |
| Final IAS completed. | March 1983 |
| Verification Step 1A Study. | February 1988 |
| Phase I RI completed. | August 1992 |
| Remedial Design for OU1 began. | 1994 |
| Focused FS finalized. | May 1995 |
| Proposed Plan for OU1 issued. | June 1995 |
| Public Meeting for OU1. | June 1995 |
| ROD for OU1 signed. | September 1995 |
| Remedial Design for OU1 completed. | December 1996 |
| Remedial Action for OU1 began. | December 1996 |
| Phase II RI finalized. | March 1997 |
| Remedial Action for OU1 completed. | September 1997 |

| Event | Date |
|---|---|
| Final Report for Remedial Action at OU1 issued. | March 1998 |
| Final Groundwater Monitoring Plan issued. | January 1999 |
| Groundwater Monitoring Program initiated. | October 1999 |
| Final Year 1 Groundwater Monitoring Report (GMR) issued. | May 2001 |
| First Five-Year Review Report completed. | December 2001 |
| BGOURI completed. | January 2002 |
| Draft Final O&M Manual - Volumes I, III, IV, and V completed. | September 2002 |
| Year 2 GMR for Area A Landfill issued. | December 2002 |
| SOPA (ADMIN) New London Instruction 5090.18B issued. | February 2003 |
| Draft O&M Manual - Volume II issued. | March 2003 |
| Year 3 GMR issued. | July 2003 |
| 2003 Annual Landfill Inspection Report (LIR) issued. | November 2004 |
| Year 4 GMR issued. | December 2004 |
| 2004 Annual LIR issued. | September 2005 |
| Year 5 GMR issued. | August 2005 |
| 2005 Annual LIR issued. | October 2005 |
| Final O&M Manual - Volumes I, II, III, IV, and V completed. | January 2006 |
| SOPA (ADMIN) New London Instruction 5090.18C issued. | December 2006 |

**AREA A WETLAND**

| Event | Date |
|---|---|
| Wetland created with Thames River dredge spoils. | 1950s |
| Phase I RI completed. | August 1992 |
| Phase II RI completed. | March 1997 |
| First Five-Year Review Report completed. | December 2001 |
| BGOURI completed. | January 2002 |

## 2.2 BACKGROUND

### 2.2.1 Area A Landfill

The Area A Landfill is a relatively flat area bordered by a steep, wooded hillside that rises to the south, a steep wooded ravine to the west, and the Area A Wetland to the north. Figure 2-1 shows a site plan of the Area A Landfill. The location of Site 2 relative to other IR sites is shown on Figure 1-2.

According to the IAS Report (NEESA, 1983), the landfill opened sometime before 1957. However, a 1957 aerial photograph shows no apparent landfilling, which may indicate a somewhat later start-up date. All combustible materials generated by base operations that were not salvageable were incinerated, and the residues were disposed in the DRMO, Goss Cove, and Area A Landfills. The base incinerator, which was located in the Lower Subase along the waterfront at the present location of Building 478, ceased

operation in 1963. From 1963 to 1973, refuse and debris were disposed in the Area A Landfill. Landfilling operations ceased in 1973. The thickness of the landfill materials is estimated to range from 10 to 20 feet, based on test boring data.

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

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

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

A two-phase RI was conducted to determine the nature and extent of contamination at the Area A Landfill. Phase I RI field activities were conducted from 1990 to 1992 (Atlantic, 1992). The Phase I RI of the Area A Landfill included test borings, monitoring well installation, and soil and groundwater sampling. Landfill materials encountered included glass, brick, wood, plastic, and ash intermixed with sand and gravel material used as cover. The Phase I RI concluded that risks associated with several exposure

scenarios exceeded acceptable regulatory levels and that a FS should be performed for the Area A Landfill site.

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

A low-permeability cover system was designed and installed on the Area A Landfill as the remedial action for soil at the site. Investigations were conducted to support the design of the cover system. Installation of the cover system was completed in September 1997. The CBU Drum Storage Area (Site 1) and the Rubble Fill Area at Bunker A-86 (Site 4) were also addressed during the remedial action at the Area A Landfill. The CBU Drum Storage Area (Site 1), formerly located within the boundary of the Area A Landfill, was capped at the same time as the landfill, and an NFA Decision Document was signed for Site 1. The Rubble Fill Area at Bunker A-86 (Site 4) was located along the southern boundary of the Area A Landfill. Construction debris and contaminated soil and sediment from the site were removed as part of a time-critical removal action and incorporated into the Area A Landfill subgrade. After the removal action, only exposed bedrock was left at the former Rubble Fill Area at Bunker A-86. An NFA Decision Document was also signed for this site. A majority of the Area A Landfill is paved and is currently used for storage of equipment and vehicles. Access by military personnel to most of the site is unrestricted.

The groundwater at the Area A Landfill is currently being monitored under a long-term groundwater monitoring program. The groundwater at the site was also investigated as part of the BGOURI. A final version of the BGOURI Report was issued in January 2002 (TtNUS, 2002a). The BGOURI recommended that the monitoring program be continued to gather data to evaluate long-term trends in contaminant concentrations and the decision to proceed to an FS should be made after sufficient data have been collected and evaluated.

### 2.2.2 Area A Wetland

The Area A Wetland is located north of the Area A Landfill (see Figures 1-2 and 2-2). The location of the Area A Wetland was undeveloped, wooded land and possibly wetland until the late 1950s. In the late 1950s, dredge spoils from the Thames River were pumped to this area and contained within an earthen dike that extends from the Area A Landfill to the southern side of the Area A Weapons Center.

The Area A Wetland is underlain by dredge spoils that consist of silt and clay with traces of fine sand and shell fragments. The thickness of dredge spoils ranges from 25 to 35 feet on the southern side of the wetland, adjacent to the landfill, and from 10 to 15 feet on the northeastern side of the wetland. The total volume of dredged material in the wetlands is approximately 1.2 million cubic yards.

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

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

Phase II RI field investigation activities were conducted from 1993 to 1995 (B&RE, 1997a). The Phase II RI of the Area A Wetland included test borings, monitoring well installation, and sediment, surface water, and groundwater sampling. The Phase II RI concluded that little surface water or groundwater contamination exists at the site, the site may pose a risk to a construction worker due to potential exposure to manganese in the groundwater, and significant pesticide, PCB, and polynuclear aromatic hydrocarbon (PAH) concentrations exist in site soil and sediments. The recommendations in the Phase II RI indicated that an FS should be conducted for this site that evaluates a limited action alternative including groundwater monitoring and access/use restrictions. The Area A Wetland sediment was subsequently identified as OU12 and the site is still be investigated under CERCLA.

## 2.3 REMEDIAL ACTIONS

Based on the results of the RI/FS process, it was determined that a remedial action was necessary for the Area A Landfill OU1. A ROD for OU1 was signed in September 1995 (Navy, 1995). The following sections describe the process used to select and implement the appropriate remedial action for OU1 at the Area A Landfill.

The groundwater OU for the Area A Landfill (a part of OU9) is still being investigated, and final recommendations for the OU will be determined when sufficient data are collected and evaluated.

The Area A Wetland (OU12) is still being investigated, and no remedial alternatives have been developed for the site; therefore, the Area A Wetland is not discussed in the following sections.

### 2.3.1 Remedy Selection

An FFS for the Area A Landfill (Atlantic, 1995c) was completed in response to the recommendations of the Phase I and Phase II RIs. The FFS evaluated several remedial alternatives, and concluded that the off-site disposal and off-site incineration alternatives would provide superior protection of the environment, but that the capping alternative would be more cost effective than the incineration alternative. The capping alternative was selected as the preferred remedial alternative for OU1 at the Area A Landfill. The alternative was presented in the Proposed Plan in June 1995 and was formally selected in the ROD signed in September 1995.

Based on ARARs and risk assessment results, the following remedial action objectives (RAOs) were selected for OU1 at Area A Landfill:

- Protect potential human and ecological receptors from exposure to contaminated soil.
- Reduce contaminant migration from the site by preventing exposure of contaminated soils to wind and erosive elements and by preventing infiltration of rainwater through contaminated areas of the unsaturated zone.

To meet the RAOs, the selected remedy for the Area A Landfill, as defined in the ROD, consisted of the following components:

- Access Restrictions – Access to contaminated areas of the site was to be limited via perimeter fencing and institutional controls. Access was to be limited to workers and other persons having business in these areas. The institutional controls would provide notice of hazardous materials at the site and ensure maintenance of cap integrity, worker protection, and other considerations.

- Site Grading and Stormwater Management – As part of the cap installation process, the site was to be graded to promote runoff and prevent run-on. In addition, a groundwater interception system was to be installed to collect shallow groundwater flowing to the landfill and reroute it around the landfill to reduce groundwater contact with landfill contents/soils.

- Horizontal Barrier Cap Installation – A low-permeability cap, covering approximately 13 acres, was to be installed over contaminated areas of the Area A Landfill. The components of the cap system were to vary depending on location. The final cover system in the plateau areas was to consist of the following components in ascending order: bedding/gas collection layer, geosynthetic clay liner and

geomembrane, drainage layer/subbase, woven geotextile, base course, and bituminous concrete surface course. The final cover system along the side slope areas was to consist of the following components in ascending order: bedding/gas collection layer, non-woven geotextile, cohesive backfill, textured geomembrane, drainage layer, non-woven geotextile, and riprap.

- Leachate Collection and Treatment – A leachate collection system was to be considered to stabilize the cap and to further contain landfill wastes. The system was to isolate and collect leachate for treatment and/or disposal. A pre-design study was to be completed to determine the need for such a system and, if necessary, the type of system that would be required.

- Post-Closure Groundwater Monitoring – The groundwater at the site was to be monitored after the installation of the cap system to assess the impacts of the cap system. The results were to be used to determine the need for groundwater remediation.

### 2.3.2 Remedy Implementation

The Remedial Design for OU1 began in 1994 and was completed for the Navy by two different contractors, Atlantic and Brown and Root Environmental (B&RE). Additional field work (i.e., field survey, geotechnical field investigation, and geotechnical laboratory testing program) was conducted to collect the data necessary to complete the design. An extensive groundwater modeling study was also completed to address design issues (i.e., leachate collection system, slope stability, etc.). The remedial design was completed in phases and was finalized in December 1996 (B&RE, 1996b).

The final cover system developed during the design included a majority of the components of the system included in the ROD. Minor modifications were made as a result of normal refinement of details during the design. The two most significant modifications were the following:

- No leachate collection system
- Increased protection at the toe of the side slope area

The decision for not including a leachate collection system was based on the results of the groundwater modeling study. For the design, the riprap layer at the toe of the side slope was replaced with a gabion basket system to provide increased resistance to shallow-based stability failures at the toe of slope and to prevent potential hydrostatic uplift on the low-permeability component of the side slope cap system. A comparison of the ROD and design cap components is provided below.

**Plateau Areas**

| Cap Components in ROD | Cap Components in Final Design |
|---|---|
| • Bedding/gas collection layer | • Granular bedding/gas management layer (12-inch-thick) and passive gas vent system |
| • Geosynthetic clay liner and geomembrane | • Geosynthetic clay liner and 40-mil low-density polyethylene (LDPE) geomembrane |
| • Drainage layer/subbase | • Granular drainage layer (12-inch-thick) |
| • Woven geotextile | • Woven geotextile |
| • Base course | • Base course (6-inch-thick) |
| • Bituminous concrete surface course | • Bituminous concrete (3-inch-thick) |

**Side Slope Areas**

| Cap Components in ROD | Cap Components in Final Design |
|---|---|
| • Bedding/gas collection layer | • Granular bedding/gas management layer (12-inch thick) and passive gas vent system |
| • Non-woven geotextile | • Non-woven geotextile |
| • Cohesive backfill | • Cohesive backfill (6-inch thick) |
| • Textured geomembrane | • 40-mil LDPE textured geomembrane |
| • Drainage layer | • Granular drainage layer (12-inch thick) |
| • Non-woven geotextile | • Non-woven geotextile |
| • Riprap | • Riprap (12-inch thick)/gabion basket system |

The Navy's Remedial Action Contractor (RAC) mobilized to the site to begin preliminary construction activities in December 1996, and the remedial action was completed in September 1997. Details regarding the remedial action are summarized in the Final Remedial Action Report (B&RE, 1998c). The most significant change that occurred during the implementation of the remedial action was the inclusion of soil and debris excavated from Site 4 (OU10) under the cap. This change resulted in a 2.8-foot elevation increase in one area of the landfill that necessitated modifications to the cover system that was installed, primarily to the slopes of three drainage channels.

To ensure the quality of the remedial action, quality control testing and inspection were completed during the remedial action in accordance with the Construction Quality Control (CQC) Plan and the Material Quality Assurance (MQA)/Construction Quality Assurance (CQA) Plan. Two non-conformances were noted during quality control testing and inspection, but neither were regarded as significant enough to affect the performance of the cap system.

The cost estimate for implementation of the preferred remedial alternative was estimated at $5,700,000 in the ROD. This estimate included costs associated with a groundwater collection and treatment system, cap O&M, and groundwater monitoring. A revised estimate was prepared during the remedial design that included only construction costs. The estimated cost for implementation of the remedial design was approximately $4,500,000. This estimate did not include costs associated with a groundwater collection and treatment system, cap O&M, or groundwater monitoring. The actual final cost for implementation of the remedial design was approximately $6,000,000. The major reason for the cost increase was the removal action that was completed at Site 4 (OU10) concurrent with the implementation of the OU1 remedial design.

To meet the land use control requirements in the ROD, the Navy prepared and implemented an instruction [SOPA (ADMIN) New London Instruction 5090.18 (Navy, 2000b)] to restrict use at IR sites at NSB-NLON. The instruction defined the Navy's policy regarding ground surface disturbance of soils or any subsurface disturbance of soils and/or groundwater at IR sites.

Other components of the remedial action, including long-term groundwater monitoring and O&M, are discussed in Section 2.3.3.

### 2.3.3 System Operations/Operation and Maintenance

#### 2.3.3.1 Monitoring Program

The Navy implemented a monitoring program for groundwater and surface water at the Area A Landfill in October 1999. The results of the program are being used to assess the effectiveness of the remedial action. Sampling was completed at the site in accordance with the final Groundwater Monitoring Plan for Area A Landfill (TtNUS, 1999a) from the initiation of the program through 2005. Future sampling activities at the site will be done in accordance with Volume II – Groundwater Monitoring Plan of the O&M Manual (TtNUS, 2006a).

Monitoring at the Area A Landfill was initially conducted quarterly, and then during Year 3, the monitoring frequency was reduced to semi-annually. Round 10 was the final quarterly sampling round, and Round 11 was the first semi-annual round. Groundwater and surface water samples collected under the original monitoring plan were analyzed for VOCs, semivolatile organic compounds (SVOCs), PAHs, PCBs, metals (total and dissolved), and water quality parameters [total organic carbon (TOC), chemical oxygen demand (COD), total dissolved solids (TDS), alkalinity, chloride, sulfate, and hardness]. Samples collected under the new monitoring program will be analyzed for SVOCs, PAHs, metals (total and dissolved), and water quality parameters [TDS, alkalinity, total suspended solids (TSS), and hardness].

Five annual reports (TtNUS, 2001b; TtNUS 2002f; TtNUS, 2003b; ECC, 2004e; and ECC, 2005f) have been issued that summarize the results of the monitoring program. The annual reports include a thorough evaluation of each year of data collected under the program. Numerous round-specific reports have also been prepared to document the results of the monitoring program. The round-specific reports provide a brief screening-level assessment of the sampling round data. All of the monitoring reports have been submitted to the USEPA and CTDEP for review and comment. The results of the monitoring program during this five-year review period are discussed in Section 2.5.2.1.

#### 2.3.3.2 Operation and Maintenance

The Navy issued a draft O&M Manual for the IR Program Sites at NSB-NLON, which included Area A Landfill, in September 2002 (TtNUS, 2002c). Volume III of the five-volume manual included site-specific instructions for O&M activities and an inspection checklist for the Area A Landfill. Due to an extended comment resolution period, O&M inspections of the Area A Landfill were conducted from 2003 through 2005 (3 years) in accordance with the draft O&M Manual. The O&M Manual was finalized in 2006 (TtNUS, 2006a), and it will provide the basis for future O&M activities at Area A Landfill.

The O&M process for the site includes annual inspections, reporting of results, and correcting any identified problems. The findings of the inspections are documented in the field on inspection checklists and then summarized in Annual LIRs (ECC, 2004b; ECC, 2005i; and ECC, 2005m). The inspections of the landfill focus on institutional controls, landscaping features, cap areas, stormwater features, and housekeeping and maintenance. Deficiencies noted during the inspections are addressed through the preparation of a Plan of Action and then executing the Plan of Action. Typically the inspections are conducted in the fall, and corrective actions are completed during the following summer. The results of three inspections conducted during this five-year review period are discussed in Section 2.5.2.2.

## 2.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of the Area A Landfill. The recommendations from the First Five-Year Review Report are provided below along with the actions taken to address the recommendations.

<u>Prepare and implement an O&M plan for the Area A Landfill to address the noted deficiencies.</u>

- A draft O&M Manual for the IR Program Sites at NSB-NLON, which included Area A Landfill, was issued on September 2002. Due to an extended comment resolution period, O&M activities were conducted from 2003 through 2005 (3 years) in accordance with the draft O&M Manual. The O&M Manual was finalized in 2006 and will provide the basis for future O&M activities at Area A Landfill.

- The deficiencies included lack of maintenance of vegetation, sediment, and asphalt cracks; improper storage of heavy equipment on the cap; lack of maintenance of monitoring wells; and lack of correction of a depression in the riprap along the toe of the landfill. The actions taken to address the deficiencies were as follows:

  - Unwanted vegetation in cracks, drainage channels, gabion baskets, and other areas on the landfill was addressed in August and September 2004 and July 2005. Herbicide was applied to some of the vegetation, and other vegetation was cut and removed.

  - Approximately 5,000 linear feet of cracks in the cap pavement were sealed with an asphalt sealant in December 2004. In July 2005, similar lengths of cracks were sealed, and holes in the pavement were filled with cold patch asphalt.

  - Sediment, vegetation, and debris were removed from the drainage channels in August and September 2004 and July 2005.

  - Limited progress has been made toward proper storage of heavy equipment on the cap. The Navy is considering various options to implement better housekeeping practices.

  - Limited maintenance has been performed on the monitoring wells that are part of the Groundwater Monitoring Program and located within the vicinity of the Area A Landfill. Routine maintenance has not been conducted on the monitoring wells at the Area A Landfill that are not included in the monitoring program.

  - No correction of the depression has been made. Subsequent inspections indicated that the stone and gabion systems appeared to be in good condition, and no mention was made of a depression in riprap.

  - Damaged fencing around the Deployed Parking Lot was repaired in October 2004.

<u>Continue the Groundwater Monitoring Program, but optimize the sampling frequency and analytical parameter list. Determine the appropriate remedial action for the groundwater OU, if necessary, when sufficient data have been collected.</u>

- By comparing the original Groundwater Monitoring Plan (TtNUS, 1999a) to the new plan included in Volume III of the O&M Manual (TtNUS, 2006a), the following steps have been taken to optimize the monitoring program at Area A Landfill:

  - The sampling frequency of the monitoring program has been reduced from quarterly to semi-annually.

  - VOCs, PCBs, pesticides, and some water quality parameters (COD, sulfate, and TOC) have been removed from the analytical parameter list.

  - Surface water sampling at 6 of the 10 staff gauges (SG15, SG16, SG17, SG-18, SG-22, and SG-24) has been discontinued.

  - Groundwater sampling at 6 of the 16 monitoring wells (3MW12S, 2WMW38DS, 2WMW39DS, 2WMW41DS, 2WMW45DS, and 2WMW47DS) has been eliminated from the monitoring program.

  - An existing monitoring well (2LOW1D) that is completed in alluvium will be added to the program to better monitor potential contaminant migration from the site.

- A geochemical investigation was completed during Year 3 of the monitoring program to better understand the geochemistry of the local groundwater. The results indicated that the dredge spoils, and not the landfill waste material, significantly influence the geochemistry of the groundwater and concentrations of metals in groundwater downgradient (north) of the landfill.

- The BGOURI (TtNUS, 2002a), which included evaluation of the groundwater from the Area A Landfill, was completed. It was recommended that additional groundwater data be collected at the site under the monitoring program before a remedial action is selected for the groundwater OU.

<u>Considering further restricting access to the site.</u>

- Signs were posted with the name and telephone number of the contact authority for persons requesting access to the site. No additional restrictions on site access have occurred. Due to the restrictive access to the base itself, it was determined that locking the gates at the landfill was not a major concern.

Continued enforcement of New London Instruction 5090.18.

- The instruction was updated to include the Goss Cove Landfill and was re-issued in 2003 (Instruction 5090.18B). The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information for Site 2 - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON.

- The instruction has been followed by personnel at NSB-NLON, and no significant disturbances of the soil or cap at the Area A Landfill have occurred.

Complete the RI/FS process for the Area A Wetland and determine the appropriate remedial action(s).

- No progress has been made in the RI/FS process for the Area A Wetland.

## 2.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 2.5.1 Document Review

The documents reviewed for the second five-year review are listed below, and key information obtained from the documents is summarized in the following sections.

| | |
|---|---|
| Final BGOURI | January 2002 |
| Year 2 GMR for Area A Landfill | December 2002 |
| Year 3 GMR for Area A Landfill | July 2003 |
| 2003 Annual LIR | November 2004 |
| Year 4 GMR for Area A Landfill | December 2004 |
| Year 5 GMR for Area A Landfill | August 2005 |
| 2004 Annual LIR | September 2005 |
| 2005 Annual LIR | October 2005 |
| Final O&M Manual, Volumes I, II, and III | January 2006 |
| SOPA (ADMIN) New London Instruction 5090.18C | December 2006 |

### 2.5.2 Data Review

#### 2.5.2.1 Monitoring Data Review

Groundwater and surface water monitoring are being conducted as part of post-closure activities associated with Site 2 to evaluate the effectiveness of the remedial action. The monitoring program was designed to determine the following:

- The effectiveness of the remedial action in preventing the migration of COPCs at concentrations greater than the monitoring criteria to underlying groundwater and to surface water in nearby wetlands.
- The effectiveness of the remedial action in eliminating health risks.
- Whether the criteria used for evaluating the data have been met.
- Whether a groundwater plume exists and/or interferes with any existing use of groundwater.

The ultimate goal of the monitoring program is to show compliance with the selected monitoring criteria for those COPCs migrating or having the potential to migrate from the site. The criteria used to screen the data are a combination of CTDEP SWPC, federal AWQC, Connecticut WQSs, and background concentrations.

Data from Years 2 through 6 of the monitoring program are presented and evaluated in this Second Five-Year Review Report. The results of Year 1 of the program were presented in the First Five-Year Review Report (TtNUS, 2001). It should be noted that monitoring wells 3MW12S and 3MW12D were sampled during Year 1 but were destroyed during the remedial action at the Area A Downstream site. Well 3MW12D was replaced during Year 3 and was again sampled starting with Round 11.

Year 2

Four quarterly rounds of sampling (Rounds 5, 6, 7, and 8) were conducted during 2000/2001 (Year 2). Figures 2-3 and 2-4 are tag maps that show groundwater and surface water data, respectively, that exceeded criteria during Year 2 of the monitoring program. The contaminants detected in groundwater in excess of criteria include benzo(a)pyrene, phenanthrene, arsenic, chromium, copper, lead, and zinc. The contaminants detected in surface water in excess of criteria include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, phenanthrene, arsenic, and zinc.

PAHs were not detected in groundwater and surface water samples at concentrations greater than criteria during Year 1. The more frequent detection of PAHs in excess of criteria during Year 2 may reflect the impact of the asphalt pavement that was placed over the landfill.

A statistical evaluation of the groundwater data from Year 2 indicated an increase in arsenic concentrations when comparing data from upgradient and downgradient of the landfill. The evaluation also indicated that no temporal increase in arsenic concentrations was evident over the four sampling rounds. The results of the monitoring efforts indicated that there were limited exceedances of criteria, but overall no significant contaminant migration is occurring.

Year 3

Two quarterly rounds of sampling (Rounds 9 and 10) and one semi-annual round of sampling (Round 11) were conducted during 2001/2002 (Year 3). Figures 2-5 and 2-6 are tag maps that show groundwater and surface water data, respectively, that exceeded criteria during Year 3 of the monitoring program. The contaminants detected in groundwater in excess of the criteria include arsenic, cadmium, chromium, copper, and zinc. The contaminants detected in surface water in excess of criteria include phenanthrene, arsenic, copper, lead, and zinc. PAHs were not detected as frequently in groundwater and surface water samples at concentrations greater than criteria as during Year 2.

A statistical evaluation of the data from Year 3 indicated that total xylenes, bis(2ethylhexyl)phthalate (BEHP), arsenic, cadmium, chromium, copper, and zinc are present in downgradient groundwater at statistically greater concentrations than in upgradient groundwater. Further evaluation of the results (criteria comparisons and trend analysis) indicated that these contaminants do not pose any significant migration issues.

A geochemical investigation completed during Year 3 provided conclusive evidence that the slightly elevated arsenic concentrations detected in the downgradient monitoring wells in the Area A Wetland, which were completed in dredge spoils, are related to the dredge spoils and not the landfill. It is also likely that the elevated zinc levels are related to the dredge spoils as well as background conditions.

The geochemical investigation also indicated that the pore water in the dredge spoil is generally isolated from the local groundwater flow system. This conclusion was based on measured hydraulic conductivities (vertical and horizontal) and the observation that the dredge spoil pore water retains strong signatures of seawater. Therefore, the monitoring results do not indicate that the Area A Landfill is acting as a significant source of contamination to groundwater or surface water.

In addition, the annual statistical evaluations of the data indicated no temporal increase in arsenic concentrations over the sample rounds. Some of the other inorganics detected at elevated concentrations in downgradient dredge spoil wells are also probably related to the dredge spoils, but their concentrations are similar to background concentrations.

The results of the surface water/seep sampling efforts generally confirmed the groundwater monitoring results and indicated that no significant contaminant migration is occurring.

Year 4

Two semi-annual rounds of sampling (Rounds 12 and 13) were conducted during 2003 (Year 4). Figures 2-7 and 2-8 are tag maps that show groundwater and surface water data, respectively, that exceeded criteria during Year 4 of the monitoring program. The contaminants detected in groundwater in excess of criteria include phenanthrene, arsenic, copper, lead, and zinc. The contaminants detected in surface water in excess of criteria include benzo(b)fluoranthene, benzo(k)fluoranthene, phenanthrene, arsenic, chromium, copper, lead, and zinc.

A statistical evaluation of data from Year 4 indicated that benzo(a)anthracene, phenanthrene, arsenic, chromium, and lead had downgradient results that were statistically greater than upgradient concentrations. Further evaluation of the results (criteria comparisons and trend analysis) did not indicate that these contaminants pose any significant migration issues. Overall, the results of Year 4 monitoring indicated that the cap system was working properly and that significant contaminant migration from the site to surrounding areas was not occurring.

Year 5

Two semi-annual rounds of sampling (Rounds 14 and 15) were conducted during 2004 (Year 5). Figures 2-9 and 2-10 are tag maps that show groundwater and surface water data, respectively, that exceeded criteria during Year 5 of the monitoring program. The contaminants detected in groundwater in excess of the criteria include arsenic, chromium, copper, lead, and zinc. The contaminants detected in surface water in excess of criteria include arsenic, cadmium, chromium, copper, lead, and zinc.

A statistical evaluation of the data from Year 5 indicated that chromium and copper had downgradient results that were statistically greater than upgradient concentrations. Further evaluation of the results (criteria comparisons and trend analysis) did not indicate that these contaminants pose any significant migration issues. The results of Year 5 are generally similar to the results of the first four years of groundwater monitoring, although detected concentrations and frequencies of detection were of a smaller magnitude. Overall the results of Year 5 monitoring indicated that the cap system was working properly and significant contaminant migration from the site to surrounding areas was not occurring.

Year 6

The final Year 6 monitoring report was not available at the time of preparation of this report. The results from the first of two semi-annual rounds of sampling (Rounds 16 and 17) conducted during 2005 (Year 6) were available. Figures 2-11 and 2-12 are tag maps that show Round 16 groundwater and surface water data, respectively, that exceeded criteria (ECC, 2006b). The contaminants detected in groundwater in excess of criteria include arsenic, chromium, and lead. The contaminants detected in surface water in excess of criteria include arsenic, cadmium, chromium, copper, lead, and zinc. No conclusions or recommendations were available for Year 6 of the monitoring program.

#### 2.5.2.2 O&M Data Review

Inspections are being conducted as part of post-closure O&M activities associated with Site 2. The goal of the inspections is to determine if appropriate O&M is being performed to maintain the effectiveness of the remedial action. As indicated in the table below, three inspections have been performed at Site 2 since the cap system was installed. All of the inspections were performed during the period being evaluated in this second five-year review. The findings of the annual inspections are summarized below.

| Year | Date of Initial Inspection | Date of Supplemental Inspection | Final Report Date |
|---|---|---|---|
| 2003 | June 4, 2003 | November 4, 2003 | November 2004 |
| 2004 | December 29,2004 | April 26, 2005 | September 2005 |
| 2005 | October 11, 2005 | NA | October 2005 |

NA – Not Applicable

2003

A copy of the completed 2003 Inspection Checklist for Area A Landfill is provided in Appendix A. The inspection showed that the landfill was in generally good condition and was functioning as designed and meeting the long-term remedial objectives. However, the following housekeeping and maintenance deficiencies were noted during the inspection:

- Damaged fence sections at the Deployed Parking Area.
- Inadequate site security, including gates not closed and locked and signs that did not indicate contact authority (name and phone number).
- Vegetated/grass areas in the western and southern portions of the site were not stabilized.

- Significant cracking and separation of asphalt along paving lane joints.

- Vegetation and wind-blown trash present in the gabion system.

- Sediment, debris, and vegetation have accumulated in the drainage channels and culverts, causing obstruction of surface water flow.

- Equipment and materials are not properly stored on the landfill and have caused minor damage to the asphalt surface.

- Monitoring wells 2LMW20S, 2WMW44DS, 3MW37S, and 4MW1S have road boxes that do not fasten or have cracks in the surrounding concrete.

A Plan of Action was prepared to document the steps to be taken to address the identified deficiencies. Corrective actions were implemented to address the deficiencies, and these actions are discussed in Section 2.4. The corrective actions were implemented in August, September, and December of 2004. The extent of the corrective actions was limited to the level of funding available for the fiscal year.

<u>2004</u>

A copy of the completed 2004 Inspection Checklist for Area A Landfill is provided in Appendix A. The inspection showed that the landfill continues to be in generally good condition and was functioning as designed and meeting the long-term remedial objectives. However, similar to 2003, the following house keeping and maintenance deficiencies were noted during the inspection:

- Vegetation and grass in the western and southwestern portions of the site are encroaching on the asphalt cap.

- Significant cracking and separation of asphalt continue to be a problem along paving lane joints.

- Sediment, debris, and vegetation continue to accumulate and cause obstructions in the drainage channels and culverts.

- Equipment and materials are not properly stored on the landfill and have caused minor damage to the asphalt surface.

- Vehicles and heavy equipment stored on the cap are leaking fluids onto the cap, and there are no means for collecting or containing the leaks.

A Plan of Action was prepared to document the steps to be taken to address the identified deficiencies. Corrective actions were implemented in July 2005 to address most of the deficiencies, and these actions are discussed in Section 2.4. Similar to 2003, the extent of the corrective actions was limited by the level of funding available for the fiscal year.

2005

A copy of the completed 2005 Inspection Checklist for Area A Landfill is provided in Appendix A. The inspection showed that the landfill was in generally good condition and was functioning as designed and meeting the long-term remedial objectives. However, the following housekeeping and maintenance deficiencies were noted during the inspection:

- Significant cracking and separation of asphalt continue to be a problem along paving lane joints.

- Bulges in the asphalt surface have appeared in the Deployed Parking Area.

- Sediment, debris, and vegetation continue to accumulate and cause obstructions in the drainage channels and culverts (Drainage Channels A, B, C, and D).

- Equipment and materials continue to be improperly stored on the landfill and cause minor damage to the asphalt surface.

- Several of the monitoring wells have sediment and vegetation on them. Others are missing covers and are exposed to the elements.

- Gas vents do not have screens to restrict animal habitation.

A Plan of Action was prepared to document the steps to be taken to address the identified deficiencies. It is expected that the corrective actions will be implemented during the summer of 2006.

### 2.5.3 ARAR and Site-Specific Action Level Changes

The remedial action implemented for soil at the Area A Landfill includes an engineered cap system, land use controls, groundwater monitoring, and O&M. ARARs and TBCs were reviewed to determine whether there have been changes since the Remedial Design Report and final Groundwater Monitoring Plan were

issued. Listings of chemical-specific, location-specific, and action-specific ARARs, advisories and guidance (TBCs) that were considered in the ROD are listed in Tables 2-1, 2-2, and 2-3, respectively. With the exception of monitoring criteria, the ARARs have not been amended since the Remedial Design and final Groundwater Monitoring Plan. Changes associated with monitoring are addressed in the response to Question 2 of Section 2.6.

The ERA for the Area A Landfill indicated that chemicals detected in surface soil present a potential risk to ecological receptors. The site was subsequently capped, which eliminated the exposure pathway. Therefore, any changes in the screening values since the completion of the ERA would not impact the effectiveness of the remedial action.

### 2.5.4 Site Inspection

The Area A Landfill was inspected on April 4, 2006. The focus of the inspection was on the engineered cap system installed over the landfill. Weather conditions during the inspection were cold (mid-40s), overcast, and windy. Representatives from the Navy, USEPA, CTDEP, TtNUS, Environmental Chemical Corporation (ECC), and Gannett Fleming participated in the inspection. Photographs taken of site features during the inspection are provided in Appendix B. The site inspection checklist completed during the inspection is provided in Appendix C.

The site inspection included visual observations of the current condition of the engineered landfill cap system at Site 2. During the site inspection, the team found that the land use for the site has remained unchanged since the remedial action and first five-year review were completed. The Navy has continued to use the area for equipment storage and vehicle parking. Signs were observed during the inspection at the entrances to the site, warning that access is only for authorized users and that personnel should not dig at the site. In general, the site inspection found that the cap system was working as intended. However, even though the Navy has implemented an O&M program for Site 2 and corrective actions have been taken, a number of items were identified during the site inspection that if not addressed, could negatively affect the long-term performance of the cap system. These items are noted in the site inspection checklist provided in Appendix C and on Figure 2-1. The items and their potential long-term impacts on the cap system are as follows:

- Vegetation continues to grow along the edge of the asphalt covering the plateau, in cracks in the asphalt, and in the riprap covering the sideslopes. The root systems of the vegetation could penetrate the cap system.

- Sediment, debris, and vegetation (*Phragmites*) clog portions of the drainage channels (i.e., A, B, C, and D). The affected portions of the channels are shown on Figure 2-1. If the sediment and debris

are not removed, it may result in surface water overtopping the channels and flowing across the cap system. Continued *Phragmites* growth may result in the root system penetrating the cap because the roots can penetrate up to 2 meters.

- Two catch basins near the gate at Thresher Avenue are completely blocked with silt and debris. Surface water runoff typically collected by these catch basins is flowing across the landfill and discharging into Channel C. It appears that the off-site runoff is contributing to the debris buildup in Channel C. These catch basins should be cleaned out to minimize any further impacts to Channel C.

- Heavy equipment continues to be improperly stored on the cap, resulting in minor damage to the asphalt. The damage mainly consists of holes/penetrations in the asphalt that may allow surface water to enter the cap drainage layer. This could result in further deterioration of the asphalt during freeze-thaw cycles and underlying cap components.

- Stored items (e.g., concrete barriers, treated timbers, etc.) are blocking access to some of the monitoring wells. The wells cannot be inspected, maintained, or used for the groundwater monitoring program. Barriers should be placed around the monitoring wells to maintain access to them and to restrict storage of items on top of them.

- Longitudinal cracks continue to form in the asphalt. Several of the cracks fully penetrate the asphalt. Many of the cracks have been sealed, but if the new cracks are not sealed, surface water will penetrate the asphalt and further deteriorate the asphalt during freeze-thaw cycles.

- Monitoring wells that are not part of the groundwater monitoring program have not been maintained or properly abandoned. Two monitoring wells (2LMW8S and 2LMW20D) were found to be unprotected (i.e., no protective cover or j-plug), providing a direct conduit to the groundwater aquifer beneath the site.

- The small depression discovered in the riprap along the toe of the landfill at the northwestern corner during the first five-year review was still evident during the second five-year review. The area is shown on Figure 2-1. It appears that surface water runoff is channeled through this area, which may be causing erosion of material underlying the riprap. If the situation is not addressed, the long-term impact could be that the cap system is impacted in this location.

- Debris (e.g., concrete rubble and furniture) has been dumped on the site. The site was not intended to be used for waste disposal. It is unlikely that the debris will impact the functionality of the cap

system, but it should be removed and disposed at an approved off-site disposal facility (i.e., municipal landfill).

- The gas vents do not have screens. The screens will prevent habitation of animals in the vents and prevent unwanted material (e.g., trash) from being deposited in them.

### 2.5.5 Site Interviews

No official interviews were conducted as part of the second 5-year review. Relevant discussions with the inspection team regarding the site are documented on the site inspection checklist (see Appendix C).

## 2.6 ASSESSMENT

The following conclusions support the determination that the remedy for the Area A Landfill OU1 is currently protective of human health and the environment.

***Question 1. Is the remedy functioning as intended by the decision documents?***

- ***Remedial Action Performance:*** The engineered landfill cap system installed at the Area A Landfill is currently effective in limiting direct exposure to contaminated soil and minimizing contaminant migration from the site. A monitoring program is being conducted to evaluate the cap's performance regarding minimizing contaminant migration. The data do not indicate any significant contaminant migration concerns. If future groundwater data indicate the need to evaluate additional remedial actions, the Navy will perform the evaluation at that time. O&M of the cap began in 2003, and annual maintenance is being performed to maintain proper long-term performance of the cap system.

- ***System Operations/O&M:*** Installation of the engineered cap system was completed in September 1997. An O&M Manual was developed and implemented in 2003. The cap system is still functioning as intended, and O&M of the cap system is being performed annually at the site. The items noted in Section 2.5.4 should be addressed to improve the O&M of the site.

  Actual costs for the monitoring program have ranged from approximately $133,000 per year to $245,000 per year (see table below). Costs have generally decreased due to optimization of the monitoring program. The costs include the costs associated with sampling, analysis, validation, and reporting. Costs associated with preparing and updating the Groundwater Monitoring Plan and maintaining the groundwater monitoring wells are not included in the costs.

| Source | Cost of Monitoring |
|---|---|
| Projected Annual Cost in ROD | $125,000 |
| Actual Year 1 Cost (1999/2000) | $210,000 |
| Actual Year 2 Cost (2000/2001) | $245,000 |
| Actual Year 3 Cost (2001/2002) | $200,000 |
| Actual Year 4 Cost (2002/2003) | $133,000 |
| Actual Year 5 Cost (2003/2004) | $138,000 |
| Actual Year 6 Cost (2004/2005) | $151,000 |

The cost for annual O&M estimated during preparation of the ROD was $11,100. O&M of the cap system began in 2003, and costs have ranged from approximately $14,600 per year to $83,800 per year (see table below). Costs have fluctuated due to the amount of maintenance required and the amount of funding available. The annual O&M costs include the costs for landfill inspections, reporting, and maintenance.

| Source | Cost of O&M |
|---|---|
| Projected Annual Cost in ROD | $11,100 |
| Actual Year 1 Cost (2003) | $14,600 |
| Actual Year 2 Cost (2004) | $83,800 |
| Actual Year 3 Cost (2005) | $53,700 |

- ***Opportunities for Optimization:*** The sampling frequency of the monitoring program was reduced from quarterly to semi-annually. The monitoring frequency should be further reduced to annually. VOCs, pesticides, PCBs, and water quality parameters (TOC, sulfates, and COD) were eliminated from the analytical parameter list. Six monitoring wells and six surface water sampling locations were eliminated from the monitoring program.

- ***Early Indicators of Potential Issues:*** There were deficiencies noted during the O&M inspections of the cap system. Currently, the deficiencies do not compromise the protectiveness of the remedy, but if they are left unaddressed, they could result in remedy failure in the future.

- ***Implementation of Institutional Controls and Other Measures:*** Institutional controls associated with the Area A Landfill are being implemented in accordance with New London Instruction 5090.18C. Fencing is in place around the site, and signs are posted at the entrances of Site 2 warning that access is only for authorized users and that a cap is in place and no digging is allowed. These controls meet the intent of the access restriction RAO.

***Question 2. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?***

- ***Changes in Standards and TBCs***: ARARs and TBCs considered during preparation of the ROD were reviewed to determine changes since the Remedial Design and final Groundwater Monitoring Plan were issued. As presented in Section 2.5.3, there have been no changes to currently relevant ARARs with the exception of monitoring criteria.

  In the first Groundwater Monitoring Plan for the Area A Landfill (TtNUS, 1999a), Connecticut SWPC were identified as the primary monitoring criteria for the Area A Landfill and the lesser of the federal AWQC and the Connecticut WQSs were identified as the secondary criteria. The monitoring plan and criteria for the Area A Landfill were recently updated during finalization of the O&M Manual (TtNUS, 2006a). The following changes were noted between the plans:

  - Pesticides and PCBs were eliminated from the monitoring program in the new plan because the monitoring data showed that these contaminants were not detected during the first 10 rounds of monitoring. VOCs were eliminated from the monitoring program because the monitoring data showed that these contaminants were not detected or not present at significant concentrations.

  - The SWPC for phenanthrene (0.077 µg/L) in the 1996 CTDEP RSRs was found to be incorrect and was updated to 0.3 µg/L. This correction was confirmed with the CTDEP. None of the other SWPC for the COCs at the Area A Landfill have changed.

  - The Connecticut WQSs were updated in December 2002. The federal AWQC were updated in 2006, but it was determined that only the Connecticut WQSs should be used for the site into the future.

  - A comparison of the old and new criteria is presented in Table 2-4.

  The changes in criteria do not impact the protectiveness of the remedy.

- ***Changes in Exposure Pathways:*** There have been no changes at the site that would have resulted in new exposure pathways to human or ecological receptors.

- ***Changes in Toxicity and Other Contaminant Characteristics:*** There have been no changes in the human health toxicity criteria that will impact the primary or secondary monitoring criteria.

- ***Changes in Risk Assessment Methods:*** As discussed in Section 1.4, there have been no major changes in human health risk assessment methodology since the signing of the ROD that will impact the protectiveness of the remedy.

- ***Expected Progress Towards Meeting RAOs:*** The RAOs for OU1 were met by installing and maintaining the engineered cap system and conducting groundwater monitoring. RAOs for the groundwater at the Area A Landfill, a portion of OU9, will be defined in the future.

***Question 3. Has any other information come to light that could call into question the protectiveness of the remedy?***

No additional information has been identified that would call into question the protectiveness of the remedy.

## 2.7 ISSUES

Several O&M deficiencies were noted during the five-year review site inspection that should be resolved. The deficiencies are presented in Sections 2.5.4 and summarized in Table 2-5.

## 2.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Based on the results of the site inspection and review, the following recommendations are made for Site 2:

- Continue O&M of the site and address the O&M deficiencies noted in Sections 2.5.4 and 2.6.

- Install screens on every gas vent and add an additional jersey barrier for gas vents GVR-1 and GVR-11.

- Continue the monitoring program, but reduce sampling frequency to annually and further optimize the analytical parameter list, as appropriate. Develop and implement a well abandonment program to eliminate wells that are no longer required for the monitoring program. The wells that should be abandoned at Site 2 include 2LMW8S, 2LMW18S, 2LMW18D, 2LMW20D, and 2LMW34DS.

- Develop and implement an equipment storage plan that would organize storage, provide safe methods for storage of equipment on the cap, and eliminate storage of equipment on top of active monitoring wells.

- Select an appropriate remedial action for the groundwater OU and document the remedy in a Proposed Plan and ROD.

- Continue enforcement of New London Instruction 5090.18C. Continue control of the site by Command Masters at Arms, but consider further restricting access to the site to eliminate dumping of waste on the site.

- Complete the RI/FS process for the Area A Wetland and determine the appropriate remedial action(s).

- At least yearly monitoring of Institutional Control compliance with the monitoring reports incorporated into future five-year reviews.

- Amend O&M Manual to remove federal AWQC.

Follow-up actions should be completed by the Navy in a timely manner to address the recommendations.

## 2.9 PROTECTIVENESS STATEMENT

The remedy at the Area A Landfill is currently protective of human health and the environment. The source of contamination is contained. The engineered cap system minimizes infiltration and subsequent contaminant migration and prevents direct contact with soil. A monitoring program is being implemented to verify that the cap is performing as designed, and the results of the program suggest that the cap is performing as planned. Continued implementation of land use controls and O&M will maintain the effectiveness of the remedy into the future.

A protectiveness determination for the Area A Wetland cannot be made at this time because no remedy has been implemented. When a remedy has been selected and implemented for the Area A Wetland, its protectiveness will be determined.

**TABLE 2-1**

**CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 2 – AREA A LANDFILL OU1**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Requirement | Citation | Status | Requirement Synopsis | Current Status / Applicability |
|---|---|---|---|---|
| **FEDERAL** | | | | |
| USEPA Human Health Assessment Cancer Slope Factors (CSFs) | NA | TBC | CSFs are guidance values used to evaluate the potential carcinogenic hazard caused by exposure to contaminants. | The selected remedy prevents exposure to contaminated media and thereby minimizes human health concerns, although any changes to the cap in the future could allow exposure. |
| USEPA Reference Dose (RfDs) | NA | TBC | RfDs are guidance values use to evaluate the potential noncarcinogenic hazard caused by exposure to contaminants. | The selected remedy prevents exposure to contaminated media and thereby minimizes human health concerns, although any changes to the cap in the future could allow exposure. |
| **STATE OF CONNECTICUT** | | | | |
| Cleanup Standard Regulations | CGS §22a-133k (Updated to RCSA Section 22a-133k-1 through 3) | TBC | These regulations provide specific numeric cleanup criteria for a wide variety of contaminants in soil and groundwater. Separate criteria are established for threats to human health and environmental receptors posed by direct contact with contaminants. | These were replaced by the CTDEP RSRs. The selected remedy complies with these standards because of employment of the engineered control. Changes in action levels for groundwater are addressed on Table 2-4. |
| Water Pollution Control | RCSA § 22a-430-1 through 8 | Applicable | These rules establish permitting requirements and criteria for water discharge to surface water. | This regulation was addressed during construction. Now that the cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |

**TABLE 2-1**

**CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 2 – AREA A LANDFILL OU1**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Requirement | Citation | Status | Requirement Synopsis | Current Status / Applicability |
|---|---|---|---|---|
| **STATE OF CONNECTICUT (Continued)** | | | | |
| Water Quality Standards | CGS 22a-426 | Applicable | Connecticut's WQSs establish specific numeric criteria, designated uses, and anti-degradation policies for groundwater and surface water. | Standards are being used to evaluate monitoring results to determine if further remedial action is required to protect resources. Remedial activities were undertaken in a manner that was consistent with the antidegradation policy in the WQSs. Changes in groundwater quality criteria are addressed in Table 2-4. |

NA – Not Applicable.

**TABLE 2-2**

**LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 2 – AREA A LANDFILL OU1**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Requirement | Citation | Status | Requirement Synopsis | Current Status / Applicability |
|---|---|---|---|---|
| **FEDERAL** | | | | |
| Executive Order (E.O.) on Protection of Wetlands | E. O. 11990, 40 CFR Part 6, App. A | Applicable | Requires federal agencies to avoid impacts associated with the destruction or loss or wetlands, minimize potential harm, preserve and enhance wetlands, and avoid support of new construction in wetlands if a practicable alternative exists. | The cap was designed to minimize impacts to the adjacent wetlands. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| Clean Water Act §404 – Dredge and Fill Activities | 40 CFR Parts 230; 33 CFR Parts 320-328 | Applicable | Requires that for dredging or filling of wetlands: no practicable alternatives exist, the activity will not cause a violation of state water quality standards or significant degradation of the water, and adverse effects will be minimized. | The landfill cap was designed to meet these standards and minimize the impacts to adjacent wetlands. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy.. |

**TABLE 2-2**

**LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 2 – AREA A LANDFILL OU1**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Requirement | Citation | Status | Requirement Synopsis | Current Status / Applicability |
|---|---|---|---|---|
| **STATE OF CONNECTICUT** | | | | |
| Inland Wetlands and Watercourses Regulations | RCSA §§22a-39-1 through 15 | Applicable | Regulates any operation within or use of a wetland or watercourse involving removal or deposition of material, or any obstruction, construction, alteration, or pollution of such wetland or watercourse. | The landfill cap was designed to meet these standards and minimize the impacts to adjacent wetlands. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| Inland Wetlands and Watercourses Regulations | CGS §§22a-45a | TBC | Governs minor activities including installation of water quality monitoring equipment such as water quality testing devices, and survey activities including test pits and core sampling. The CTDEP was drafting these requirements during preparation of the FFS. | This regulation was addressed during construction. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |

**TABLE 2-3**

**ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 2 – AREA A LANDFILL OU1**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Requirement | Citation | Status | Requirement Synopsis | Current Status / Applicability |
|---|---|---|---|---|
| **FEDERAL** | | | | |
| RCRA – General Requirements | 40 CFR Part 264 Subpart A | Relevant and Appropriate | Established general requirements for owners and operators of hazardous waste treatment, storage, and disposal facilities. | The cap and associated systems were designed to meet these requirements. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| RCRA – Preparedness and Prevention | 40 CFR Part 264 Subpart C | Relevant and Appropriate | Established requirements for minimizing the possibility of fire, explosion, or release of hazardous material. | The cap and associated systems were designed and remedial action was carried out to meet these requirements. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| RCRA – Contingency Plan and Emergency Procedures | 40 CFR Part 264 Subpart D | Relevant and Appropriate | Established contingency plan requirements on the event of fire, explosion, or release from a facility. | This regulation was addressed during construction. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |

**TABLE 2-3**

**ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 2 – AREA A LANDFILL OU1**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Requirement | Citation | Status | Requirement Synopsis | Current Status / Applicability |
|---|---|---|---|---|
| **FEDERAL (Continued)** | | | | |
| RCRA – Releases from Solid Waste Management Units | 40 CFR Part 264 Subpart F | Relevant and Appropriate | Regulates releases from Solid Waste Management Units (SWMUs). | This regulation was addressed during construction. Now that cap construction has been completed, possible releases are being addressed by groundwater monitoring. Section 264.99 specified a sequence of at least four samples from each well collected at least semi-annually during the compliance period, and Section 264.96 specified a compliance period of demonstrating groundwater protection for a period of three consecutive years beyond closure. Groundwater and surface water sampling continue at the site based on the requirements specified in the Groundwater Monitoring Plan. |
| RCRA – Closure and Post-Closure Requirements | 40 CFR Part 264 Subpart G | Relevant and Appropriate | Establishes general requirements for closure and post-closure of hazardous waste landfills. | The cap and associated systems were designed to meet these requirements. Post-closure groundwater monitoring is addressed under Subpart F. |
| Federal Clean Air Act – National Emission Standard for Hazardous Air Pollutants (NESHAPS) | 40 CFR Part 61 | Relevant and Appropriate | Establishes emission levels for eight listed hazardous air pollutants emitted from particular types of facilities. | This act was considered during the selection of the remedy. The selected remedy included passive gas management but no sampling; therefore this requirement is no longer applicable. |

**TABLE 2-3**

**ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 2 – AREA A LANDFILL OU1**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Requirement | Citation | Status | Requirement Synopsis | Current Status / Applicability |
|---|---|---|---|---|
| **FEDERAL (Continued)** | | | | |
| Federal Clean Air Act – Non-methane Organic Compounds (NMOCs) | Proposed Rule – 56 FR 24468, to be codified at 40 CFR Part 60 Subpart WWW. | TBC | Regulations would require specific gas collection and control systems, monitoring, and gas generation estimates. The proposed rule would establish a performance standard for NMOC emissions from municipal and solid waste landfills. | This act was considered during the selection of the remedy. The selected remedy included passive gas management but no sampling; therefore this requirement is no longer applicable. |
| Clean Water Act, Section 402, National Pollution Discharge Elimination System (NPDES) | 40 CFR 122 through 125, 131 | Applicable | NPDES (National Pollution Discharge Elimination System) permits are required for any discharges to navigable waters. If remedial activities include such a discharge, the NPDES standards would be ARARs. | This regulation was addressed during construction. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| PCB Regulation under TSCA | 40 Part CFR 761 | Applicable | These standards govern the storage of PCB items. | PCB contamination was addressed by capping the site, although any changes to the cap in the future would require revisiting this issue. |
| EPA Technical Guidance – Final Covers on Hazardous Waste Landfills and Surface Impoundments | EPA/530-SW-89-047 | TBC | Presents technical specifications for the design of multi-layer covers at landfills where hazardous wastes were disposed. | The cap and associated systems were designed to meet these requirements. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |

**TABLE 2-3**

**ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 2 – AREA A LANDFILL OU1**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Requirement | Citation | Status | Requirement Synopsis | Current Status / Applicability |
|---|---|---|---|---|
| **STATE OF CONNECTICUT** | | | | |
| Hazardous Waste Management: Generator and Handler Requirements | RCSA § 22a-449(c) 100-101 | Applicable | These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR Parts 260 and 261 are incorporated by reference. | This regulation was addressed during construction. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| 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 Part 262 are incorporated by reference. Storage requirements in 40 CFR Part 265.15 are also included. | Any hazardous wastes generated during the remedial action were managed in accordance with the substantive requirements of these regulations. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| Hazardous Waste Management: TSDF Standards | RCSA § 22a-449(c)-104 | Relevant and Appropriate | This section establishes standards for treatment, storage, and disposal or hazardous waste, and establishes standards for closure, post-closure, and groundwater monitoring. The standards or 40 CFR Part 364 are incorporated by reference. | The remedial action does not include any on-site treatment, storage, or disposal of hazardous waste. The proposed cap design complied with the closure requirements of this regulation. The remedial action includes groundwater monitoring. This regulation was last amended in 1994; therefore, compliance with this regulation is current. |

**TABLE 2-3**

**ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 2 – AREA A LANDFILL OU1**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Requirement | Citation | Status | Requirement Synopsis | Current Status / Applicability |
|---|---|---|---|---|
| **STATE OF CONNECTICUT (Continued)** | | | | |
| Hazardous Waste Management: Interim Status Facilities and Groundwater Monitoring Requirements, Closure and Post-Closure Requirements | RCSA §§ 22a-449(c)-105 | Relevant and Appropriate | This section establishes interim status standards for treatment, storage, and disposal or hazardous waste, and establishes standards for closure, post-closure, and groundwater monitoring. The standards or 40 CFR Part 364 are incorporated by reference. | The proposed cap design complied with the closure requirements of this regulation. The remedial action includes groundwater monitoring. This regulation was last amended in 1994; therefore, compliance with this regulation is current. |
| Solid Waste Management | RCSA 22a-209-1 through 15 | Applicable | Establishes standards for closure of solid waste disposal areas | Those portions of the regulations that are more stringent than federal RCRA Subtitle D regulations were met. This regulation was last amended in 1996; therefore, compliance with this regulation is current. |
| Transportation of Oil and Chemical Liquids | RCSA 29-337-1 through 3 | Applicable | These rules govern the transportation of hazardous materials, including flammable liquids and other chemicals. | This regulation was addressed during construction. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| Control of Noise | RCSA 22a-69-1 through 7.4 | Applicable | These regulations establish allowable noise levels. | This regulation was addressed during construction. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |

**TABLE 2-3**

**ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 2 – AREA A LANDFILL OU1**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Requirement | Citation | Status | Requirement Synopsis | Current Status / Applicability |
|---|---|---|---|---|
| **STATE OF CONNECTICUT (Continued)** | | | | |
| Air Pollution Control – Organic Compound Emissions, Odors, Hazardous Air Pollutants, Particulate Emissions, Stationary Sources, Sulfur Compound Emissions | RCSA § 22a-174-1 through 29 | Applicable | These regulations require permits to construct and operate specified types of emission sources and contain emission standards that must be met prior to issuance of a permit. Pollutant abatement controls may be required. Specific standards pertain to fugitive dust (18b) and control of odors (23). | The remedial action activities were implemented following the requirements of this regulation. The selected remedy included passive gas management but no sampling; therefore, this requirement is no longer applicable. |

**TABLE 2-4**

**COMPARISON OF MONITORING CRITERIA**
**SITE 2 - AREA A LANDFILL OU9**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

| | CTDEP SWPC[1] | | CTDEP WQSs[2] | |
|---|---|---|---|---|
| **Chemical** | **1999[3]** | **2006[4]** | **April 1996** | **December 2002** |
| **VOCs (ug/L)** | | | | |
| 1,1,2,2-TETRACHLOROETHANE | 110 | --- | NA | --- |
| ETHYLBENZENE | 580000 | --- | NA | --- |
| XYLENES, TOTAL | NA | --- | NA | --- |
| **SVOCs (ug/L)** | | | | |
| BENZO(A)ANTHRACENE | 0.3 | 0.3 | NA | NA |
| BENZO(A)PYRENE | 0.3 | 0.3 | NA | NA |
| BENZO(B)FLUORANTHENE | 0.3 | 0.3 | NA | NA |
| BENZO(K)FLUORANTHENE | 0.3 | 0.3 | NA | NA |
| BIS(2-ETHYLHEXYL)PHTHALATE | 59 | 59 | NA | NA |
| PHENANTHRENE | 0.077 | 0.3 | NA | NA |
| **Pesticides/PCBs (ug/L)** | | | | |
| AROCLOR-1016 | 0.5 | --- | 0.014 | --- |
| AROCLOR-1254 | 0.5 | --- | 0.014 | --- |
| AROCLOR-1260 | 0.5 | --- | 0.014 | --- |
| DIELDRIN | 0.1 | --- | **0.0019** | --- |
| HEPTACHLOR | 0.05 | --- | 0.0038 | --- |
| **Inorganics (total/dissolved) (ug/L)** | | | | |
| ARSENIC | 4 | 4 | **190** | **150** |
| BERYLLIUM | 4 | 4 | NA | NA |
| CADMIUM | 6 | 6 | **0.62** | **1.35** |
| CHROMIUM[2] | 1,200/110[5] | 110[6] | **10** | **11** |
| COPPER | 48 | 48 | 4.8 | 4.8 |
| LEAD | 13 | 13 | **1.3** | **1.2** |
| ZINC | 123 | 123 | **12.3** | **65** |

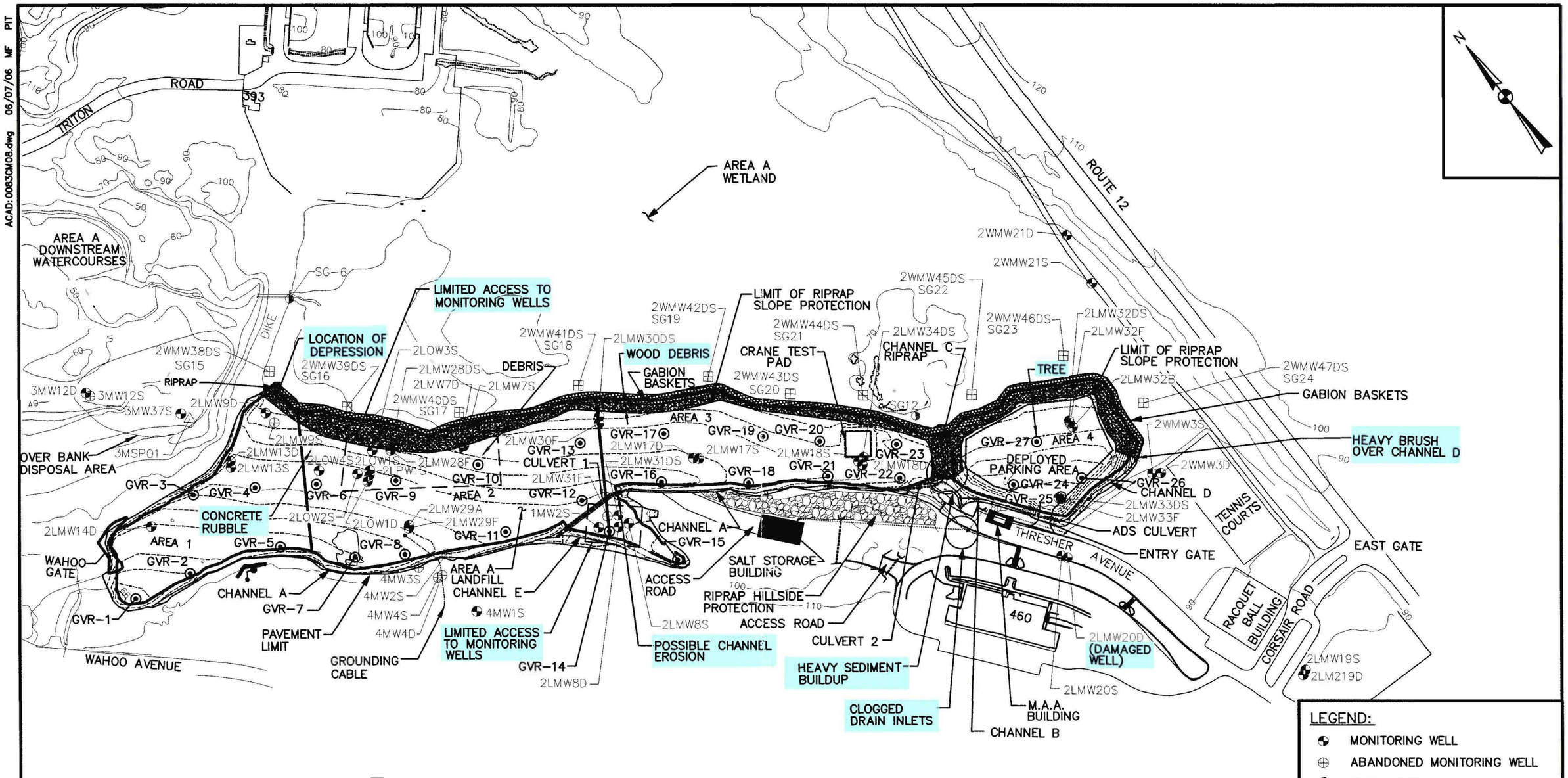
1 - CTDEP Surface Water Protection Criteria from Connecticut RSRs (1996).
2 - CTDEP Water Quality Standards.
3 - Area A Landfill Groundwater Monitoring Plan (TtNUS, 1999).
4 - Area A Landfill Groundwater Monitoring Plan, Volume II of the O&M Manual (TtNUS, 2006a).
5 - Criteria listed are for trivalent chromium and hexavalent chromium.
6 - Criteria listed are for hexavalent chromium.
Shading indicates criterion that has changed.
NA - Not Available.
--- - Contaminant is no longer part of the monitoring program.

**TABLE 2-5**

**DEFICIENCIES IDENTIFIED FOR**
**SITE 2 – AREA A LANDFILL OU1**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

| Deficiency | Effects Protectiveness | |
|---|---|---|
| | Current | Future |
| Install screens on gas vents | N | N |
| O&M of cap system [vegetation (Phragmites, trees, etc.), sediment, and asphalt cracks] | N | Y |
| Improper storage of heavy equipment on cap | N | Y |
| Maintenance/abandonment of monitoring wells | Y | Y |
| Depression in rip rap along toe of the landfill | N | Y |

ACAD: 0083CM08.dwg 06/07/06 MF PIT




LEGEND:

- MONITORING WELL
- ABANDONED MONITORING WELL
- STAFF GAUGE
- MONITORING WELL AND STAFF GAUGE
- SEEP
- GAS VENT

0 200 400
GRAPHIC SCALE IN FEET

SOURCES:

1. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON AND PHASE II RI WORK PLAN (ATLANTIC, 1993).
2. GAS VENT COORDINATE INFORMATION FROM SAI SURVEY CO. FOSTER WHEELER AS-BUILT REPORT 11-1-97.

NOTE:

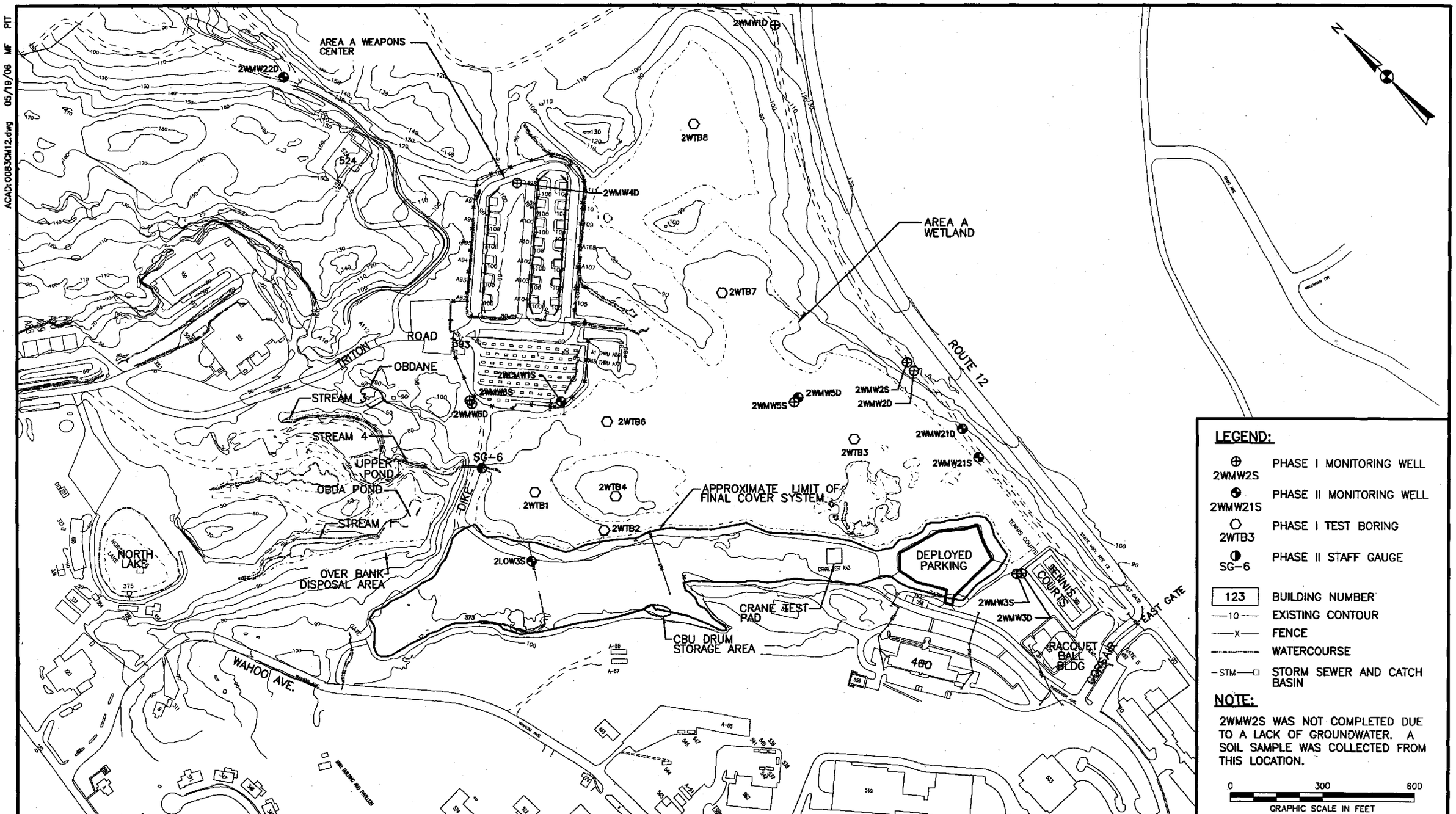
MONITORING WELL 3MW12D REINSTALLED OCTOBER 2002

| | | | |
|---|---|---|---|
| DRAWN BY DT | DATE 5/15/06 | Tetra Tech NUS, Inc. | SITE PLAN FOR SITE 2 - AREA A LANDFILL AND WETLAND NSB-NLON GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

CONTRACT NO. 0083
OWNER NO. 038
APPROVED BY CAR DATE 6/7/06
DRAWING NO. FIGURE 2-1
REV. 0

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

ACAD:0083CM12.dwg 05/19/06 MF PIT




**LEGEND:**

| | |
|---|---|
| ⊕ 2WMW2S | PHASE I MONITORING WELL |
| ⊕ 2WMW21S | PHASE II MONITORING WELL |
| ⬡ 2WTB3 | PHASE I TEST BORING |
| ◑ SG-6 | PHASE II STAFF GAUGE |
| 123 | BUILDING NUMBER |
| —10— | EXISTING CONTOUR |
| —X— | FENCE |
| ——— | WATERCOURSE |
| —STM—□ | STORM SEWER AND CATCH BASIN |

**NOTE:**

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

0 300 600
GRAPHIC SCALE IN FEET

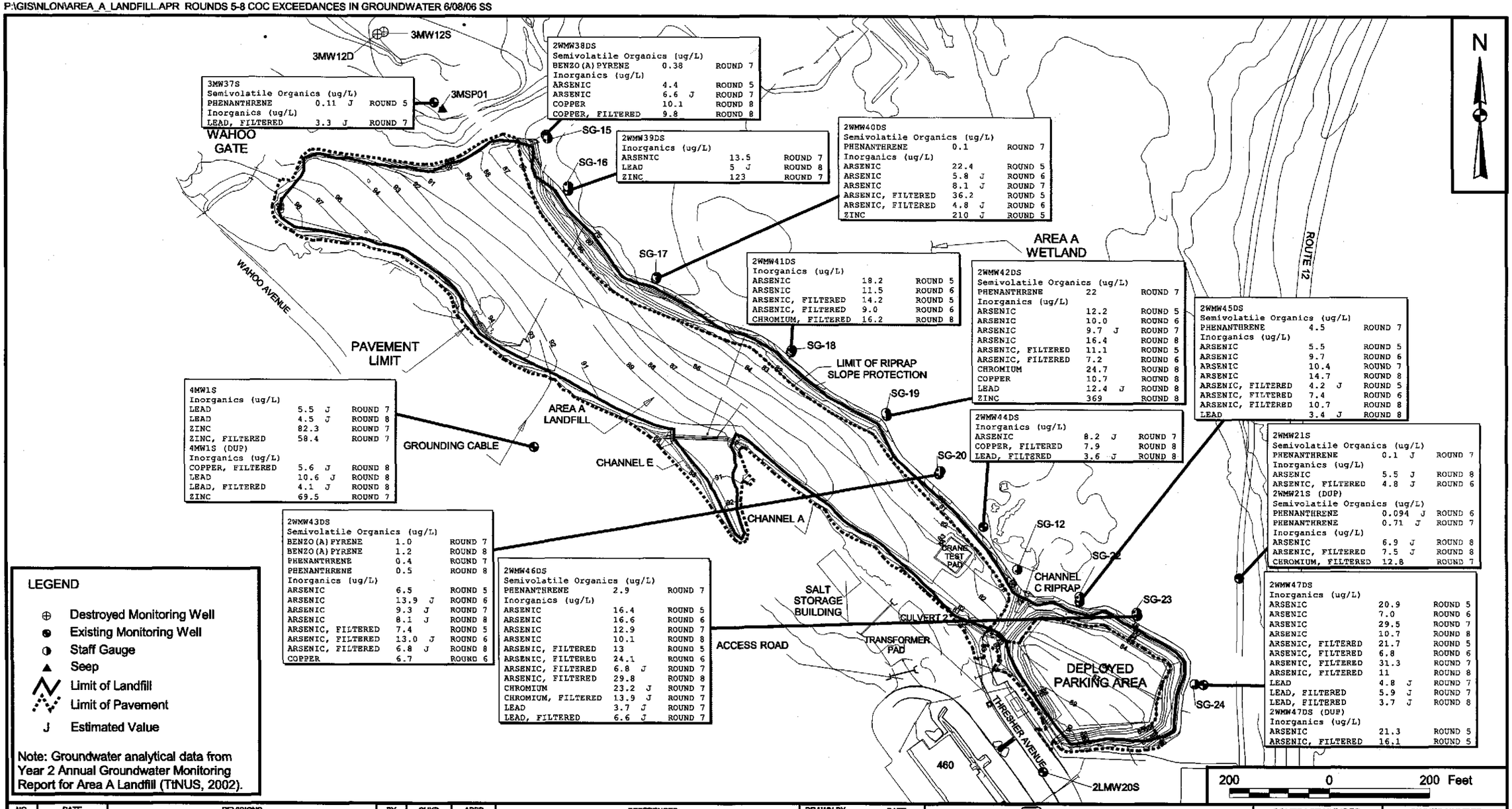
BASE MAP SOURCE: PREPARED BY THE NAVAL SUBMARINE BASE PUBLIC WORKS DEPT., ENGINEERING DIVISION. MARCH 2006, DRAWING NO. A-667.

| | | | |
|---|---|---|---|
| DRAWN BY MF | DATE 5/19/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 2 - AREA A WETLAND<br>NSB-NLON<br>GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

| | |
|---|---|
| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAR | DATE 6/7/06 |
| DRAWING NO. FIGURE 2-2 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

P:\GIS\NLON\AREA_A_LANDFILL.APR ROUNDS 5-8 COC EXCEEDANCES IN GROUNDWATER 6/08/06 SS




3MW37S
Semivolatile Organics (ug/L)

| | | |
|---|---|---|
| PHENANTHRENE | 0.11 J | ROUND 5 |
| Inorganics (ug/L) | | |
| LEAD, FILTERED | 3.3 J | ROUND 7 |

2WMW38DS
Semivolatile Organics (ug/L)

| | | |
|---|---|---|
| BENZO(A)PYRENE | 0.38 | ROUND 7 |
| Inorganics (ug/L) | | |
| ARSENIC | 4.4 | ROUND 5 |
| ARSENIC | 6.6 J | ROUND 7 |
| COPPER | 10.1 | ROUND 8 |
| COPPER, FILTERED | 9.8 | ROUND 8 |

2WMW39DS
Inorganics (ug/L)

| | | |
|---|---|---|
| ARSENIC | 13.5 | ROUND 7 |
| LEAD | 5 J | ROUND 8 |
| ZINC | 123 | ROUND 7 |

2WMW40DS
Semivolatile Organics (ug/L)

| | | |
|---|---|---|
| PHENANTHRENE | 0.1 | ROUND 7 |
| Inorganics (ug/L) | | |
| ARSENIC | 22.4 | ROUND 5 |
| ARSENIC | 5.8 J | ROUND 6 |
| ARSENIC | 8.1 J | ROUND 7 |
| ARSENIC, FILTERED | 36.2 | ROUND 5 |
| ARSENIC, FILTERED | 4.8 J | ROUND 6 |
| ZINC | 210 J | ROUND 5 |

2WMW41DS
Inorganics (ug/L)

| | | |
|---|---|---|
| ARSENIC | 18.2 | ROUND 5 |
| ARSENIC | 11.5 | ROUND 6 |
| ARSENIC, FILTERED | 14.2 | ROUND 5 |
| ARSENIC, FILTERED | 9.0 | ROUND 6 |
| CHROMIUM, FILTERED | 16.2 | ROUND 8 |

2WMW42DS
Semivolatile Organics (ug/L)

| | | |
|---|---|---|
| PHENANTHRENE | 22 | ROUND 7 |
| Inorganics (ug/L) | | |
| ARSENIC | 12.2 | ROUND 5 |
| ARSENIC | 10.0 | ROUND 6 |
| ARSENIC | 9.7 J | ROUND 7 |
| ARSENIC | 16.4 | ROUND 8 |
| ARSENIC, FILTERED | 11.1 | ROUND 5 |
| ARSENIC, FILTERED | 7.2 | ROUND 6 |
| CHROMIUM | 24.7 | ROUND 8 |
| COPPER | 10.7 | ROUND 8 |
| LEAD | 12.4 J | ROUND 8 |
| ZINC | 369 | ROUND 8 |

2WMW45DS
Semivolatile Organics (ug/L)

| | | |
|---|---|---|
| PHENANTHRENE | 4.5 | ROUND 7 |
| Inorganics (ug/L) | | |
| ARSENIC | 5.5 | ROUND 5 |
| ARSENIC | 9.7 | ROUND 6 |
| ARSENIC | 10.4 | ROUND 7 |
| ARSENIC | 14.7 | ROUND 8 |
| ARSENIC, FILTERED | 4.2 J | ROUND 5 |
| ARSENIC, FILTERED | 7.4 | ROUND 6 |
| ARSENIC, FILTERED | 10.7 | ROUND 8 |
| LEAD | 3.4 J | ROUND 8 |

4MW1S
Inorganics (ug/L)

| | | |
|---|---|---|
| LEAD | 5.5 J | ROUND 7 |
| LEAD | 4.5 J | ROUND 8 |
| ZINC | 82.3 | ROUND 7 |
| ZINC, FILTERED | 58.4 | ROUND 7 |
| 4MW1S (DUP) | | |
| Inorganics (ug/L) | | |
| COPPER, FILTERED | 5.6 J | ROUND 8 |
| LEAD | 10.6 J | ROUND 8 |
| LEAD, FILTERED | 4.1 J | ROUND 8 |
| ZINC | 69.5 | ROUND 7 |

2WMW44DS
Inorganics (ug/L)

| | | |
|---|---|---|
| ARSENIC | 8.2 J | ROUND 7 |
| COPPER, FILTERED | 7.9 | ROUND 8 |
| LEAD, FILTERED | 3.6 J | ROUND 8 |

2WMW21S
Semivolatile Organics (ug/L)

| | | |
|---|---|---|
| PHENANTHRENE | 0.1 J | ROUND 7 |
| Inorganics (ug/L) | | |
| ARSENIC | 5.5 J | ROUND 8 |
| ARSENIC, FILTERED | 4.8 J | ROUND 6 |
| 2WMW21S (DUP) | | |
| Semivolatile Organics (ug/L) | | |
| PHENANTHRENE | 0.094 J | ROUND 6 |
| PHENANTHRENE | 0.71 J | ROUND 7 |
| Inorganics (ug/L) | | |
| ARSENIC | 6.9 J | ROUND 8 |
| ARSENIC, FILTERED | 7.5 J | ROUND 8 |
| CHROMIUM, FILTERED | 12.8 | ROUND 7 |

2WMW43DS
Semivolatile Organics (ug/L)

| | | |
|---|---|---|
| BENZO(A)PYRENE | 1.0 | ROUND 7 |
| BENZO(A)PYRENE | 1.2 | ROUND 8 |
| PHENANTHRENE | 0.4 | ROUND 7 |
| PHENANTHRENE | 0.5 | ROUND 8 |
| Inorganics (ug/L) | | |
| ARSENIC | 6.5 | ROUND 5 |
| ARSENIC | 13.9 J | ROUND 6 |
| ARSENIC | 9.3 J | ROUND 7 |
| ARSENIC | 8.1 J | ROUND 8 |
| ARSENIC, FILTERED | 7.4 | ROUND 5 |
| ARSENIC, FILTERED | 13.0 J | ROUND 6 |
| ARSENIC, FILTERED | 6.8 J | ROUND 8 |
| COPPER | 6.7 | ROUND 6 |

2WMW46DS
Semivolatile Organics (ug/L)

| | | |
|---|---|---|
| PHENANTHRENE | 2.9 | ROUND 7 |
| Inorganics (ug/L) | | |
| ARSENIC | 16.4 | ROUND 5 |
| ARSENIC | 16.6 | ROUND 6 |
| ARSENIC | 12.9 | ROUND 7 |
| ARSENIC | 10.1 | ROUND 8 |
| ARSENIC, FILTERED | 13 | ROUND 5 |
| ARSENIC, FILTERED | 24.1 | ROUND 6 |
| ARSENIC, FILTERED | 6.8 J | ROUND 7 |
| ARSENIC, FILTERED | 29.8 | ROUND 8 |
| CHROMIUM | 23.2 J | ROUND 7 |
| CHROMIUM, FILTERED | 13.9 J | ROUND 7 |
| LEAD | 3.7 J | ROUND 7 |
| LEAD, FILTERED | 6.6 J | ROUND 7 |

2WMW47DS
Inorganics (ug/L)

| | | |
|---|---|---|
| ARSENIC | 20.9 | ROUND 5 |
| ARSENIC | 7.0 | ROUND 6 |
| ARSENIC | 29.5 | ROUND 7 |
| ARSENIC | 10.7 | ROUND 8 |
| ARSENIC, FILTERED | 21.7 | ROUND 5 |
| ARSENIC, FILTERED | 6.8 | ROUND 6 |
| ARSENIC, FILTERED | 31.3 | ROUND 7 |
| ARSENIC, FILTERED | 11 | ROUND 8 |
| LEAD | 4.8 J | ROUND 7 |
| LEAD, FILTERED | 5.9 J | ROUND 7 |
| LEAD, FILTERED | 3.7 J | ROUND 8 |
| 2WMW47DS (DUP) | | |
| Inorganics (ug/L) | | |
| ARSENIC | 21.3 | ROUND 5 |
| ARSENIC, FILTERED | 16.1 | ROUND 5 |

LEGEND

- Destroyed Monitoring Well
- Existing Monitoring Well
- Staff Gauge
- Seep
- Limit of Landfill
- Limit of Pavement
- J Estimated Value

Note: Groundwater analytical data from Year 2 Annual Groundwater Monitoring Report for Area A Landfill (TtNUS, 2002).

| NO. | DATE | REVISIONS | BY | CHKD | APPD | REFERENCES |
|---|---|---|---|---|---|---|
| | | | | | | |

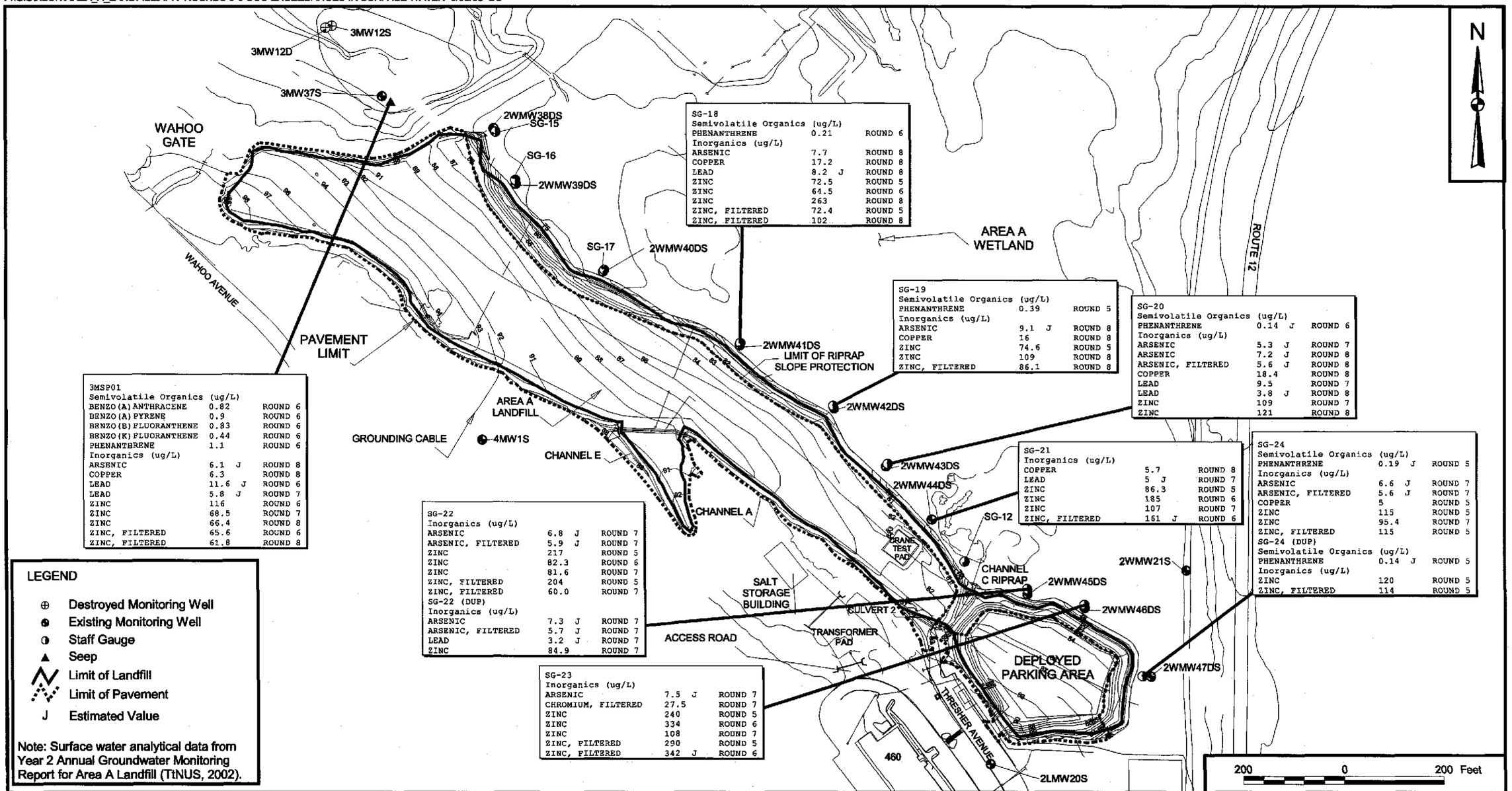
| | |
|---|---|
| DRAWN BY J. LAMEY | DATE 12/13/01 |
| CHECKED BY N. BALSAMO | DATE 6/08/06 |
| COST/SCHEDULE-AREA | |
| SCALE AS NOTED | |

Tetra Tech NUS, Inc.

COPC EXCEEDANCES OF MONITORING CRITERIA
YEAR 2 GROUNDWATER SAMPLING
SITE 2 - AREA A LANDFILL
NSB-NLON, GROTON, CONNECTICUT

| | |
|---|---|
| CONTRACT NUMBER 0083 | OWNER NUMBER 038 |
| APPROVED BY CAL | DATE 6/8/06 |
| APPROVED BY — | DATE — |
| DRAWING NO. FIGURE 2 - 3 | REV 0 |

P:\GIS\NLON\AREA_A_LANDFILL.APR ROUNDS 5-8 COC EXCEEDANCES IN SURFACE WATER 6/08/06 SS




SG-18
Semivolatile Organics (ug/L)

| | | |
|---|---|---|
| PHENANTHRENE | 0.21 | ROUND 6 |
| Inorganics (ug/L) | | |
| ARSENIC | 7.7 | ROUND 8 |
| COPPER | 17.2 | ROUND 8 |
| LEAD | 8.2 J | ROUND 8 |
| ZINC | 72.5 | ROUND 5 |
| ZINC | 64.5 | ROUND 6 |
| ZINC | 263 | ROUND 8 |
| ZINC, FILTERED | 72.4 | ROUND 5 |
| ZINC, FILTERED | 102 | ROUND 8 |

SG-19
Semivolatile Organics (ug/L)

| | | |
|---|---|---|
| PHENANTHRENE | 0.39 | ROUND 5 |
| Inorganics (ug/L) | | |
| ARSENIC | 9.1 J | ROUND 8 |
| COPPER | 16 | ROUND 8 |
| ZINC | 74.6 | ROUND 5 |
| ZINC | 109 | ROUND 8 |
| ZINC, FILTERED | 86.1 | ROUND 8 |

SG-20
Semivolatile Organics (ug/L)

| | | |
|---|---|---|
| PHENANTHRENE | 0.14 J | ROUND 6 |
| Inorganics (ug/L) | | |
| ARSENIC | 5.3 J | ROUND 7 |
| ARSENIC | 7.2 J | ROUND 8 |
| ARSENIC, FILTERED | 5.6 J | ROUND 8 |
| COPPER | 18.4 | ROUND 8 |
| LEAD | 9.5 | ROUND 7 |
| LEAD | 3.8 J | ROUND 8 |
| ZINC | 109 | ROUND 7 |
| ZINC | 121 | ROUND 8 |

3MSP01
Semivolatile Organics (ug/L)

| | | |
|---|---|---|
| BENZO(A)ANTHRACENE | 0.82 | ROUND 6 |
| BENZO(A)PYRENE | 0.9 | ROUND 6 |
| BENZO(B)FLUORANTHENE | 0.83 | ROUND 6 |
| BENZO(K)FLUORANTHENE | 0.44 | ROUND 6 |
| PHENANTHRENE | 1.1 | ROUND 6 |
| Inorganics (ug/L) | | |
| ARSENIC | 6.1 J | ROUND 8 |
| COPPER | 6.3 | ROUND 8 |
| LEAD | 11.6 J | ROUND 6 |
| LEAD | 5.8 J | ROUND 7 |
| ZINC | 116 | ROUND 6 |
| ZINC | 68.5 | ROUND 7 |
| ZINC | 66.4 | ROUND 8 |
| ZINC, FILTERED | 65.6 | ROUND 6 |
| ZINC, FILTERED | 61.8 | ROUND 8 |

SG-21
Inorganics (ug/L)

| | | |
|---|---|---|
| COPPER | 5.7 | ROUND 8 |
| LEAD | 5 J | ROUND 7 |
| ZINC | 86.3 | ROUND 5 |
| ZINC | 185 | ROUND 6 |
| ZINC | 107 | ROUND 7 |
| ZINC, FILTERED | 161 J | ROUND 6 |

SG-24
Semivolatile Organics (ug/L)

| | | |
|---|---|---|
| PHENANTHRENE | 0.19 J | ROUND 5 |
| Inorganics (ug/L) | | |
| ARSENIC | 6.6 J | ROUND 7 |
| ARSENIC, FILTERED | 5.6 J | ROUND 7 |
| COPPER | 5 | ROUND 5 |
| ZINC | 115 | ROUND 5 |
| ZINC | 95.4 | ROUND 7 |
| ZINC, FILTERED | 115 | ROUND 5 |
| SG-24 (DUP) | | |
| Semivolatile Organics (ug/L) | | |
| PHENANTHRENE | 0.14 J | ROUND 5 |
| Inorganics (ug/L) | | |
| ZINC | 120 | ROUND 5 |
| ZINC, FILTERED | 114 | ROUND 5 |

SG-22
Inorganics (ug/L)

| | | |
|---|---|---|
| ARSENIC | 6.8 J | ROUND 7 |
| ARSENIC, FILTERED | 5.9 J | ROUND 7 |
| ZINC | 217 | ROUND 5 |
| ZINC | 82.3 | ROUND 6 |
| ZINC | 81.6 | ROUND 7 |
| ZINC, FILTERED | 204 | ROUND 5 |
| ZINC, FILTERED | 60.0 | ROUND 7 |
| SG-22 (DUP) | | |
| Inorganics (ug/L) | | |
| ARSENIC | 7.3 J | ROUND 7 |
| ARSENIC, FILTERED | 5.7 J | ROUND 7 |
| LEAD | 3.2 J | ROUND 7 |
| ZINC | 84.9 | ROUND 7 |

SG-23
Inorganics (ug/L)

| | | |
|---|---|---|
| ARSENIC | 7.5 J | ROUND 7 |
| CHROMIUM, FILTERED | 27.5 | ROUND 7 |
| ZINC | 240 | ROUND 5 |
| ZINC | 334 | ROUND 6 |
| ZINC | 108 | ROUND 7 |
| ZINC, FILTERED | 290 | ROUND 5 |
| ZINC, FILTERED | 342 J | ROUND 6 |

LEGEND

- Destroyed Monitoring Well
- Existing Monitoring Well
- Staff Gauge
- Seep
- Limit of Landfill
- Limit of Pavement
- J Estimated Value

Note: Surface water analytical data from Year 2 Annual Groundwater Monitoring Report for Area A Landfill (TtNUS, 2002).

| NO. | DATE | REVISIONS | BY | CHKD | APPD | REFERENCES |
|---|---|---|---|---|---|---|
| | | | | | | |

| | |
|---|---|
| DRAWN BY J. LAMEY | DATE 12/13/01 |
| CHECKED BY N. BALSAMO | DATE 6/08/06 |
| COST/SCHEDULE-AREA | |
| SCALE AS NOTED | |

Tetra Tech NUS, Inc.

COPC EXCEEDANCES OF MONITORING CRITERIA
YEAR 2 SURFACE WATER SAMPLING
SITE 2 - AREA A LANDFILL
NSB-NLON, GROTON, CONNECTICUT

| | |
|---|---|
| CONTRACT NUMBER 0083 | OWNER NUMBER 038 |
| APPROVED BY C. RICH | DATE 6/8/06 |
| APPROVED BY — | DATE — |
| DRAWING NO. FIGURE 2-4 | REV 0 |

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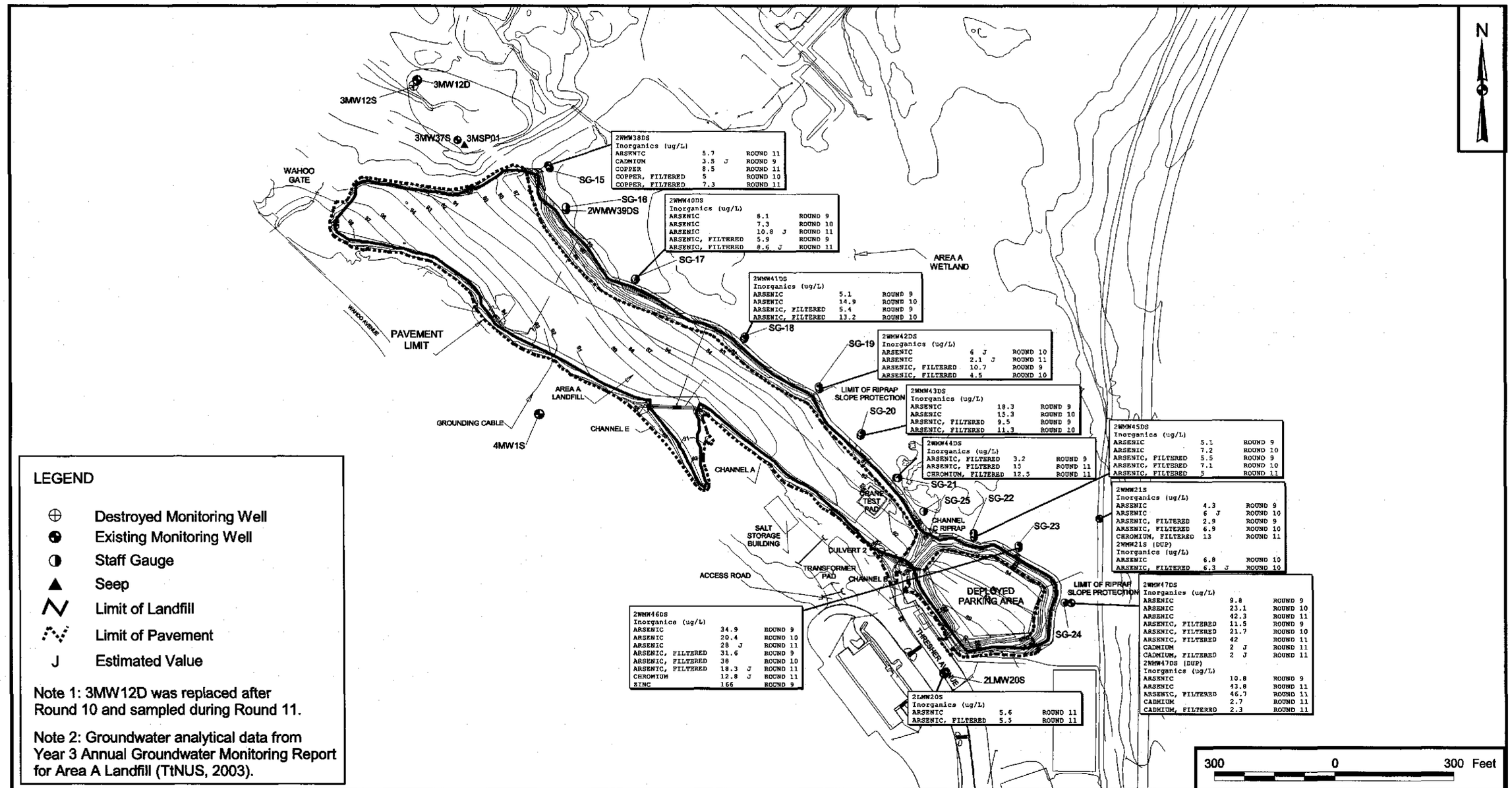



LEGEND

- Destroyed Monitoring Well
- Existing Monitoring Well
- Staff Gauge
- Seep
- Limit of Landfill
- Limit of Pavement
- J Estimated Value

Note 1: 3MW12D was replaced after Round 10 and sampled during Round 11.

Note 2: Groundwater analytical data from Year 3 Annual Groundwater Monitoring Report for Area A Landfill (TtNUS, 2003).

| NO. | DATE | REVISIONS | BY | CHKD | APPD | REFERENCES |
|---|---|---|---|---|---|---|
| | | | | | | |

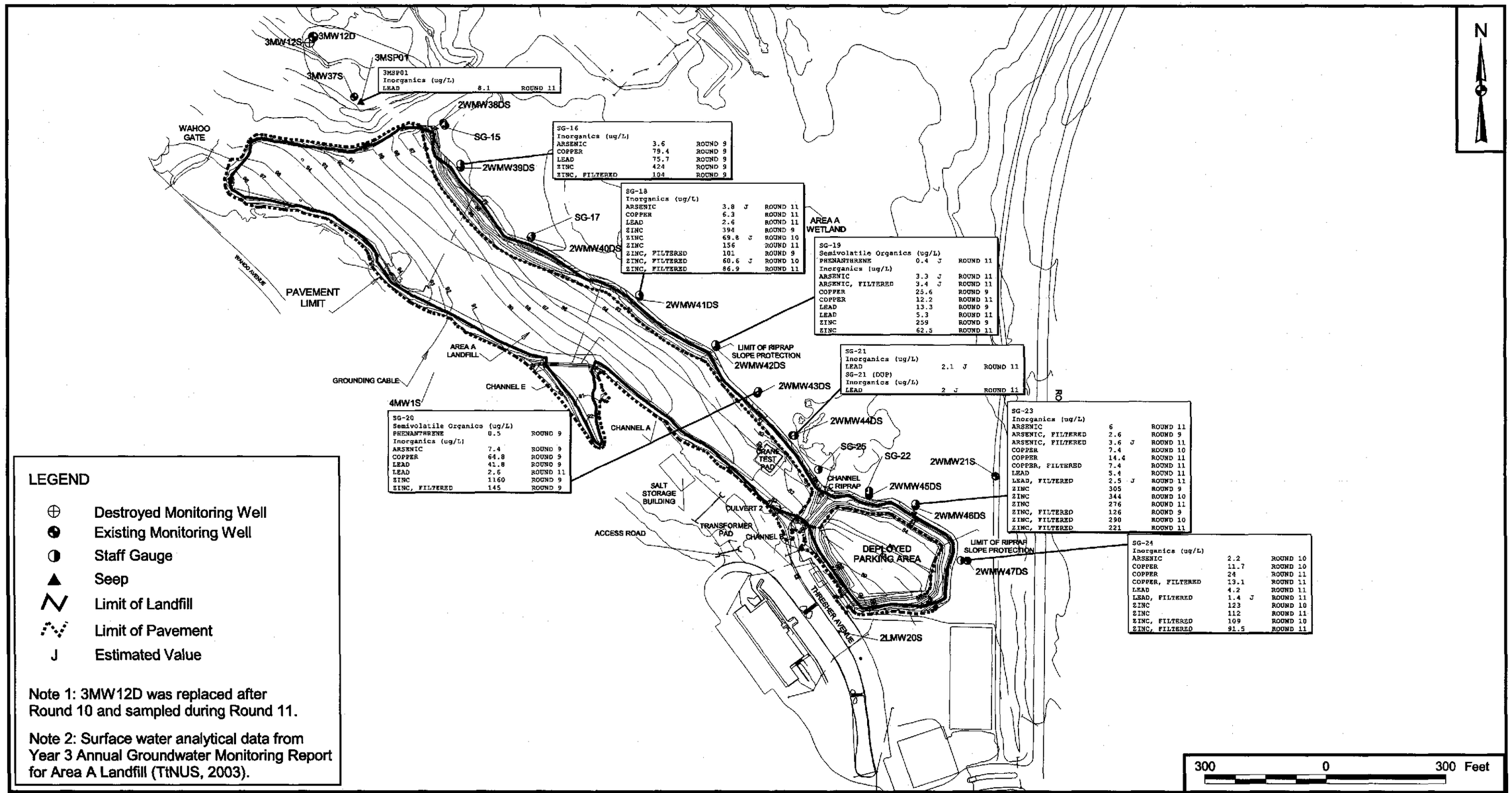
| | |
|---|---|
| DRAWN BY K. PEILA | DATE 2/11/03 |
| CHECKED BY N. BALSAMO | DATE 6/08/06 |
| COST/SCHEDULE-AREA | |
| SCALE AS NOTED | |

Tetra Tech NUS, Inc.

COPC EXCEEDANCES OF MONITORING CRITERIA
YEAR 3 GROUNDWATER SAMPLING
SITE 2 - AREA A LANDFILL
NSB-NLON, GROTON, CONNECTICUT

| | |
|---|---|
| CONTRACT NUMBER 0083 | OWNER NUMBER CTO 038 |
| APPROVED BY CAL | DATE 6/8/06 |
| APPROVED BY — | DATE — |
| DRAWING NO. FIGURE 2 - 5 | REV 0 |

P:\GIS\NLON\50820390.APR\AREA A LANDFILL ROUND 11 SW TAGS 6/08/06 SS




## LEGEND

- ⊕ Destroyed Monitoring Well
- Existing Monitoring Well
- Staff Gauge
- ▲ Seep
- Limit of Landfill
- Limit of Pavement
- J Estimated Value

Note 1: 3MW12D was replaced after Round 10 and sampled during Round 11.

Note 2: Surface water analytical data from Year 3 Annual Groundwater Monitoring Report for Area A Landfill (TtNUS, 2003).

| NO. | DATE | REVISIONS | BY | CHKD | APPD | REFERENCES |
|---|---|---|---|---|---|---|
| | | | | | | |

| DRAWN BY | DATE |
|---|---|
| K. PEILA | 2/11/03 |
| CHECKED BY | DATE |
| N. BALSAMO | 6/08/06 |
| COST/SCHEDULE-AREA | |
| SCALE | |
| AS NOTED | |

Tetra Tech NUS, Inc.

COPC EXCEEDANCES OF MONITORING CRITERIA
YEAR 3 SURFACE WATER SAMPLING
SITE 2 - AREA A LANDFILL
NSB-NLON, GROTON, CONNECTICUT

| CONTRACT NUMBER | OWNER NUMBER |
|---|---|
| 0083 | CTO 038 |
| APPROVED BY: CAR | DATE: 6/8/06 |
| APPROVED BY: — | DATE: — |
| DRAWING NO. FIGURE 2 - 6 | REV 0 |

ACAD:0083CM05.dwg 06/07/06 MF PIT

| 2WMW42DS | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 12 | ROUND 13 |
| ARSENIC | 4.0 | |
| ARSENIC, FILTERED | 13 | 18.6 J |
| SEMIVOLATILE ORGANICS (µg/L) | | |
| PHENANTHRENE | 7.2 | |

| 2WMW43DS | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 12 | ROUND 13 |
| ARSENIC | 7.0 | 6 |
| ARSENIC, FILTERED | 6.0 | 6 |
| CHROMIUM | 20 | |
| **2WMW43DS (DUP)** | | |
| INORGANICS (µg/L) | ROUND 12 | ROUND 13 |
| ARSENIC, FILTERED | | 3.97 J |
| ARSENIC | | 6 |

| 2WMW45DS | |
|---|---|
| INORGANICS (µg/L) | ROUND 12 |
| ARSENIC | 12 |
| ARSENIC, FILTERED | 5.0 |
| **2WMW45DS (DUP)** | |
| INORGANICS (µg/L) | ROUND 12 |
| ARSENIC | 5.0 |
| ARSENIC, FILTERED | 6.0 |

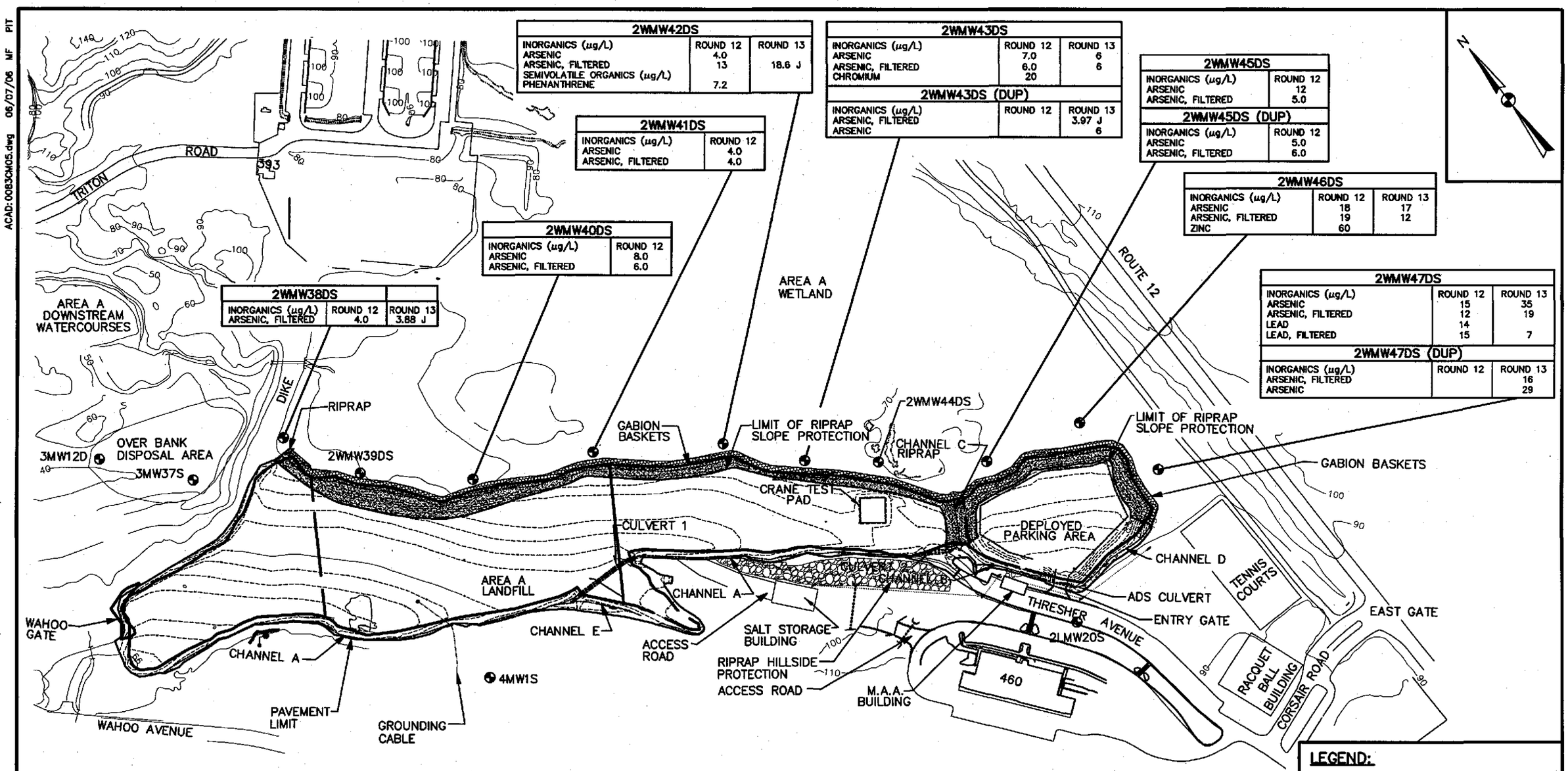
| 2WMW41DS | |
|---|---|
| INORGANICS (µg/L) | ROUND 12 |
| ARSENIC | 4.0 |
| ARSENIC, FILTERED | 4.0 |

| 2WMW46DS | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 12 | ROUND 13 |
| ARSENIC | 18 | 17 |
| ARSENIC, FILTERED | 19 | 12 |
| ZINC | 60 | |

| 2WMW40DS | |
|---|---|
| INORGANICS (µg/L) | ROUND 12 |
| ARSENIC | 8.0 |
| ARSENIC, FILTERED | 6.0 |

| 2WMW38DS | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 12 | ROUND 13 |
| ARSENIC, FILTERED | 4.0 | 3.88 J |

| 2WMW47DS | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 12 | ROUND 13 |
| ARSENIC | 15 | 35 |
| ARSENIC, FILTERED | 12 | 19 |
| LEAD | 14 | |
| LEAD, FILTERED | 15 | 7 |
| **2WMW47DS (DUP)** | | |
| INORGANICS (µg/L) | ROUND 12 | ROUND 13 |
| ARSENIC, FILTERED | | 16 |
| ARSENIC | | 29 |




**NOTE:**

GROUNDWATER ANALYTICAL DATA FROM THE FOLLOWING GROUNDWATER MONITORING REPORTS FOR AREA A LANDFILL: ROUND 12 (ECC, 2003) AND FINAL YEAR 4 (ECC, 2004).

**LEGEND:**

MONITORING WELL

0 200 400
GRAPHIC SCALE IN FEET

**SOURCE:**

BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB–NLON AND PHASE II RI WORK PLAN (ATLANTIC, MAY 1993).

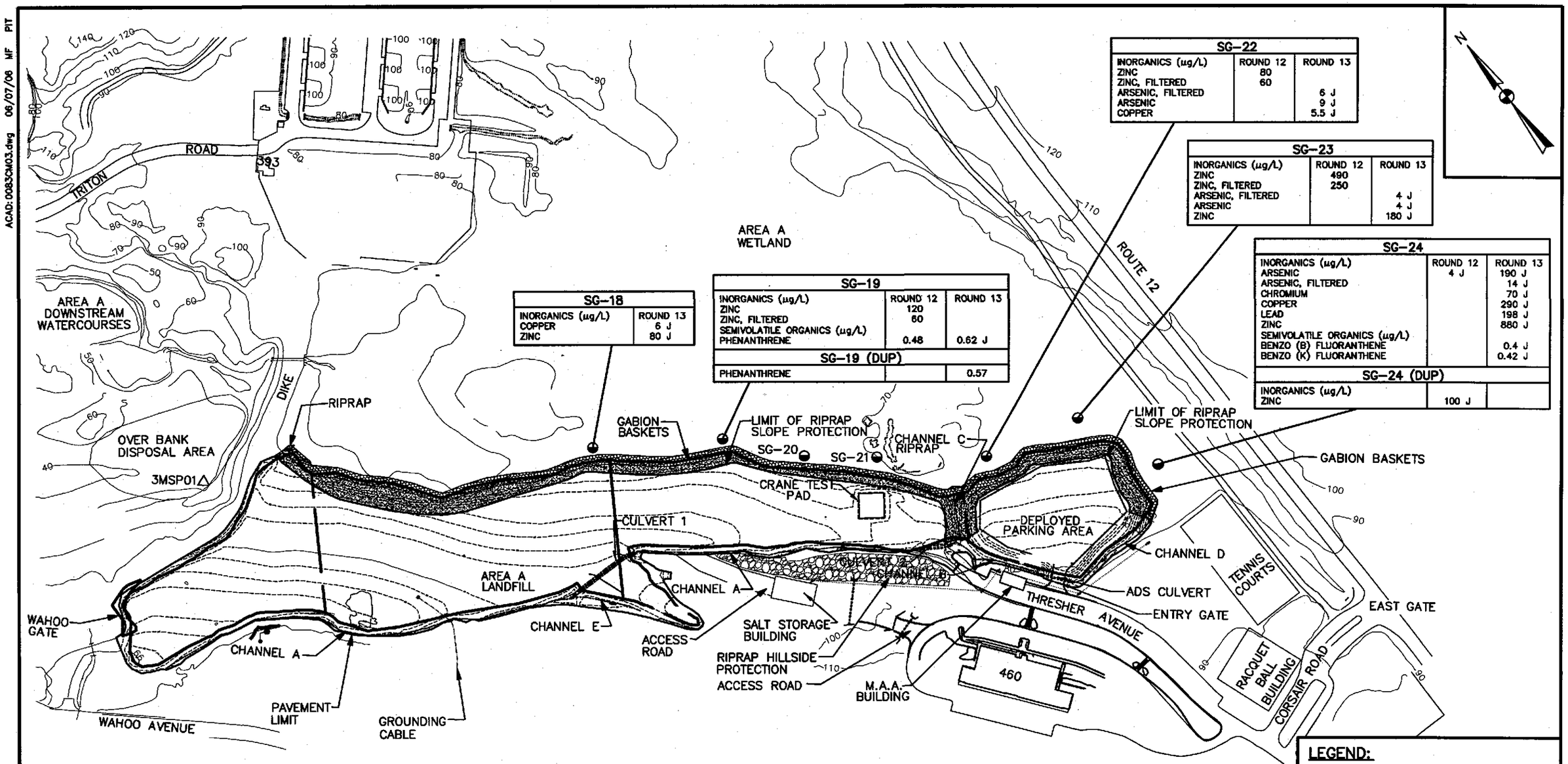
| | | |
|---|---|---|
| DRAWN BY MF | DATE 4/19/06 | Tetra Tech NUS, Inc. |
| CHECKED BY | DATE | |
| REVISED BY | DATE | |
| SCALE AS NOTED | | |

COPC EXCEEDANCES OF MONITORING CRITERIA
YEAR 4 GROUNDWATER SAMPLING
SITE 2 - AREA A LANDFILL
NSB-NLON
GROTON, CONNECTICUT

| | |
|---|---|
| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAL | DATE 6/7/06 |
| DRAWING NO. FIGURE 2-7 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG – REV 1 – 9/10/98

ACAD: 0083CM03.dwg 06/07/06 MF PIT




| SG-22 | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 12 | ROUND 13 |
| ZINC | 80 | |
| ZINC, FILTERED | 60 | |
| ARSENIC, FILTERED | | 6 J |
| ARSENIC | | 9 J |
| COPPER | | 5.5 J |

| SG-23 | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 12 | ROUND 13 |
| ZINC | 490 | |
| ZINC, FILTERED | 250 | |
| ARSENIC, FILTERED | | 4 J |
| ARSENIC | | 4 J |
| ZINC | | 180 J |

| SG-24 | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 12 | ROUND 13 |
| ARSENIC | 4 J | 190 J |
| ARSENIC, FILTERED | | 14 J |
| CHROMIUM | | 70 J |
| COPPER | | 290 J |
| LEAD | | 198 J |
| ZINC | | 880 J |
| SEMIVOLATILE ORGANICS (µg/L) | | |
| BENZO (B) FLUORANTHENE | | 0.4 J |
| BENZO (K) FLUORANTHENE | | 0.42 J |
| **SG-24 (DUP)** | | |
| INORGANICS (µg/L) | | |
| ZINC | 100 J | |

| SG-18 | |
|---|---|
| INORGANICS (µg/L) | ROUND 13 |
| COPPER | 6 J |
| ZINC | 80 J |

| SG-19 | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 12 | ROUND 13 |
| ZINC | 120 | |
| ZINC, FILTERED | 60 | |
| SEMIVOLATILE ORGANICS (µg/L) | | |
| PHENANTHRENE | 0.48 | 0.62 J |
| **SG-19 (DUP)** | | |
| PHENANTHRENE | | 0.57 |

**LEGEND:**

- ◒ STAFF GAUGE
- △ SEEP LOCATION

0 200 400
GRAPHIC SCALE IN FEET

**NOTE:**

SURFACE WATER ANALYTICAL DATA FROM THE FOLLOWING GROUNDWATER MONITORING REPORTS FOR AREA A LANDFILL: ROUND 12 (ECC, 2003) AND FINAL YEAR 4 (ECC, 2004).

**SOURCE:**

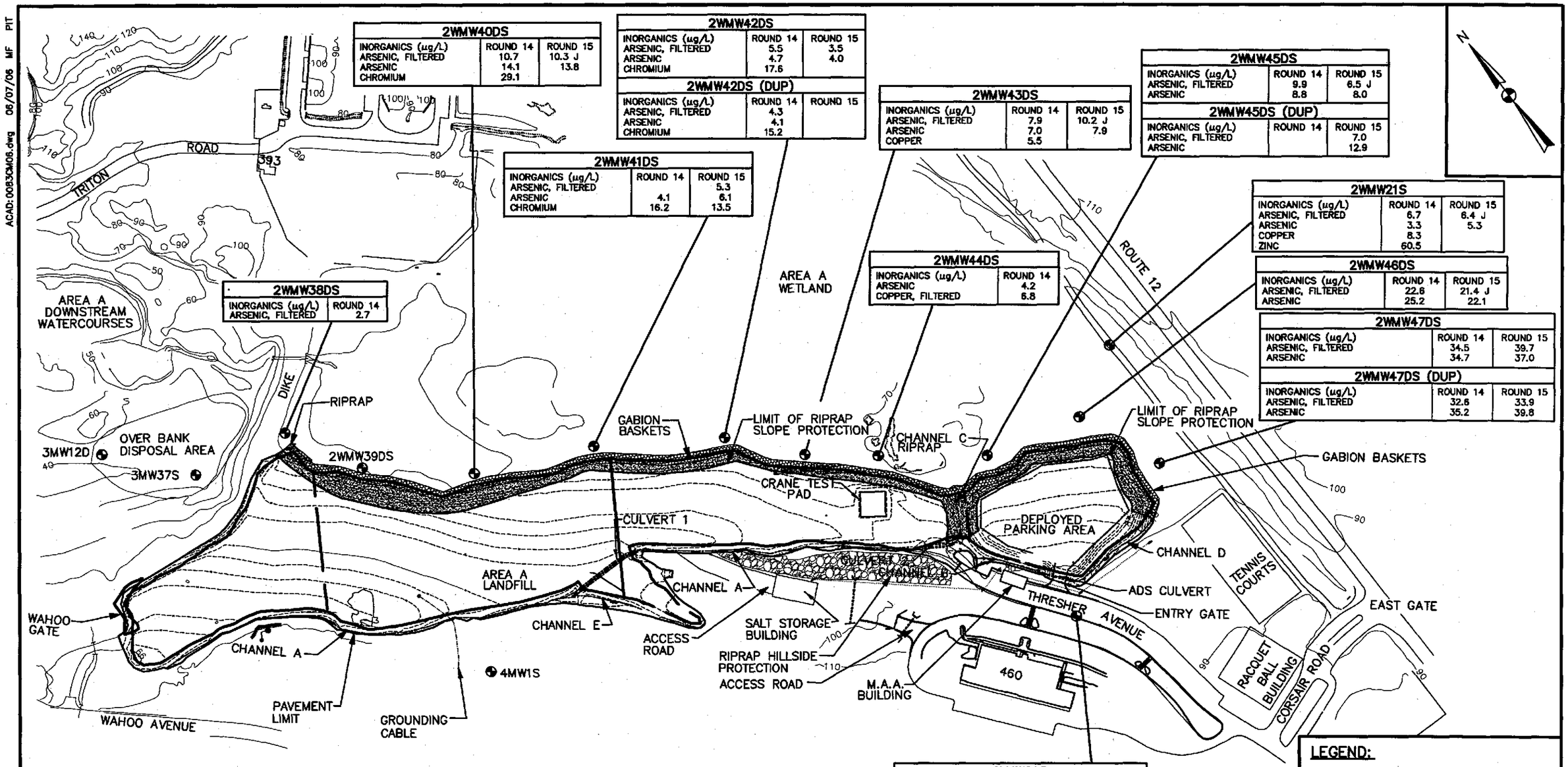
BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON AND PHASE II RI WORK PLAN (ATLANTIC, MAY 1993).

| | | | |
|---|---|---|---|
| DRAWN BY MF | DATE 4/18/06 | Tetra Tech NUS, Inc. | COPC EXCEEDANCES OF MONITORING CRITERIA YEAR 4 SURFACE WATER SAMPLING SITE 2 - AREA A LANDFILL NSB-NLON GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

| | |
|---|---|
| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAL | DATE 6/7/06 |
| DRAWING NO. FIGURE 2-8 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG – REV 1 – 9/10/98

ACAD:0083CM06.dwg 06/07/06 MF PIT




| 2WMW40DS | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC, FILTERED | 10.7 | 10.3 J |
| ARSENIC | 14.1 | 13.8 |
| CHROMIUM | 29.1 | |

| 2WMW42DS | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC, FILTERED | 5.5 | 3.5 |
| ARSENIC | 4.7 | 4.0 |
| CHROMIUM | 17.6 | |

| 2WMW42DS (DUP) | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC, FILTERED | 4.3 | |
| ARSENIC | 4.1 | |
| CHROMIUM | 15.2 | |

| 2WMW41DS | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC, FILTERED | | 5.3 |
| ARSENIC | 4.1 | 6.1 |
| CHROMIUM | 16.2 | 13.5 |

| 2WMW43DS | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC, FILTERED | 7.9 | 10.2 J |
| ARSENIC | 7.0 | 7.9 |
| COPPER | 5.5 | |

| 2WMW45DS | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC, FILTERED | 9.9 | 6.5 J |
| ARSENIC | 8.8 | 8.0 |

| 2WMW45DS (DUP) | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC, FILTERED | | 7.0 |
| ARSENIC | | 12.9 |

| 2WMW21S | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC, FILTERED | 6.7 | 6.4 J |
| ARSENIC | 3.3 | 5.3 |
| COPPER | 8.3 | |
| ZINC | 60.5 | |

| 2WMW46DS | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC, FILTERED | 22.6 | 21.4 J |
| ARSENIC | 25.2 | 22.1 |

| 2WMW47DS | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC, FILTERED | 34.5 | 39.7 |
| ARSENIC | 34.7 | 37.0 |

| 2WMW47DS (DUP) | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC, FILTERED | 32.6 | 33.9 |
| ARSENIC | 35.2 | 39.8 |

| 2WMW44DS | |
|---|---|
| INORGANICS (µg/L) | ROUND 14 |
| ARSENIC | 4.2 |
| COPPER, FILTERED | 6.8 |

| 2WMW38DS | |
|---|---|
| INORGANICS (µg/L) | ROUND 14 |
| ARSENIC, FILTERED | 2.7 |

| 2LMW20S | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC, FILTERED | | 7.3 J |
| ARSENIC | 2.9 | 9.3 |

**NOTE:**

GROUNDWATER ANALYTICAL DATA FROM THE FOLLOWING MONITORING REPORTS FOR AREA A LANDFILL: ROUND 14 (ECC, 2004) AND YEAR 5 (ECC, 2005).

**LEGEND:**

MONITORING WELL

0 200 400
GRAPHIC SCALE IN FEET

**SOURCE:**

BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON AND PHASE II RI WORK PLAN (ATLANTIC, MAY 1993).

| DRAWN BY | DATE |
|---|---|
| MF | 4/20/06 |
| CHECKED BY | DATE |
| REVISED BY | DATE |
| SCALE AS NOTED | |

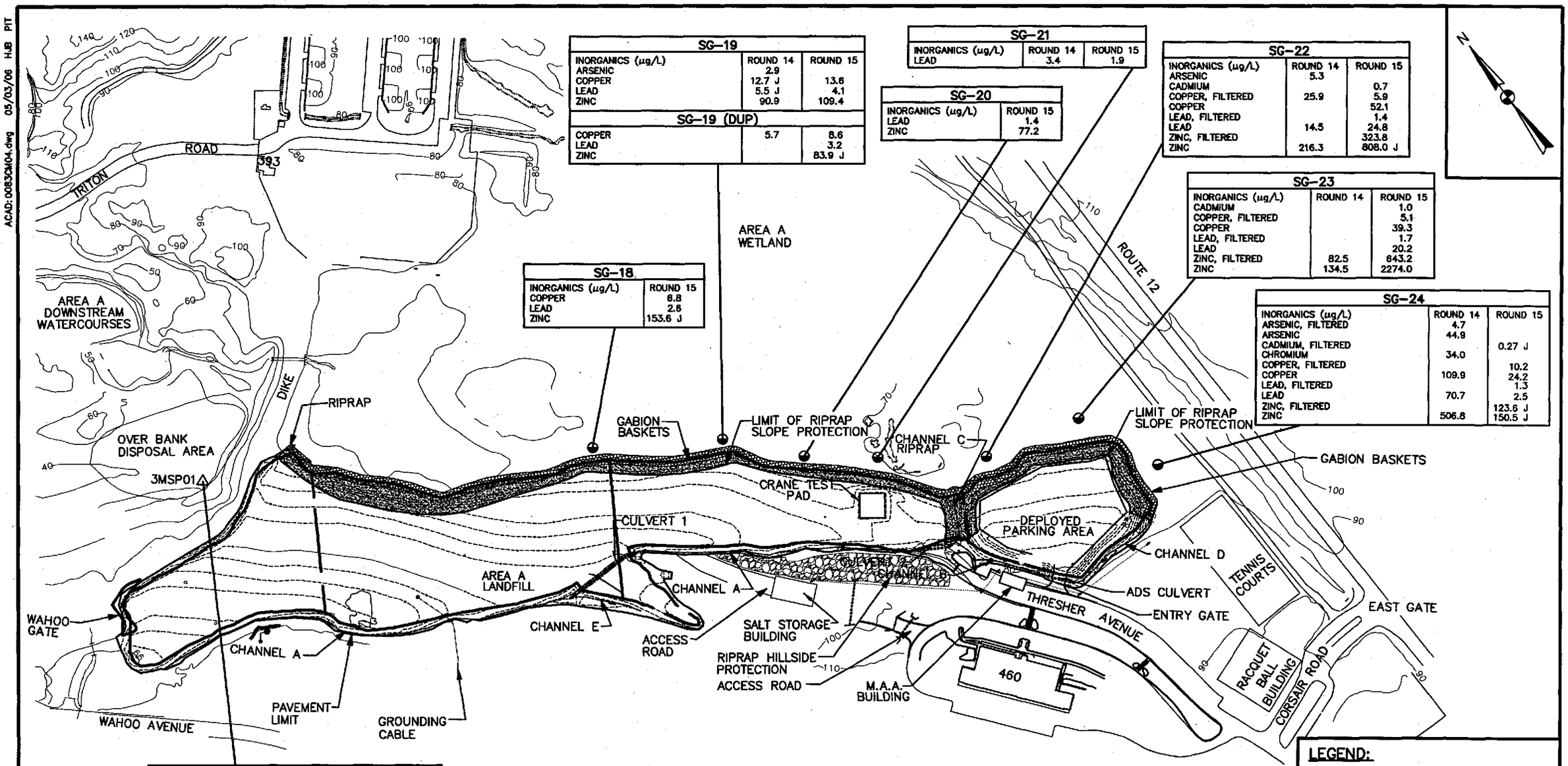
Tetra Tech NUS, Inc.

COPC EXCEEDANCES OF MONITORING CRITERIA
YEAR 5 GROUNDWATER SAMPLING
AREA A LANDFILL
NSB-NLON
GROTON, CONNECTICUT

CONTRACT NO. 0083
OWNER NO. 038
APPROVED BY CAL DATE 6/7/06
DRAWING NO. FIGURE 2-9
REV. 0

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

ACAD: 0083CM04.dwg 05/03/06 HJB PIT




| SG-19 | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC | 2.9 | |
| COPPER | 12.7 J | 13.6 |
| LEAD | 5.5 J | 4.1 |
| ZINC | 90.9 | 109.4 |
| **SG-19 (DUP)** | | |
| COPPER | 5.7 | 8.6 |
| LEAD | | 3.2 |
| ZINC | | 83.9 J |

| SG-18 | |
|---|---|
| INORGANICS (µg/L) | ROUND 15 |
| COPPER | 6.8 |
| LEAD | 2.6 |
| ZINC | 153.6 J |

| SG-21 | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| LEAD | 3.4 | 1.9 |

| SG-20 | |
|---|---|
| INORGANICS (µg/L) | ROUND 15 |
| LEAD | 1.4 |
| ZINC | 77.2 |

| SG-22 | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC | 5.3 | |
| CADMIUM | | 0.7 |
| COPPER, FILTERED | 25.9 | 5.9 |
| COPPER | | 52.1 |
| LEAD, FILTERED | | 1.4 |
| LEAD | 14.5 | 24.8 |
| ZINC, FILTERED | | 323.8 |
| ZINC | 216.3 | 808.0 J |

| SG-23 | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| CADMIUM | | 1.0 |
| COPPER, FILTERED | | 5.1 |
| COPPER | | 39.3 |
| LEAD, FILTERED | | 1.7 |
| LEAD | | 20.2 |
| ZINC, FILTERED | 82.5 | 643.2 |
| ZINC | 134.5 | 2274.0 |

| SG-24 | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC, FILTERED | 4.7 | |
| ARSENIC | 44.9 | |
| CADMIUM, FILTERED | | 0.27 J |
| CHROMIUM | 34.0 | |
| COPPER, FILTERED | | 10.2 |
| COPPER | 109.9 | 24.2 |
| LEAD, FILTERED | | 1.3 |
| LEAD | 70.7 | 2.5 |
| ZINC, FILTERED | | 123.6 J |
| ZINC | 506.8 | 150.5 J |

| 3MSP01 | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 14 | ROUND 15 |
| ARSENIC | 2.1 | |
| CADMIUM | | 0.3 |
| COPPER | 14.2 | 19.4 |
| LEAD | 24.0 | 35.6 |
| ZINC | 81.7 | 105.2 J |
| SEMIVOLATILE ORGANICS (µg/L) | | |
| BENZO (A) ANTHRACENE | 0.35 J | |

**LEGEND:**

- STAFF GAUGE
- SEEP LOCATION

0 200 400
GRAPHIC SCALE IN FEET

**SOURCE:**

BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON AND PHASE II RI WORK PLAN (ATLANTIC, MAY 1993).

**NOTE:**

SURFACE WATER ANALYTICAL DATA FROM ROUND 14 GROUNDWATER MONITORING REPORT FOR AREA A LANDFILL (ECC, 2004) AND YEAR 5 ANNUAL GROUNDWATER MONITORING REPORT FOR AREA A LANDFILL (ECC, 2005).

| | |
|---|---|
| DRAWN BY MF | DATE 4/19/06 |
| CHECKED BY | DATE |
| REVISED BY | DATE |
| SCALE AS NOTED | |

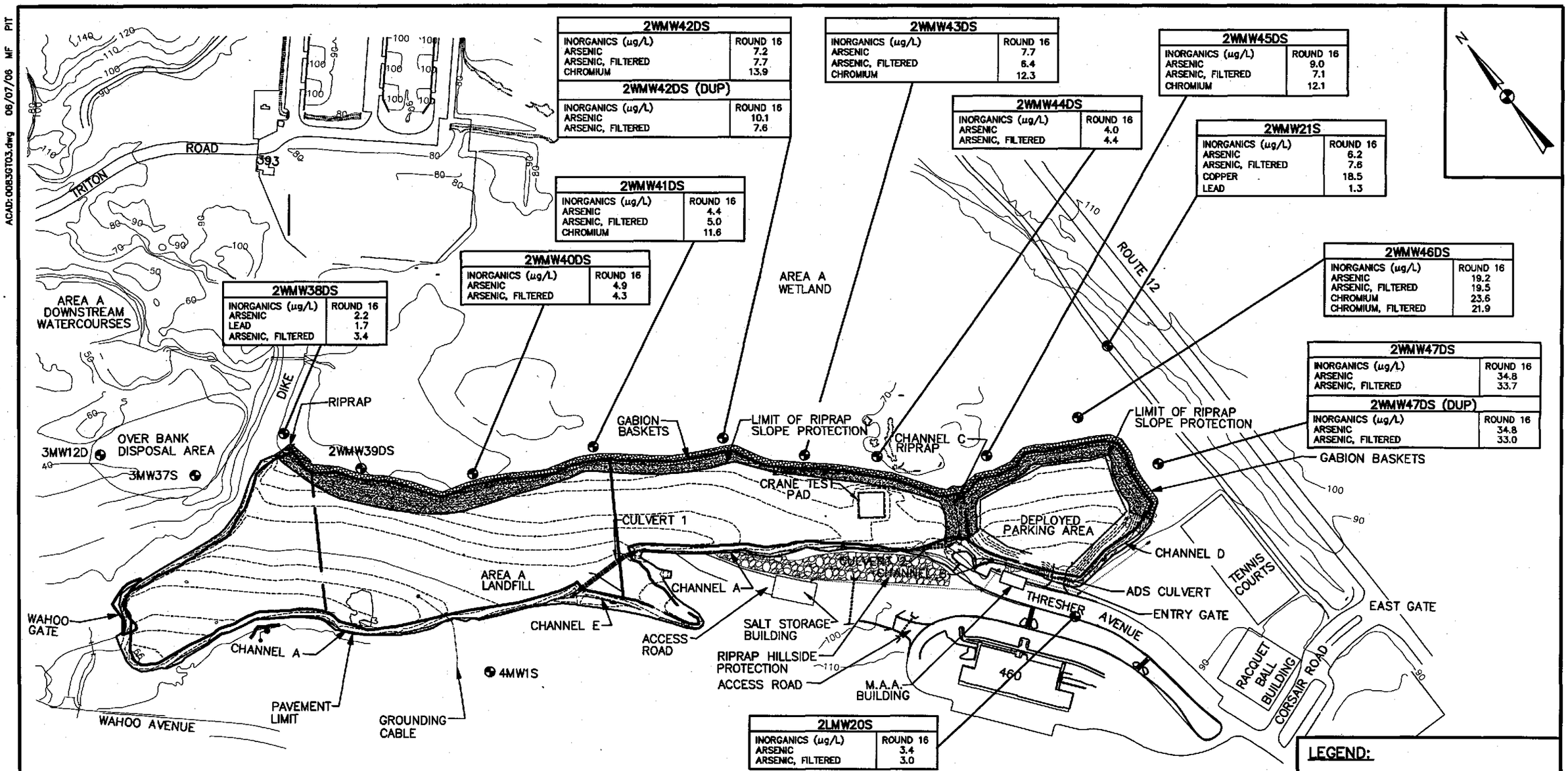
Tetra Tech NUS, Inc.

COPC EXCEEDANCES OF MONITORING CRITERIA
YEAR 5 SURFACE WATER SAMPLING
SITE 2 - AREA A LANDFILL
NSB-NLON
GROTON, CONNECTICUT

| | |
|---|---|
| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAM | DATE 6/7/06 |
| DRAWING NO. FIGURE 2-10 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

ACAD: 0083GT03.dwg 06/07/06 MF PIT




**NOTE:**

GROUNDWATER ANALYTICAL DATA FROM THE FOLLOWING GROUNDWATER MONITORING REPORTS FOR AREA A LANDFILL: FINAL ROUND 16 (ECC, 2006). YEAR 6 SAMPLING INCLUDED ROUNDS 16 AND 17. ROUND 17 RESULTS WERE NOT AVAILABLE AT THE TIME OF THIS REPORT.

**LEGEND:**

MONITORING WELL

0 200 400
GRAPHIC SCALE IN FEET

**SOURCE:**

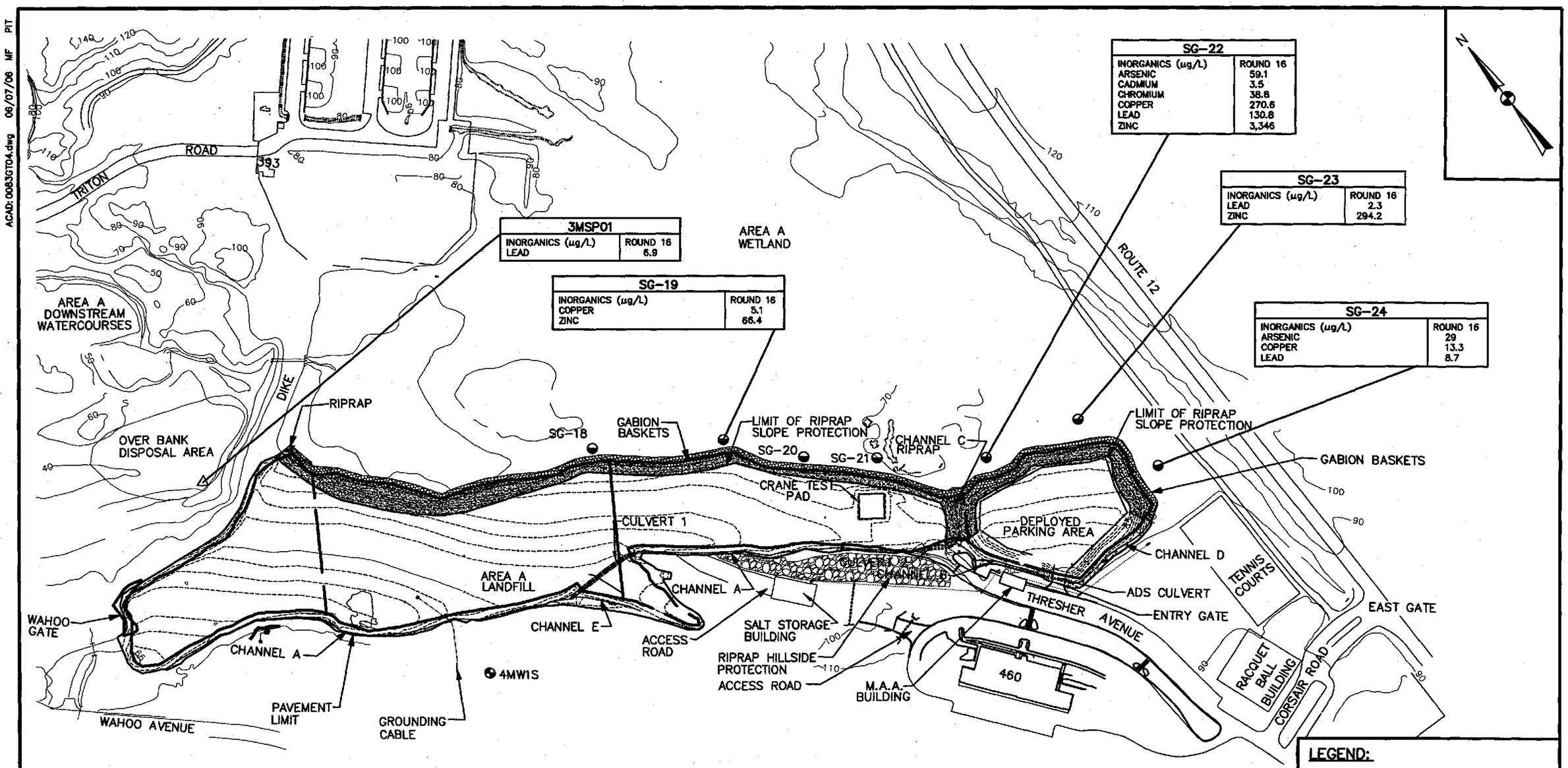
BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON AND PHASE II RI WORK PLAN (ATLANTIC, MAY 1993).

| | | | |
|---|---|---|---|
| DRAWN BY MF | DATE 4/19/06 | Tetra Tech NUS, Inc. | COPC EXCEEDANCES OF MONITORING CRITERIA YEAR 6 GROUNDWATER SAMPLING SITE 2 - AREA A LANDFILL NSB-NLON GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

| | |
|---|---|
| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAL | DATE 6/7/06 |
| DRAWING NO. FIGURE 2-11 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG – REV 1 – 9/10/98

ACAD: 0083GT04.dwg 06/07/06 MF PIT




**LEGEND:**

- STAFF GAUGE
- SEEP LOCATION

0 200 400
GRAPHIC SCALE IN FEET

**NOTE:**

SURFACE WATER ANALYTICAL DATA FROM THE FOLLOWING GROUNDWATER MONITORING REPORTS FOR AREA A LANDFILL: FINAL ROUND 16 (ECC, 2006). YEAR 6 SAMPLING INCLUDED ROUNDS 16 AND 17. ROUND 17 RESULTS WERE NOT AVAILABLE AT THE TIME OF THIS REPORT.

**SOURCE:**

BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON AND PHASE II RI WORK PLAN (ATLANTIC, MAY 1993).

| | | | |
|---|---|---|---|
| DRAWN BY MF | DATE 4/18/06 | Tetra Tech NUS, Inc. | COPC EXCEEDANCES OF MONITORING CRITERIA YEAR 6 SURFACE WATER SAMPLING SITE 2 - AREA A LANDFILL NSB-NLON GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

| | |
|---|---|
| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAL | DATE 6/7/06 |
| DRAWING NO. FIGURE 2-12 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG – REV 1 – 9/10/98

# 3.0 SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA (OU3 AND OU9)

Site 3 under the Navy's IRP includes the Area A Downstream Watercourses and the OBDA. This five-year review of Site 3 is required by statute because hazardous substances, pollutants, or contaminants remain in soil and groundwater that do not allow for unlimited use or unrestricted exposure. The soil OU associated with the OBDA was addressed through a non-time-critical removal action (NTCRA). The Action Memorandum for the OBDA was signed in July 1997 (Navy, 1997a). The soil and sediment OU (OU3) associated with the Area A Downstream Watercourses was addressed through a remedial action. The ROD for the soil and sediment OU was signed in March 1998 (Navy, 1998). After completion of the BGOURI Update/FS, an Interim ROD for the groundwater in OU9, which includes Site 3, was signed in December 2004 (Navy, 2004). The selected remedy for Site 3 groundwater is institutional controls with monitoring. The selected remedy for the groundwater at this site is an interim remedy, but it is expected that it will be the final remedy after remedial actions are selected for all portions of OU9.

## 3.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 3 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Pesticides used in waterbodies. | 1960s |
| Final IAS completed. | March 1983 |
| Phase I RI completed. | August 1992 |
| Draft FFS issued. | April 1994 |
| Phase II RI finalized. | March 1997 |
| OBDA NTCRA completed. | March 1997 |
| Proposed Plan for soil and sediment (OU3) issued. | July 1997 |
| EE/CA for OBDA issued and Action Memorandum for OBDA signed. | July 1997 |
| Final Post-Removal Report for OBDA issued. | July 1997 |
| Public Meeting for soil and sediment (OU3) conducted. | August 1997 |
| ROD for soil and sediment (OU3) signed. | March 1998 |
| Remedial Design for soil and sediment (OU3) completed. | 1999 |
| Remedial Action for soil and sediment (OU3) completed. | August 2000 |
| First Five-Year Review completed. | December 2001 |
| BGOURI completed. | January 2002 |
| Restoration and Long-Term Monitoring of OU3 completed. | 2003 |
| BGOURI Update/Feasibility Study completed. | July 2004 |
| Proposed Plan for Site 3 - NSA Soil (OU3) completed. | July 2004 |

| | |
|---|---|
| ROD for Site 3 - NSA Soil (OU3) signed. | September 2004 |
| Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 Groundwater (OU9) issued. | September 2004 |
| Interim ROD for Sites 3, 7, 14, 15, 18, and 20 Groundwater (OU9) signed. | December 2004 |
| Land Use Control (LUC) Remedial Design for Sites 3 and 7 Groundwater completed. | June 2005 |
| Final O&M Manual - Volumes I, II, III, IV and V | January 2006 |
| Work Plan for Remedial Action at Sites 3 and 7 completed. | March 2006 |
| Round 1 of groundwater monitoring at Sites 3 and 7 completed. | May 2006 |
| SOPA (ADMIN) New London Instruction 5090.18C issued. | December 2006 |
| Design for Site 3 – NSA soil completed. | TBD |
| Remediation of Site 3 – NSA soil completed. | TBD |

## 3.2 BACKGROUND

### 3.2.1 Area A Downstream Watercourses

The Area A Downstream Watercourses receive surface water and groundwater recharge from the Area A Landfill, Area A Wetland, Torpedo Shops, OBDA, OBDANE, and surrounding areas and convey them to the Thames River. The Area A Downstream Watercourses include North Lake and several small ponds (Upper Pond, Lower Pond, and OBDA Pond) and interconnected streams (Streams 1 through 6). The general configuration of the Area A Downstream Watercourses and adjacent areas is shown on Figure 3-1. The location of this site relative to other IR sites at NSB-NLON is shown on Figure 1-2.

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

Groundwater passing beneath the Area A Landfill/Wetland dike discharges to a small pond (the OBDA Pond) located at the base of the dike and the OBDA. Stream 1 flows from this pond westward toward North Lake, a recreational swimming area for Navy personnel. Under normal flow conditions, the stream enters a culvert that bypasses North Lake and discharges to Stream 6 below the outfall of the lake.

Stream 6, which is formed by Stream 1, Stream 2, and the outflow of North Lake, flows westward under Shark Boulevard and through the golf course to the Thames River. North Lake is filled with potable water every year and drained at the end of the season. Surface water levels in North Lake do not appear to coincide with groundwater levels in adjacent monitoring wells, indicating little hydraulic connection between surface water in North Lake and the shallow groundwater.

Most of Site 3 is within designated Explosive Safety Quantity Distance (ESQD) arcs of the Area A Weapons Center; therefore, further development is not planned for this area. Navy regulations prohibit construction of inhabited buildings or structures within these arcs and, although existing buildings operate under a waiver of these regulations, no further construction is planned.

The main cause of contamination at the Area A Downstream Watercourses was the application of pesticides. These pesticides were reportedly applied on the surface of water bodies to control mosquito proliferation adjacent to the nearby base recreational facilities (North Lake and golf course). Additional contaminants are inorganic constituents of river dredge spoil and Area A Landfill material carried over from adjacent sites. Samples of surface soil and sediment showed the presence of mainly DDT, 1,1-dichloro-2,2-bis(4-chlorphenyl)ethane (DDD), 1,1-dichloro-2,2-bis(4-chlorphenyl) ethene (DDE) (collectively referred to as DDTR), and small amounts of other pesticides such as dieldrin. Samples of sediment also contained relatively high levels of several metals (such as arsenic, beryllium, cadmium, lead, and zinc) compared to less contaminated reference areas outside the site.

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

Phase II RI field activities were conducted from 1993 to 1995 (B&RE, 1997a) and included test borings, monitoring well installation, and soil, surface water, sediment, and groundwater sampling. A soil gas survey and an extensive ecological investigation were also completed during the Phase II RI. The Phase II RI concluded that VOCs were present in groundwater at Site 3, that the site poses noncarcinogenic risks to the site worker and older child trespasser, and that notable concentrations of pesticides exist in site soil and sediments. The Phase II RI recommended that the FS for this site be revisited to focus on

pesticides in soil and sediment, that more sampling is required to delineate pesticide contamination and determine the origin of VOCs in groundwater, and that the debris associated with the OBDA should be removed.

Following the Phase II RI, an FS was completed in 1997 for soil and sediment at Site 3 (B&RE, 1997g). An alternative that included dredging, on-site dewatering, off-site disposal of sediment and soil, restoration of wetlands and waterways, and monitoring was selected for the site, and the selected remedy was documented in a ROD signed in March 1998 (B&RE, 1998d). A Remedial Design was completed for soil and sediment at Site 3 in 1998 and 1999 (FWEC, 2000), and the Remedial Action for Site 3 soil and sediment was completed in 1999 and 2000. The following general tasks were completed during the remedial action:

- Dewater and treat water, if necessary.
- Properties sampling for match to fill material prior to excavation.
- Excavate soil/sediment and load directly to front-end loader.
- Transfer soil/sediment to material-handling pad.
- Sample excavated soil and sediment for waste characterization purposes prior to stabilization.
- Sample excavation sidewalls/base at the frequency specified in the Sampling and Analysis Plan.
- Perform field immunoassay screening in conjunction with off-site laboratory analysis for pesticides and metals.
- Backfill or continue excavation based on field screening and laboratory analysis.
- Mix contaminated sediment on material handling pad with stabilizing agent.
- Load stabilized material onto dump trucks and transport to disposal/recycling facility.

Approximately 18,050 tons of soil and sediment were excavated and disposed off-site during the remedial action. Post-excavation confirmatory sampling and analysis were performed to confirm that remedial goals had been met prior to closing the excavation. Post-construction restoration and long-term monitoring were conducted for 3 years at the site to ensure that vegetation and habitat were properly restored.

Groundwater at Site 3 was further investigated during the BGOURI in 2000, but the results of the investigation were inconclusive and data gaps remained. To address the newly found Site 3 – NSA and the data gaps identified during the BGOURI, a Data Gap Investigation (DGI) (TtNUS, 2002e) was completed in the fall of 2002 prior to initiating an FS. The results of the DGI were presented in the BGOURI Update/FS (TtNUS, 2004).

The soil sampling program and a portion of the groundwater sampling program were concentrated on determining the overall nature and extent of contamination at the Site 3 – NSA. The remaining portion of the groundwater sampling program was focused on confirming the nature and magnitude of the groundwater contamination identified during the BGOURI. Petroleum contamination was identified at the Site 3 – NSA during the DGI; however, no significant source of VOC contamination was identified at the Site 3 – NSA.

The groundwater data collected during the DGI indicated that VOCs were originally released upgradient in the vicinity of Site 7 and are in the process of migrating through Site 3. It is likely that the primary original compound released was trichloroethene (TCE). There were detections of VOCs along Stream 5 from Site 7 to the Thames River. Comparisons of results from the Phase II RI, BGOURI, and DGI show that VOC concentrations in groundwater are decreasing steadily and that degradation products from the dechlorination of TCE have been detected, indicating that natural attenuation is occurring.

An FS was completed to identify and evaluate appropriate remedial alternatives for the soil at Site 3 – NSA and the groundwater at Site 3 (TtNUS, 2004). A ROD was signed for the Site 3 – NSA soil in September 2004 (Navy, 2004e). The ROD called for NFA for the petroleum-contaminated soil under CERCLA because petroleum is excluded from consideration under CERCLA; however, the Navy's cleanup plan to address the petroleum-contaminated soil under other applicable regulations was also detailed in an appendix to the ROD. The Navy anticipates completion of the cleanup of the debris and contaminated soil at Site 3 – NSA by the end of 2006.

Institutional controls and monitoring were selected as the remedy for Site 3 groundwater in the Interim ROD in 2004 (Navy, 2004h). A Remedial Design for Land Use Controls was subsequently completed for Site 3 groundwater in June 2005 (TtNUS, 2005). The Navy began implementation of the groundwater monitoring program as described in the Remedial Action Work Plan (TtNUS, 2006b) and Site 3 Groundwater Monitoring Plan (TtNUS, 2006a) in January 2006.

### 3.2.2 OBDA

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

Orange iron floc was observed in sediments in the area where water was discharging from the base of the dike embankment.

As discussed above, the OBDA Pond, located downgradient of the OBDA, was investigated as part of the Area A Downstream Watercourses during the Phase I and II RIs and the FFS and FS for the site. No investigative activities were completed within the limits of the disposal area. All the debris from the OBDA area was removed and disposed off site as part of a NTCRA in 1997. This removal action was completed during the Area A Landfill Remedial Action because the sites are located adjacent to one another. An EE/CA and Action Memorandum were prepared in 1997 to document the decision process for the NTCRA (Navy, 1997a).

## 3.3 REMEDIAL ACTIONS

### 3.3.1 Remedy Selection

#### 3.3.1.1 Area A Downstream Watercourses

Soil and Sediment

Following the Phase II RI, an FS for soil and sediment at Site 3 was completed (B&RE, 1997g). No additional samples were collected during the study. Four remedial alternatives were evaluated during the FS. Although groundwater was not the focus of the FS, the cross-medium impact from contaminated soil and sediment was considered during the evaluation of alternatives. Based on site information such as types of contaminants, environmental media of concern, and potential exposure pathways, RAOs were developed to aid in the development of alternatives. The following RAOs were selected to mitigate existing and future potential threats to public health and the environment from the soil and sediment OU (OU3):

- Protection of potential human receptors by preventing incidental ingestion of contaminated soil and sediment containing DDT, DDD, and dieldrin at concentrations exceeding 27 mg/kg, 38 mg/kg, and 0.57 mg/kg, respectively.

- Protection of potential human receptors by preventing incidental ingestion of sediment containing arsenic and beryllium at concentrations exceeding 6.1 mg/kg and 2.1 mg/kg, respectively.

- Protection of ecological receptors by preventing contaminated soil (containing DDTR concentrations exceeding 5.6 mg/kg, rounded down to 5.0 mg/kg to be conservative) and contaminated sediment (containing DDTR concentrations exceeding 2.0 mg/kg and dieldrin concentrations exceeding 0.045 mg/kg) from entering the food chain.

- Protection of ecological receptors from potential toxicity of sediment containing cadmium, lead, and zinc at concentrations exceeding their respective effects range-medium (ER-M) values of 9.6 mg/kg, 218 mg/kg, and 410 mg/kg.

The preferred alternative selected in the FS and documented in the ROD was excavation of contaminated soil and sediment followed by on-site dewatering and disposal at an off-site landfill. The sequence of actions envisioned at the conceptual stage were as follows: (1) removal, on-site treatment, and discharge of standing water from ponds and streams with appropriate stream flow diversions; (2) clearing/grubbing of contaminated soil areas; (3) dredging, on-site dewatering, and off-site disposal of contaminated sediment; (4) excavation, on-site dewatering, and off-site disposal of contaminated soil; (5) placement of clean soil backfill over the excavated soil areas with topsoil cover and revegetation to replace altered wetland functions and values; and (6) placement of suitable borrow material over the dredged sediment areas (such as sand in ponds and gravel in streams) and restoration of aquatic habitats. It was assumed that fencing and security measures would be present and would continue during the remedial action.

The remedial goals selected for the soil and sediment remedial action are summarized in Table 3-1. The arsenic and beryllium remedial goals were derived for protection of human receptors, and the remaining remedial goals were derived for protection of ecological receptors of concern. The ecological remedial goals are sufficiently low to be protective of human receptors of concern. The human health remedial goals are contaminant concentrations that would reduce potential health risks to receptors of concern (i.e., older child trespasser and construction worker) to acceptable levels. The bases for the ecological remedial goals are as follows:

- The soil remedial goal for DDTR was based on potential impacts to the short-tail shrew via ingestion of soil and contaminated prey items. The no-observed-adverse effects level (NOAEL) used for the shrew was 0.8 mg/kg-day (Opresko et al., 1994). The soil-to-earthworm bioaccumulation factor (BAF) was determined based on a site-specific bioaccumulation study. The exposure parameters in the food-chain model (i.e., ingestion rates) were obtained from the Wildlife Exposure Factors Handbook (USEPA, 1993b).

- The sediment remedial goals for metals were based on the ER-M value from Long et al. (1995).

- The sediment remedial goal for DDTR is based on empirical relationships between effects to benthic macroinvertebrates and DDTR concentrations.

- The sediment remedial goal for dieldrin is based on equilibrium partitioning using site-specific TOC concentrations, chemical-specific $K_{oc}$ value, and water-quality screening value (WQSV) for dieldrin. The WQSV for dieldrin (0.062 µg/L) was obtained from the draft Sediment Quality Criteria for the Protection of Benthic Organisms: Dieldrin (USEPA, 1993a) and was used because it is based on risks to aquatic organisms.

The cost associated with the selected remedy was estimated to be $8,125,000. The cost for wetland restoration and O&M for years 0 through 5 was estimated at $50,000 per year.

The Remedial Design for the soil and sediment OU began in 1998 and was completed in 1999. Additional sampling was conducted in the fall and winter of 1998 to further delineate the extent of contamination. The focus of the design was to develop a work plan and construction drawings that showed the details for excavating and disposing of the contaminated soil and sediment. The work plan and drawings developed described and showed construction sequencing, equipment lay-down areas, stream and pond dewatering details, dewatering pads, site restoration details, final grading plans, erosion and sediment control details, etc. for the remedial action. A verification sampling plan was also included in the work plan. The goal of the plan was to verify that the remedial action met the remedial goals defined above.

Groundwater

Remedial alternatives for Site 3 groundwater were developed and evaluated in the BGOURI Update/FS (TtNUS, 2004) to meet the following RAOs:

- Protect current receptors (construction workers) from incidental exposure to groundwater contaminated with petroleum and chlorinated hydrocarbons at concentrations greater than PRGs.

- Protect potential future receptors (potable water supply) from regular ingestion of groundwater contaminated with chlorinated hydrocarbons at concentrations greater than PRGs.

- Protect aquatic ecological receptors by preventing the migration of groundwater contaminated with petroleum hydrocarbons at concentrations greater than PRGs to surface water.

The two alternatives developed and evaluated during the FS were No Action and Institutional Controls with Monitoring. A remedy of Institutional Controls with Monitoring was selected for Site 3 groundwater in an Interim ROD (Navy, 2004c) to address the potential risks to future receptors from exposure to groundwater. Risks to current human and ecological receptors were shown not to be of significant concern, but there are potentially significant risks to hypothetical future human receptors from routine,

long-term consumption of contaminated groundwater. It is expected that the selected remedy for groundwater at Site 3, a portion of OU9, will be the final remedy after remedial actions are selected for all portions of OU9. The selected remedy complies with regulatory requirements and includes the following major components:

- Implementation of institutional controls that identify the location and magnitude of groundwater contamination and restrict extraction and use of the groundwater. The details of the administration of institutional controls will be provided in the remedial design documentation. In the event of property transfer and with confirmation that contaminated groundwater remains at the sites, a deed restriction would be used to prohibit the use of groundwater.

- Monitoring the degradation and potential migration of groundwater contaminants until concentrations decrease to the remedial goals in Table 3-2 by natural processes and until the resulting concentrations are shown to be protective of human health and the environment. Additional details regarding the scope and duration of the monitoring program will be provided in the groundwater monitoring plan.

The estimated cost of the selected remedy for Site 3 groundwater in the ROD was $319,500, which included capital, monitoring, and O&M costs. A Remedial Design for Land Use Controls was subsequently completed for Site 3 groundwater in June 2005 (TtNUS, 2005). The Navy also prepared the Remedial Action Work Plan (TtNUS, 2006b) and Site 3 Groundwater Monitoring Plan (TtNUS, 2006a) to address implementation of the groundwater monitoring program at Site 3.

#### 3.3.1.2 OBDA

The decision process for selecting the NTCRA for OBDA was documented in the Action Memorandum for the OBDA (Navy, 1997a). The NTCRA was completed to eliminate the potential threat to human and ecological receptors caused by the migration of contamination from potentially leaking tanks, drums, or other containers. It was determined that the most effective way to address this threat was to perform a NTCRA and dispose of the material off site. Other actions considered included institutional controls and containment. The ARARs/TBCs for the NTCRA were CTDEP Pollutant Mobility Criteria, CTDEP Direct Exposure Criteria for soil, and FFDC action tolerance levels. The estimated cost of the NTCRA, as presented in the Action Memorandum, was $500,000.

### 3.3.2 Remedy Implementation

#### 3.3.2.1 Area A Downstream Watercourses

Soil and Sediment

The remedial action for the Area A Downstream Watercourses/OBDA soil and sediment OU (OU3) was completed during July 1999 and August 2000. The details of the remedial action were documented in the Remedial Action Completion Report for Area A Downstream/OBDA Remediation (Foster Wheeler, 2001a). The actual cost of remediation was approximately $6,000,000. This cost does not include O&M costs.

Remediation and restoration of the site was completed in phases (i.e., Phases I through VI). The waterbodies addressed in each phase are as follows.

- Phase I – Stream 4
- Phase II – Stream 3
- Phase III – Stream 5
- Phase IV – Upper Pond
- Phase V – Lower Pond/Stream 2
- Phase VI – OBDA Pond/Stream 1/Base of OBDA Slope/Discharge Channel Structure

Although conditions varied between watercourses, the following general tasks were completed during each phase:

- Dewater and treat water as necessary.
- Perform properties sampling for match to fill material prior to excavation.
- Excavate soil/sediment and load directly to front-end loader.
- Transfer soil/sediment to material-handling pad.
- Sample excavated soil and sediment for waste characterization purposes prior to stabilization.
- Sample excavation sidewalls/base at the specified frequency.
- Perform field immunoassay screening in conjunction with off-site laboratory analysis for pesticides and metals.
- Backfill or continue excavation based on field screening and laboratory analysis.
- Mix contaminated sediment on material handling pad with stabilizing agent.
- Load stabilized material onto dump trucks and transport to disposal/recycling facility.

Approximately 18,050 tons of soil and sediment were excavated and disposed off-site during the remedial action. Post-excavation confirmatory sampling and analysis was performed to confirm that remedial goals at each excavation had been met prior to closing the excavation. Field sampling and screening for DDTR was used as the decision-making tool regarding excavation depth and area.

Several changes were made to the Remedial Design during the Remedial Action. The most significant change occurred during the remediation of Stream 4. Abandoned pipes were uncovered during the excavation of soil and sediment at the headwaters of the stream. Stream 4 is formed by the discharge from the Area A Wetland. These abandoned pipes were below the existing outlet structure for the Area A Wetland. It was felt that excavation and removal of the pipes would compromise the integrity of the Area A Wetland dike. Analytical results for a soil sample collected from around the pipes showed a concentration of DDTR of approximately 33 mg/kg, which is above the soil remediation goal of 5 mg/kg. To address the problem, the area around the piping was isolated and encapsulated using a cement/bentonite grout. In order to minimize erosion immediately beneath the Area A Wetland outfall structure, concrete was placed to form an apron and anchor the rock structure in part of the excavation. An Explanation of Significant Differences (ESD) needs to be prepared to document the change to the Remedial Action.

To meet the land use control requirements in the ROD, the Navy implemented an instruction [i.e., SOPA (ADMIN) New London Instruction 5090.18 (Navy, 2000b)] to restrict use at IR sites at NSB-NLON. The instruction defines the Navy's policy regarding ground surface disturbance of soils or any subsurface disturbance of soils and/or groundwater at IR sites. Other components of the remedial action, including long-term monitoring and O&M, are discussed in Section 3.3.3.

<u>Groundwater</u>

A Remedial Design for Land Use Controls was completed for Site 3 groundwater in June 2005 (TtNUS, 2005). The Navy incorporated the information in the Remedial Design into the New London Instruction 5090.18C (Navy, 2006b).

The objective of the Site 3 Groundwater Monitoring Plan is to conduct long-term monitoring of the degradation and potential migration of COCs until concentrations decrease to remedial goals by natural processes and until the resulting concentrations are shown to be protective of human health and the environment. The monitoring program will continue until compliance with remedial goals within the site boundaries are shown, and it is confirmed that contamination is not migrating from the site at concentrations in excess of remedial goals. The groundwater at Site 3 is designated as GB by the State of Connecticut; however, the Navy's goal for groundwater remediation at these sites is to meet GA requirements to eliminate groundwater use restrictions in the future. Based on State regulations,

monitoring can be discontinued after 3 years of data that show compliance with the applicable criteria. After the monitoring program can be discontinued, the groundwater use restrictions can be eliminated, and five-year reviews will no longer be necessary at the site. Annual reports will be issued to summarize the results of the monitoring program and provide thorough evaluations of each year of data collected under the program.

The Navy began implementation of the Groundwater Monitoring Program as described in the Remedial Action Work Plan (TtNUS, 2006b) and Site 3 GMP (TtNUS, 2006a) in May 2006. Four new monitoring wells were installed at Site 3 to complete the monitoring well network. A total of nine monitoring wells (five existing and four new) were then sampled and analyzed for VOCs under the monitoring program. The monitoring program will initially consist of quarterly sampling events. The analytical program and monitoring well network will be modified as necessary in the future as the monitoring program is optimized.

#### 3.3.2.2 OBDA

The NTCRA for the OBDA was completed during January 1997 and March 1997. The details of the NTCRA were documented in the Final Post Removal Action Report for Over-Bank Disposal Area (FWEC, 1997b). Tanks, large metal items, timbers, and miscellaneous construction debris resting on or protruding through the existing ground surface were removed from the OBDA during the NTCRA. Material removed from the site was decontaminated, if necessary, stockpiled, and subsequently transported off site for disposal. Potentially contaminated debris was wipe sampled and analyzed for DDT. Soil was also sampled and analyzed for DDT. DDT was not detected in either sample. After excavation, rock was placed in the excavation to stabilize it, and then the excavation area was restored with topsoil and hydroseeded.

### 3.3.3 System Operations/Operation and Maintenance

#### 3.3.3.1 Restoration and Long-Term Monitoring

Restoration

As a result of soil and sediment excavation and removal during the Site 3 remedial action, 2.90 acres of palustrine wetlands were disturbed. Compensatory mitigation for this impact required the restoration of 2.43 acres of palustrine wetlands and 0.47 acre of open water. All areas excavated during the Area A Downstream/OBDA remedial action were restored and reseeded in accordance with the Wetland Restoration Plan in the 100% Design (FWEC, 2000). This activity was considered Stage 1 of restoration activities and was completed on August 24, 2000. Vegetation, hydrologic conditions, and fish and wildlife use at Site 3 were monitored weekly between August 14 and October 26, 2000. A baseline benthic

survey was also conducted in October 2000 in conjunction with the post-construction monitoring. The results of the monitoring were documented in the Post Construction Monitoring Report, Area A Downstream/OBDA (FWEC, 2001b). In general, all of the initial monitoring results were positive and indicated that restoration activities were successful. Planting of woody species (i.e., shrubs and trees) at Site 3 was completed in April and May 2001. This activity was considered Stage 2 of the restoration activities.

Long-Term Monitoring

As detailed in the final Long-Term Wetland Monitoring Plan (FWEC, 2001c), long-term monitoring consisted of four components: vegetation, soils, hydrology, and functions and values. Long-term monitoring commenced upon the completion of the Stage 2 plantings. The performance standards for the monitoring are as follows:

Vegetation

- A minimum of 80 percent areal cover, excluding planned open water areas, by non-invasive hydrophytic species for all seeded areas.

- Greater than 50 percent of dominant plant species that have a wetland indicator status of facultative (FAC), facultative wetland (FACW), or obligate wetland (OBL) with no more than 50 percent of FAC species.

- For planted woody species, a minimum of 80 percent survival based on stem count.

- A 20 percent increase in tree height and diameter at breast height.

Soils

- Trend towards hydric condition within the upper 18 inches of the soil profile.

Hydrology

- Emergent zone hydrology that consists of soil saturated to the surface, water on the surface, or a combination of surface water and saturated soils for at least 10 consecutive days during the growing season.

- Scrub/shrub and forested zone hydrology that consists of soil saturated to the surface, or the groundwater table within 10 inches of the surface, for at least 10 consecutive days of the growing season.

Functions and Values

- All streams and ponds show a trend toward greater biological diversity in the benthic invertebrate community.

- Post-remedial functions and values equal to or greater than pre-remedial functions and values.

- Predicted potential habitat for 27 percent (16) of all wetland-dependent amphibians, reptiles, and mammals evaluated by the WEThings Method.

- Restoration of 1.26 acres of emergent wetland, 1.17 acres of scrub/shrub/forested wetland, and 0.47 acres of open water.

Year 1 of Long-Term Monitoring

The Year 1 monitoring results were documented in the Final Year 1 Long-Term Monitoring Report (FWEC, 2002d). The results indicated that the restored wetlands at Site 3 are progressing in a positive direction towards achieving the performance standards. The 2001 monitoring event indicated that the soils and hydrology performance standards have been met and that conditions are favorable for all criteria to be met in the next two growing seasons. Biological diversity is also increasing in the streams and ponds. Regarding vegetation, herbaceous communities appear to be healthy and thriving, invasive vegetation is still present and threatens to expand, and woody plantings indicate steadily progressing, extensive deer browse damage, especially to certain woody sapling species. The following corrective actions were proposed for 2002 to enhance and expedite natural development of the restored wetland communities and to ensure that long-term monitoring goals are met:

- Manually remove and/or apply herbicide to invasive vegetation
- Apply deer repellant on all planted trees
- Prune deer browsed trees and shrubs

Year 2 of Long-Term Monitoring

The Year 2 monitoring results were documented in the Final Year 2 Long-Term Monitoring Report (FWEC, 2003). The results indicated that the restored wetlands at Site 3 were generally progressing in a

positive direction towards achieving the performance standards; however, there were some setbacks caused by drought conditions. The 2002 monitoring event indicated that the soils and hydrology performance standards were met. Biological diversity, in particular the macroinvertebrate community, decreased during Year 2, primarily due to the drought conditions. The herbaceous communities at Site 3 appeared to be healthy and thriving during Year 2, but invasive vegetation is still present and threatens to expand, and the drought and deer browse continued to impact woody plantings (survival rate decreased to 59.5 percent). The corrective actions recommended in Year 1 were implemented during Year 2 and limited replanting of damaged/dead trees and shrubs took place in October 2002. The following corrective actions were proposed for 2003 to enhance and expedite natural development of the restored wetland communities and to ensure that long-term monitoring goals are met:

- Continue to manually remove and/or apply herbicide to invasive vegetation
- Apply deer repellant on all planted trees

Year 3 of Long-Term Monitoring

The Year 3 monitoring results were documented in the Final Year 3 Long-Term Monitoring Report (FWEC, 2004). The results indicated that the restored wetlands at Site 3 generally continued towards or met the identified performance standards. The monitoring results showed that the soils and hydrology performance standards were met. The biological diversity standards were met in all streams and ponds, with the exception of Stream 2, during the year. The physical characteristics of Stream 2 (intermittent flow, poorly defined channel, and nearly complete overgrowth by vegetation) limit the likelihood that a diverse and robust benthic community will develop. The herbaceous communities at Site 3 appeared to be healthy and thriving during Year 2, and the areal coverage standard was met. However, invasive vegetation is still present and requires continued maintenance. The monitoring showed that the survival standard for shrubs was met, but the results showed that the standard for trees was not met. Deer browse was the main problem in meeting the standard for tree growth. The report recommended allowing natural restoration of trees from existing seed sources instead of replanting. The corrective actions recommended in Year 2 were implemented during Year 3, and the following corrective actions were proposed for 2004 to allow continued natural development of the restored wetland communities:

- Continue to manually remove and/or apply herbicide to invasive vegetation
- Apply deer repellant on all planted trees

However, because the performance standards were generally met by the end of Year 3, restoration was considered complete, and the Navy opted not to continue the long-term monitoring program and corrective actions in Year 4.

#### 3.3.3.2 Groundwater Monitoring Program

No O&M costs have been incurred for the groundwater remedy. As presented in the BGOURI Update/FS the estimated present worth cost of groundwater monitoring activities at Site 3 for the first 5 years is $108,300. This cost estimate assumes quarterly sampling the first year, annual monitoring the next 4 years, and minimal maintenance of monitoring wells.

## 3.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of Site 3. The recommendations from the First 5-Year Review Report are provided below along with the actions taken to address the recommendations.

**Continue post-construction/long-term monitoring and restoration program.**

- The post-construction monitoring and restoration program was conducted for 3 years (2001, 2002, and 2003). A majority of the program's performance standards were met by the end of 2003, completing the program. No additional monitoring was required.

**Address erosion of Stream 5.**

- No corrective actions were taken to correct the minor area of erosion in Stream 5. The area of erosion has not increased and does not pose a significant concern.

**Complete planning documents and conduct the removal action for the NSA.**

- The Proposed Plan and ROD for Site 3 – NSA soil were completed. The planning documents and the removal action for Site 3 – NSA are expected to be completed in 2006.

**Maintain the existing monitoring well network and/or properly abandon unnecessary monitoring wells.**

- Limited maintenance of the existing monitoring well network was performed. Nine monitoring wells were redeveloped in anticipation of the Site 3 groundwater monitoring program. A well abandonment program was not developed or executed.

**Continue the RI/FS process and develop and implement an appropriate remedial alternative for the groundwater OU.**

- The FS, Proposed Plan, Interim ROD, Remedial Design for Land Use Controls, Remedial Action Work Plan, and Groundwater Monitoring Plan for Site 3 groundwater were completed. The Navy is currently implementing the Remedial Action Work Plan and Groundwater Monitoring Plan.

**Enforce New London Instruction 5090.18B.**

- The instruction was updated to include the Goss Cove Landfill and was reissued in 2003 (Instruction 5090.18B). The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information for Site 2 - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON. The instruction has been followed by personnel at NSB-NLON, and no uncontrolled disturbances of soil or groundwater at Site 3 have occurred.

## 3.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the 5-year review process and the actions taken to complete this review.

### 3.5.1 Document Review

The documents reviewed for the second five-year review are listed below, and key information obtained from the documents is summarized in the following sections.

| | |
|---|---|
| BGOURI | January 2002 |
| Final Year 1 Long-Term Monitoring Report (Restoration) | November 2002 |
| Final Year 2 Long-Term Monitoring Report (Restoration) | June 2003 |
| BGOURI Update/FS | July 2004 |
| Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 Groundwater (OU9) | September 2004 |
| Final Year 3 Long-Term Monitoring Report (Restoration) | October 2004 |
| Interim ROD for Sites 3, 7, 14, 15, 18, and 20 Groundwater (OU9) | December 2004 |
| LUC Remedial Design for Sites 3 and 7 Groundwater | June 2005 |
| Final O&M Manual - Volumes I and II | January 2006 |
| Work Plan for Remedial Action at Sites 3 and 7 | March 2006 |
| SOPA (ADMIN) New London Instruction 5090.18C | December 2006 |

### 3.5.2 Data Review

Since the first five-year review, additional monitoring and groundwater data have been collected at Site 3. The site restoration monitoring results are discussed in Section 3.3.3.1. Additional groundwater data were collected at Site 3 during the BGOURI DGI in 2002 (TtNUS, 2004). The concentrations of chlorinated VOCs (i.e., TCE, dichloroethene, and vinyl chloride) detected during the most recent investigation were less than concentrations detected during previous investigations, indicating that a continuing source of contamination is not present and that natural degradation processes are occurring. The VOCs were detected primarily along Stream 5 at concentrations less than 10 µg/L. It was the conclusion of the DGI that the chlorinated VOCs were released to groundwater via the two septic systems and associated leach fields at Site 7 and that contaminants are migrating downgradient through Site 3 towards the Thames River.

The Navy recently initiated the Groundwater Monitoring Plan for Site 3 groundwater. The data from the program will be available and included in the next five-year review.

### 3.5.3 ARAR and Site-Specific Action Level Changes

#### 3.5.3.1 Soil and Sediment

The selected remedy for soil and sediment at the Area A Downstream was excavation and off-site disposal of the material. The ARARs/TBCs considered during preparation of the ROD are presented in Tables 3-3, 3-4, and 3-5. These ARARs/TBCs were generally met during implementation of the remedial action. No new human health ARARs have been promulgated that would call into question the protectiveness of the remedy for soil and sediment.

Remedial action goals for arsenic and beryllium were based on potential impacts to older child trespassers exposed by incidental ingestion of soil/sediment. The remedial goal of 2.1 mg/kg for beryllium was based on carcinogenic health effects. In April 1998 USEPA withdrew the carcinogenic toxicity criteria for oral exposures to beryllium. The remedial goal for potential exposures to beryllium in soil/sediment by a older child trespasser based on noncarcinogenic effects would be 2,600 mg/kg. Since the revised remedial goal for beryllium is higher and therefore less stringent than the remedial goal presented in the FS and ROD, the revised remedial goal for beryllium does not call into question the effectiveness of the remedy.

The soil remedial goal of 5.0 for DDTR was based on potential impacts to the short-tail shrew via ingestion of soil and contaminated prey items. The toxicity data used to develop this value have not changed in the last 5 years. A site-specific soil-to-earthworm BAF was determined so this value has not

changed. Finally, the exposure parameters in the food-chain model have changed in the last 5 years. Therefore, the effectiveness of the remedy for soil has not changed in the last 5 years.

The sediment remedial goals for metals were based on the ER-M values from Long et al. (1995), which have not changed or been updated in the last 5 years. Also, because the sediment remedial goal for DDTR is based on site-specific empirical relationships between effects to benthic macroinvertebrates and DDTR concentrations, no changes can be made to this remedial goal. Therefore, the effectiveness of the remedy for sediment has not changed in the last 5 years.

The sediment remedial goal for dieldrin is based on equilibrium partitioning using site-specific TOC concentrations, the chemical-specific $K_{oc}$ values, and the WQSV for dieldrin. The only update to the parameters used in this equation was the WQSV, which was decreased from 0.062 µg/L (USEPA, 1993a) to 0.056 µg/L (USEPA, 1999a). This would produce a slightly lower sediment action level. Dieldrin was only detected in one post-removal sediment sample at an estimated concentration of 0.0022 mg/kg. This value was significantly less than the sediment action level of 0.045 mg/kg, and would only decrease slightly using the updated WQSV. Therefore, the revised WQSV for dieldrin does not call into question the effectiveness of the remedy.

#### 3.5.3.2 Groundwater

The ARARs/TBCs considered during preparation of the groundwater ROD are presented in Tables 3-6 and 3-7. These ARARs/TBCs have been or will be met by implementation of the remedial action. A Land Use Control Remedial Design was completed, and controls have been implemented through the New London Instruction 5090.18C. At least yearly monitoring of Institutional Control compliance will be completed with the monitoring reports being incorporated into future five-year reviews. A groundwater monitoring program was initiated, and the results will be reported in future monitoring reports. No new human health ARARs have been promulgated since the ROD was signed in 2004 that would call into question the protectiveness of the remedy for groundwater.

### 3.5.4 <u>Site Inspection</u>

Five-year review site inspections were completed on April 4, 2006. A cursory inspection of several Site 3 features (i.e., OBDA Pond, Upper Pond, Stream 4, Site 3 – NSA, and proposed locations of four new monitoring wells for the groundwater monitoring program) was completed during the inspection. Weather conditions during the inspection were cold (mid-40s), overcast, and windy. Representatives from the Navy, USEPA, CTDEP, TtNUS, ECC, and Gannett Fleming participated in the inspection. Photographs of the OBDA Pond and Upper Pond are provided in Appendix B. No significant issues were noted during the inspection.

### 3.5.5 Site Interviews

No official interviews were conducted as part of the second five-year review. The status of site restoration monitoring was discussed with the Navy. Details of the site restoration monitoring are discussed in Section 3.3.3.1.

## 3.6 ASSESSMENT

The following conclusions support the determination that the remedy for the Site 3 soil and sediment OU (OU3) is protective of human health and the environment and that the remedy for the Site 3 groundwater OU, a portion of OU9, will be protective of human health and the environment upon completion.

***Question 1. Is the remedy functioning as intended by the decision documents?***

- ***Remedial Action Performance:*** All contaminated soil and sediment in excess of remediation goals (Table 3-1) were excavated and disposed off site. The only exception was a small area in Stream 4, which was capped in place using concrete. The effectiveness of the OU3 remedial action and site restoration activities was monitored for 3 years. The results of the monitoring showed that restoration activities were successful and that no further actions were necessary. Groundwater monitoring was recently initiated at the site to monitor the natural attenuation of contaminants in groundwater until they reach the remedial goals presented in Table 3-2. The groundwater data will be summarized and evaluated in subsequent monitoring reports. The results of the groundwater monitoring program will be used to determine if changes in the selected remedial action are necessary in the future.

- ***System Operations/O&M:*** Issues noted during the post-construction monitoring program (e.g., invasive vegetation and deer browse) for OU3 were addressed as appropriate. For the groundwater OU, four new monitoring wells were installed to complete the monitoring well network, and five existing wells were redeveloped as part of the groundwater monitoring program. O&M activities for the monitoring wells will be required in the future.

  Costs for groundwater monitoring at Site 3 over the first 5 years of the program were estimated in the FS to range from $50,200 (Year 1) to $15,378 (Years 2 through 5). Because the monitoring program was initiated in May 2006, actual costs were not available at the time of preparation of this report.

  No O&M of the encapsulated soil at Stream 4 has been done to date. O&M activities need to be initiated at the site and continued into the future.

- ***Opportunities for Optimization:*** Site 3 monitoring wells not being used for the monitoring program can be abandoned. The monitoring well network can be reduced as appropriate in the future.

- ***Early Indicators of Potential Remedy Failure:*** There are no indicators of potential remedy failure.

- ***Implementation of Institutional Controls and Other Measures:*** Institutional controls associated with Site 3 are discussed in the New London Instruction 5090.18C. Controls on the area where a small amount of contaminated soil was encapsulated at Stream 4 were incorporated into the instruction. Some areas of Site 3 are fenced and access is restricted. A significant portion of the site is within designated ESQD arcs of the Area A Weapons Center; therefore, further development is not planned for the area. A Land Use Control Remedial Design for Site 3 groundwater was completed, and the controls have been implemented through the New London Instruction 5090.18C.

***Question 2. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?***

- **Changes in Standards and TBCs**: There have been no changes in standards or TBCs that call into question the protectiveness of the soil and sediment OU or groundwater OU remedies. As presented in Section 3.5.3, the WQSV for dieldrin decreased from 0.062 µg/L to 0.056 µg/L. None of the other standards/TBCs have changed since the ERA was conducted.

- **Changes in Exposure Pathways:** Because all contaminated soil and sediment with concentrations greater than remedial goals was either excavated and disposed off site or capped in place, the direct exposure pathway for human and ecological receptors to come into contact with the soil and sediment has been eliminated. This change was planned as part of the remedial action. Groundwater at Site 3 is not currently used as a drinking water source, and municipal potable water is available at the site, which would minimize the likelihood that groundwater would be used as a drinking water source in the future.

- ***Changes in Toxicity and Other Contaminant Characteristics:*** In April 1998, the USEPA withdrew the oral CSF for beryllium. In addition, the oral RfD for beryllium was lowered from 0.005 mg/kg/day to 0.002 mg/kg/day. As discussed in Section 3.5.3, the changes in the toxicity criteria for beryllium do not call into question the effectiveness of the remedy for the soil and sediment OU. None of the toxicity data for the groundwater contaminants have changed, and none of the ecological toxicity data have changed since the ERA was conducted.

- ***Changes in Risk Assessment Methods:*** Since the human health risk assessments were prepared USEPA has issued new guidance documents, as discussed in Section 1.4. The new guidance documents do not impact the conclusions of the original human health risk assessments. As discussed in Section 1.4, ecological risk assessment methodology has not changed significantly over the past 5 years.

- ***Expected Progress Towards Meeting RAOs:*** The RAOs for OU3 were met by conducting the remedial action that included excavation and off site disposal of a majority of the contaminated soil and sediment and capping in place of a small amount of contaminated soil/sediment in Stream 4. RAOs for the groundwater at Site 3, a portion of OU9, are in the progress of being met. A Remedial Design for LUCs was prepared for groundwater and was incorporated in the New London Instruction 5090.18C. A Groundwater Monitoring Plan was implemented in May 2006 to monitoring the degradation and potential migration of COCs until concentrations reach the remedial goals.

***Question 3. Has any other information come to light that could call into question the protectiveness of the remedy?***

The Site 3 – NSA was discovered during the OU3 remedial action in Stream 5 and further investigated during the BGOURI DGI in 2002. Sampling and analysis conducted during the investigation indicated that the only COC for the area was petroleum. Because petroleum was the only concern at the site, it was excluded from further evaluation under CERCLA. The Navy plans to complete a removal action to address the area in 2007.

## 3.7 ISSUES

The following deficiencies were identified during this review:

- New London Instruction 5090.18C was issued in 2006 and includes information regarding the contaminated soil/sediment capped in place in Stream 4 and the latest information from the Land Use Control Remedial Design for Site 3 groundwater. However, an ESD needs to be prepared for the contaminated soil/sediment capped in place in Stream 4.

- Maintenance of the existing monitoring wells was not completed, and a monitoring well abandonment program was not prepared or implemented.

## 3.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Based on the results of the site inspection and review, the following recommendations are made for Site 3.

- Continue implementation of the Groundwater Monitoring Plan
- Conduct the removal action for Site 3 - NSA
- Continue to enforce the New London Instruction 5090.18C
- Maintain the existing monitoring well network and/or properly abandon unnecessary monitoring wells
- At least yearly monitoring of Institutional Control compliance with the monitoring reports incorporated into future five-year reviews
- Prepare and issue an ESD for the capped wastes at Stream 4 that addresses CERCLA requirements

Follow-up actions should be completed by the Navy in a timely manner to address the recommendations.

## 3.9 PROTECTIVENESS STATEMENT

The remedy implemented for soil and sediment at Site 3 (OU3) is protective of human health and the environment. Although it is not required under CERCLA, an RA is planned for the Site 3 – NSA. It is anticipated that, when the soil associated with the NSA is addressed by a removal action, the remedial actions completed for the soil and sediment OU will be completely protective of human health and the environment.

The remedy for groundwater at Site 3 is expected to be protective of human health and the environment. The groundwater OU for Site 3 will be addressed with institutional controls and monitoring. There are no immediate threats to human health or the environment from the OU (i.e., groundwater is not currently used as a drinking water source). Implementation of institutional controls and monitoring will maintain the effectiveness of the remedy into the future.

**TABLE 3-1**

**SUMMARY OF REMEDIAL GOALS FOR SITE 3 SOIL AND SEDIMENT**
**SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

| Contaminant of Concern | Medium of Concern | |
|---|---|---|
| | Soil | Sediment |
| DDTR | 5.0 mg/kg | 2.0 mg/kg |
| Dieldrin | Not a COC | 0.045 mg/kg |
| Arsenic | Not a COC | 6.1 mg/kg |
| Beryllium | Not a COC | 2.1 mg/kg |
| Cadmium | Not a COC | 9.6 mg/kg |
| Lead | Not a COC | 218 mg/kg |
| Zinc | Not a COC | 410 mg/kg |

**TABLE 3-2**

**SUMMARY OF REMEDIAL GOALS FOR SITE 3 GROUNDWATER**
**SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

| Contaminant of Concern | Remedial Goal for Protection of Future Potential Receptors [(1)] |
|---|---|
| **Volatile Organic Compounds** | |
| Trichloroethene | 5 µg/L |
| Vinyl chloride | 2 µg/L |
| **Semi-volatile Organic Compounds** | |
| Hexachlorobenzene | 1 µg/L |

1 Future potential receptors consist of residents living at the site who may use groundwater as a source of potable water. Human health remedial goals are based on federal and State of Connecticut drinking water/groundwater quality standards.

## TABLE 3-3

## CHEMICAL-SPECIFIC ARARs AND TBCs FOR SITE 3 SOIL AND SEDIMENT
## SITE 3 – AREA A DOWNSTREAM WATERCOURSE/OBDA
## NAVAL SUBMARINE BASE NEW LONDON
## GROTON, CONNECTICUT


| Requirement | Citation | Status | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|---|
| **FEDERAL** | | | | |
| Water Quality Criteria for DDT and Metabolites (EPA 440-80-038), 1980 | NA | TBC | Provides criteria for assessing toxicity of DDT and metabolics to aquatic organisms. | DDTR-contaminated soil/sediment was either excavated, removed, and replaced with uncontaminated material or capped. Remaining soil/sediment provides no source of contamination to surface waters and poses no hazard to potential aquatic receptors. Because waste was capped in place at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy. |
| Technical Basis for deriving Sediment Quality Criteria for Non-Ionic Organic Contaminants for Protection of Benthic organisms by Using Equilibrium Partitioning (EPA-822-R-93-011), 1993 | NA | TBC | Guidance for estimating cleanup goals for sediment contamination. | Contaminated sediment was either excavated, removed, and replaced with uncontaminated material or capped. Remaining sediment poses no hazard to potential receptors. Removal of contaminated sediment achieved protection of receptors of concern; therefore, this requirement is no longer applicable. |
| National Oceanographic and Atmospheric Administration (NOAA) Incidence of Adverse Biological Effects within Ranges of Chemical Concentration in Marine and Estuarine Sediments (Long et. al., 1995) | NA | TBC | Guidance on concentration ranges of contaminants in sediment that would rarely or more likely to have adverse effects. Findings comparable with fresh-water sediments. | Contaminated sediment was either excavated, removed, and replaced with uncontaminated material or capped. Remaining sediment poses no hazard to potential receptors. Remedial actions achieved protection of receptors of concern; therefore, this requirement is no longer applicable. |

## TABLE 3-3

## CHEMICAL-SPECIFIC ARARs AND TBCs FOR SITE 3 SOIL AND SEDIMENT
## SITE 3 – AREA A DOWNSTREAM WATERCOURSE/OBDA
## NAVAL SUBMARINE BASE NEW LONDON
## GROTON, CONNECTICUT


| Requirement | Citation | Status | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|---|
| **FEDERAL (Continued)** | | | | |
| Cancer Slope Factors (CSFs) | NA | TBC | These are guidance values used to evaluate the potential carcinogenic hazard caused by exposure to contaminants. | Contaminated sediment was either excavated, removed, and replaced with uncontaminated material or capped Remaining sediment poses no hazard to potential receptors. Because waste was capped in place at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy. |
| Reference Doses (RfDs) | NA | TBC | These are guidance values used to evaluate the potential noncarcinogenic hazard caused by exposure to contaminants. | Contaminated soil/sediment was either excavated, removed, and replaced with uncontaminated material or capped. Because waste was capped in place at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy. |
| **STATE OF CONNECTICUT** | | | | |
| Soil Remediation Standards | RCSA § 22a-133k-1 through 2 | Applicable | Regulations specify remediation standards for direct exposure to soil and sediments. Regulations also specify groundwater protection standards for contaminated soil in areas with a state groundwater classification of GB. | Contaminated soil/sediment was either excavated, removed, and replaced with uncontaminated material or capped. Because waste was capped in place at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy. The groundwater aquifer is expected to meet the standards for the GB groundwater classification after the completion of the groundwater OU activities. |

## TABLE 3-4

## LOCATION-SPECIFIC ARARs AND TBCs FOR SITE 3 SOIL AND SEDIMENT
## SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA
## NAVAL SUBMARINE BASE NEW LONDON
## GROTON, CONNECTICUT


**FEDERAL**

| Requirement | Citation | Status | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|---|
| Clean Water Act, Section 404 | 33 USC 1344; 40 CFR Part 230 and 33 CFR Parts 320-323 | Applicable | 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. | Remedial action included dredging of soil and sediment from contaminated wetlands and replacement/restoration with uncontaminated material. Measures were taken to minimize adverse effects and to replace or restore protected wetland functions and values. Because waste was capped inplace at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy. |
| Executive Order 11990 RE: Protection of Wetlands | Executive Order 11990, 40 CFR Part 6, Appendix A | Applicable | This order requires Federal agencies to take action to avoid adversely impacting wetlands wherever possible, to minimize wetlands destruction and to preserve the values of wetlands, and to prescribe procedures to implement the policies and procedures of this Executive Order. | Remedial action included dredging of soil and sediment from the contaminated wetlands and replacement/restoration with uncontaminated material. Measures were taken to minimize adverse effects and to replace or restore protected wetland functions and values. Wetlands restoration was completed according to the Wetlands Restoration Plan. The substantive requirements of the wetlands ARARs have been met. Changes in remedial goals for soil and sediment as related to wildlife and benthic organisms are presented in Section 3.5.3. Because waste was capped inplace at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy |

## TABLE 3-4

## LOCATION-SPECIFIC ARARs AND TBCs FOR SITE 3 SOIL AND SEDIMENT
## SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA
## NAVAL SUBMARINE BASE NEW LONDON
## GROTON, CONNECTICUT


**FEDERAL**

| Requirement | Citation | Status | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|---|
| Fish and Wildlife Coordination Act | 16 USC Part 661 *et. seq.*, 40 CFR 122.49 | Applicable | This act protects fish and wildlife when Federal actions result in control or structural modification of a natural stream or body of water. | Remedial action included dredging of soil and sediment from the contaminated wetlands and replacement/restoration with uncontaminated material. Measures were taken to minimize adverse effects on fish and wildlife. Changes in remedial goals for soil and sediment as related to wildlife and benthic organisms are presented in Section 3.5.3. Because waste was capped inplace at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy |
| Coastal Zone Management Act | 16 USC Parts 1451 *et. seq.* | Applicable | Requires that any actions must be conducted in a manner consistent with state approved management programs. | Dredging, filling, regrading, and restoration of vegetation were completed. Because waste was capped inplace at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy |
| Executive Order 11988 RE: Floodplain Management | Executive Order 11988 | Applicable | This order requires federal agencies to evaluate the potential effects of actions it may take within a designated 100-year floodplain of a waterway to avoid adversely impacting floodplains whenever possible. | Dredging, filling, regrading, and restoration of vegetation were completed. Because waste was capped inplace at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy |

## TABLE 3-4

## LOCATION-SPECIFIC ARARs AND TBCs FOR SITE 3 SOIL AND SEDIMENT
## SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA
## NAVAL SUBMARINE BASE NEW LONDON
## GROTON, CONNECTICUT


**STATE OF CONNECTICUT**

| Requirement | Citation | Status | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|---|
| Inland Wetlands and Watercourses | CGS § 22a-37 thru 45, RCSA § 22a-39-1 through 15 | Applicable | These rules regulate all activities in wetlands and watercourses. | Contaminated soil and sediment were dredged from wetlands and watercourses, which were restored using uncontaminated material. Wetlands restoration was successfully completed in accordance with the Wetlands Restoration Plan. Changes in remedial goals for soil and sediment as related to wildlife and benthic organisms are presented in Section 3.5.3. Because waste was capped inplace at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy |
| Coastal Management | CGS §§22a-92 and 94 | Applicable | Federal facilities are required to file a coastal zone consistency determination under these rules, which includes the goal that development, preservation, or use of land and water resources of a coastal area proceed without significantly disrupting the natural environment. | Contaminated soil and sediment were removed from areas within the coastal zone, which were restored using uncontaminated material. The substantive requirements of the Connecticut standards were met to address the alteration of the coastal zone. Restoration of vegetation has been completed. Because waste was capped inplace at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy |
| CT Endangered Species Act | CGS § 26-303 through 314 | Relevant and Appropriate | Regulates activities affecting state-listed endangered or threatened species or their critical habitat. | Dredging, filling, regrading, and restoration of vegetation have been completed. Because waste was capped inplace at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy |

## TABLE 3-5

## ACTION-SPECIFIC ARARs AND TBCs FOR SITE 3 SOIL AND SEDIMENT
## SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA
## NAVAL SUBMARINE BASE NEW LONDON
## GROTON, CONNECTICUT


**FEDERAL**

| Requirement | Citation | Status | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|---|
| Clean Water Act, Section 402, National Pollution Discharge Elimination System (NPDES) | 33 USC 1342; 40 CFR 122 through 125 | Applicable | These standards govern the discharge of water into surface waters. | Surface water removed prior to dredging, along with water from the sediment/soil dewatering process, was treated by filtration and carbon adsorption to meet discharge criteria according to substantive requirements of NPDES. Because waste was capped in place at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy. |

**STATE OF CONNECTICUT**

| | | | | |
|---|---|---|---|---|
| Water Pollution Control | RCSA § 22a-430-1 through 8 | Applicable | These rules regulate water discharge to surface water. | Surface water removed prior to dredging, along with water from the sediment/soil dewatering process, was treated by filtration and carbon adsorption in compliance with these regulations. Because waste was capped in place at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy. |
| Water Quality Standards | CGS 22a-426 | Applicable | Connecticut's Water Quality Standards establish specific numeric criteria, designated uses, and anti-degradation policies for groundwater and surface water. | Surface water removed prior to dredging, along with water from the sediment/soil dewatering process, was treated by filtration and carbon adsorption in a manner that is consistent with the anti-degradation policy in the Water Quality Standards. Because waste was capped in place at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy. |

## TABLE 3-5

## ACTION-SPECIFIC ARARs AND TBCs FOR SITE 3 SOIL AND SEDIMENT
## SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA
## NAVAL SUBMARINE BASE NEW LONDON
## GROTON, CONNECTICUT


**STATE OF CONNECTICUT**

| Requirement | Citation | Status | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|---|
| Hazardous Waste Management: Generator and Handler Requirements, Listing and Identification | RCSA § 22a-449(c) 100-101 | Applicable | Connecticut is delegated to administrate 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. | Hazardous waste determinations were performed on all contaminated soils/sediments excavated to determine that levels of regulated constituents do not exceed applicable limits. Also, wastes produced from surface water and dewatering treatment were tested to determine whether levels of certain regulated constituents (lead, mercury, heptachlor, etc.) exceed TCLP limits. Any contaminated soils/sediments that exceeded applicable limits were managed in accordance with requirements of these regulations. Because waste was capped in place at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy. |
| 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. | Surface water treatment residues (spent filtration media and activated carbon) were tested for hazardous characteristics during remediation. Because waste was capped in place at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy. |
| Hazardous Waste Management: TSDF Standards | RCSA § 22a-449 (c) 104 | Applicable | This section establishes standards for treatment, storage, and disposal facilities. The standards of 40 CFR 264 are incorporated by reference. | Because waste was capped in place at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy. |

## TABLE 3-5

## ACTION-SPECIFIC ARARs AND TBCs FOR SITE 3 SOIL AND SEDIMENT
## SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA
## NAVAL SUBMARINE BASE NEW LONDON
## GROTON, CONNECTICUT


**STATE OF CONNECTICUT**

| Requirement | Citation | Status | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|---|
| Air Pollution Control | RCSA § 22a-174 1-20 | Applicable | These regulations require permits to construct and operate specified types of emission sources and contain emission standards that must be met prior to issuance of a permit. Pollutant abatement controls may be required. Specific standards pertain to fugitive dust (18b), and control of odors (23) . | Emission standards for fugitive dust from excavation and restoration operations were met with dust control measures. Odors/emissions from the dewatering piles were managed to comply with these standards. Because waste was capped in place at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy. |
| Water Diversion Policy Act | RCSA § 22a-377(b) | Relevant and Appropriate | These rules regulate a wide variety of water diversions. | Surface water diversions during remediation were conducted using best management practices. Because waste was capped in place at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy. |
| Connecticut Guidelines for Soil Erosion and Sediment Control | CT Council on Soil and Water Conservation | TBC | Technical and administrative guidance for development, adoption and implementation of erosion and sediment control program. | Guidelines were followed during remediation. Dredging, filling, regrading, and restoration of vegetation have been completed. Because waste was capped in place at Stream 4, these requirements are applicable to the future operation and maintenance of the remedy. |

**TABLE 3-6**

**CHEMICAL-SPECIFIC ARARs AND TBCs FOR SITE 3 GROUNDWATER**
**SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

**FEDERAL**

| Requirement | Citation | Status | Synopsis of Requirement | Current Status/Applicability |
|---|---|---|---|---|
| Cancer Slope Factors (CSFs) | Not Applicable | TBC | These are guidance values used in risk assessment to evaluate the potential carcinogenic hazard caused by exposure to contaminants. | A remedy of land use controls with monitoring is being implemented. The controls will prevent exposure to contaminated groundwater and the monitoring will track contaminant migration and degradation of contaminants until concentrations are less than acceptable levels. |
| Reference Doses (RfDs) | Not Applicable | TBC | These are guidance values used in risk assessment to evaluate the potential noncarcinogenic hazard caused by exposure to contaminants. | A remedy of land use controls with monitoring is being implemented. The controls will prevent exposure to contaminated groundwater and the monitoring will track contaminant migration and degradation of contaminants until concentrations are less than acceptable levels. |

**STATE OF CONNECTICUT**

| Requirement | Citation | Status | Synopsis of Requirement | Current Status/Applicability |
|---|---|---|---|---|
| Remediation Standard Regulations | CGS 22a-133k; RCSA 22a-133k - 1 thru 3 | Applicable | This regulation provides specific numerical cleanup criteria for contaminants in groundwater. Requirements are based on groundwater in the area being classified by the State as GB. | The remedy of land use controls and monitoring complies with ARAR. Land use controls will prevent exposure to and use of contaminated groundwater. Monitoring will track the location, migration, and degradation of contaminants until concentrations are less than acceptable levels. |

**TABLE 3-7**

**ACTION-SPECIFIC ARARs AND TBCs FOR SITE 3 GROUNDWATER**
**SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


**FEDERAL**

| Requirement | Citation | Status | Synopsis of Requirement | Current Status/Applicability |
|---|---|---|---|---|
| SDWA MCLs | 42 USC 300f et. seq. 40 CFR Parts 141 to 143 | Relevant and Appropriate | MCLs established under this act are health-based limits for certain chemical substances in drinking water. Site groundwater is not a current or planned future drinking water source. However, in the future, the site groundwater could be used as a potable water supply. | A remedy of land use controls with monitoring is being implemented. The controls will prevent exposure to contaminated groundwater and monitoring will track the migration and degradation of contaminants until concentrations are less than acceptable levels. |
| Clean Water Act, Section 403, Pretreatment Regulations | Section 403 | Applicable | General pretreatment requirements for discharge to a publicly-owned treatment works. | Groundwater extracted during groundwater monitoring activities is being tested and disposed off site. Discharge to a publicly-owned treatment works may be considered in the future for disposal of the groundwater and these requirements will be met if it is determined to be applicable. |

**TABLE 3-7**

**ACTION-SPECIFIC ARARs AND TBCs FOR SITE 3 GROUNDWATER**
**SITE 3 – AREA A DOWNSTREAM WATERCOURSES/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


**STATE OF CONNECTICUT**

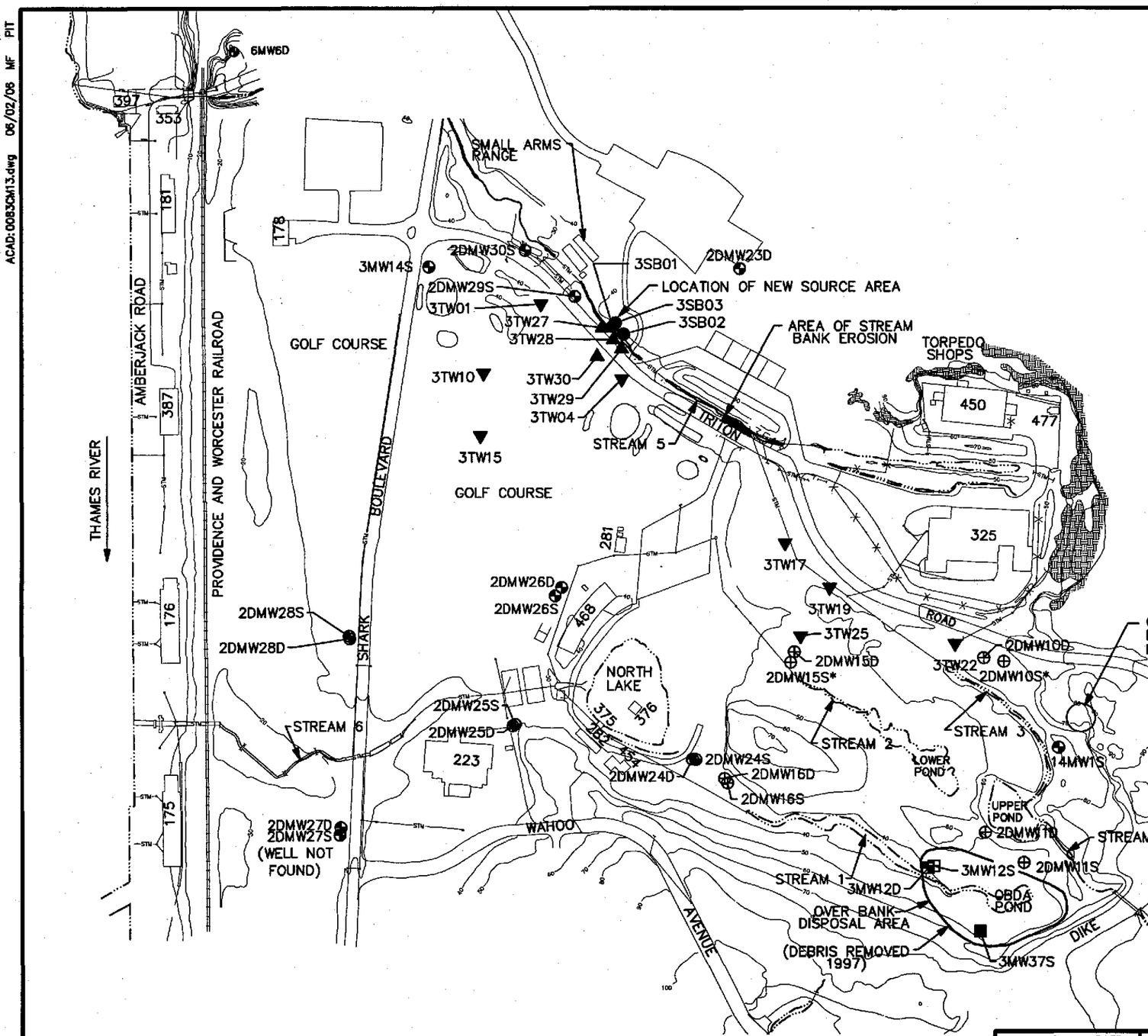
| Requirement | Citation | Status | Synopsis of Requirement | Current Status/Applicability |
|---|---|---|---|---|
| Hazardous Waste Management: Generator and Handler Requirements | RCSA § 22a-449(c) 100-101 | Applicable | Connecticut is delegated to administer the Federal Resource Conservation and Recovery Act 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. | Waste generated during the installation of monitoring wells and monitoring activities under the selected remedy was characterized for disposal and determined to be nonhazardous. This requirement is applicable during future well installation activities. |
| Hazardous Waste Management: Treatment, Storage, or Disposal Facility Standards | RCSA § 22a-449(c) 104 | Applicable | These sections establish standards for treatment, storage, and disposal facilities. The standards of 40 CFR 264 are incorporated by reference. | Waste generated during the installation of monitoring wells and monitoring activities under the selected remedy was characterized for disposal and determined to be nonhazardous. This requirement is applicable during future well installation activities. |
| Water Quality Standards | CGS 22a-426 (Connecticut General Statutes) | Applicable | These standards specify Connecticut WQSs, classifications of water of the state, and anti-degradation policies for surface water and groundwater. Groundwater at the site is classified as GB. | A remedy of land use controls with monitoring is being implemented. The controls will prevent exposure to contaminated groundwater and monitoring will track the migration and degradation of contaminants until concentrations are less than acceptable levels. |

**TABLE 3-8**

**DEFICIENCIES IDENTIFIED FOR**
**SITE 3 - AREA A DOWNSTREAM WATECOURSES/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

| Deficiency | Effects Protectiveness | |
|---|---|---|
| | Current | Future |
| Completion of ESD for soil/sediment at Stream 4 | N | N |
| Maintenance/abandonment of monitoring wells | Y | Y |

ACAD: 0083CM13.dwg 06/02/06 MF PIT




## NOTES

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

N

## LEGEND

- 3MW37S — AREA A LANDFILL GROUNDWATER MONITORING PROGRAM MONITORING WELL
- 3TW1 — BGOURI TEMPORARY WELL
- 3TW27 — BGOURI DGI TEMPORARY WELL
- 3SB01 — SOIL BORING
- 3MW12D — REPLACED WELL
- 3MW12S — ABANDONED WELL
- 2DMW25D — PHASE I MONITORING WELL
- 2DMW26D — PHASE II MONITORING WELL
- 10 — TOPOGRAPHIC CONTOUR
- 123 — BUILDING No.
- WATERCOURSE
- STM — STORM SEWER AND CATCH BASIN
- EXPOSED BEDROCK
- FENCE

0 250 500
GRAPHIC SCALE IN FEET

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

| | | | |
|---|---|---|---|
| DRAWN BY MF | DATE 5/19/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 3 - AREA A DOWNSTREAM WATERCOURSES/OBDA<br>NSB-NLON<br>GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

CONTRACT NO. 0083
OWNER NO. 038
APPROVED BY CAR DATE 6/9/06
DRAWING NO. FIGURE 3-1
REV. 0

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

# 4.0 SITE 6 – DEFENSE REUTILIZATION AND MARKETING OFFICE (OU2)

This 5-year review of Site 6 - DRMO is required by statute because hazardous substances, pollutants, or contaminants remain on site that do not allow for unlimited use or unrestricted exposure. A time-critical removal action (TCRA) completed at the DRMO in January 1995 focused on the removal of soil contaminated with lead, PAHs, and PCBs from the northern half of the DRMO. After completion of the removal activities, the area was backfilled with clean borrow material, capped with a geosynthetic clay/geotextile layer, and overlaid by gravel/asphalt. An interim ROD addressing the contaminated soil and groundwater (OU2) and the impacts on the surface water of the Thames River was completed in March 1998 (B&RE, 1998b). Groundwater monitoring has been conducted for 7 years, and annual O&M landfill inspections have been completed for 3 years as part of the remedy selected in the interim ROD. Data collected during the monitoring and inspection programs are evaluated within this report. A final ROD for soil and groundwater at Site 6 was signed in December 2006 (Navy, 2006). The final remedy selected for Site 6 is similar to the one selected in the interim ROD and it includes institutional controls and monitoring.

## 4.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 6 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| DRMO used as a landfill and waste burning area. | 1950 to 1969 |
| Final IAS completed. | March 1983 |
| Phase I RI completed. | August 1992 |
| Draft FFS completed. | March 1994 |
| TCRA completed. | January 1995 |
| Action Memorandum completed. | March 1995 |
| Final Report for IRA completed. | September 1995 |
| Phase II RI completed. | March 1997 |
| Proposed Plan issued. | September 1997 |
| Public Meeting conducted. | September 1997 |
| Groundwater Monitoring Plan finalized. | February 1998 |
| Final Interim ROD for OU2 signed. | March 1998 |
| Groundwater Monitoring Program initiated. | April 1998 |
| Year 1 Annual GMR completed. | November 1999 |
| Year 2 Annual GMR completed. | October 2000 |
| First Five-Year Review performed. | December 2001 |
| Year 3 Annual GMR completed. | March 2002 |

| Event | Date |
|---|---|
| Draft Final O&M Manual – Volumes I, III, IV, and V completed. | September 2002 |
| SOPA (ADMIN) New London Instruction 5090.18B completed. | February 2003 |
| Draft O&M Manual – Volume II completed. | March 2003 |
| Year 4 Annual GMR completed. | August 2003 |
| 2003 Annual LIR completed. | November 2004 |
| Year 5 Annual GMR completed. | December 2004 |
| 2004 Annual LIR completed. | September 2005 |
| Year 6 Annual GMR completed. | August 2005 |
| 2005 Annual LIR completed. | October 2005 |
| Draft Year 7 Annual GMR completed. | January 2006 |
| Final O&M Manual – Volumes I, II, III, IV, and V completed. | January 2006 |
| Final ROD for OU2 signed. | December 2006 |
| SOPA (ADMIN) New London Instruction 5090.18C issued. | December 2006 |

## 4.2 BACKGROUND

The DRMO (Site 6) is located adjacent to the Thames River in the northwestern section of NSB-NLON. The site's location relative to other IR sites is shown on Figure 1-2. The site is located between a bedrock outcrop that runs roughly parallel to the Providence and Worchester Railroad to the east and the Thames River to the west. The site covers approximately 3 acres of land gently sloping toward the Thames River. A majority of the site is paved with an asphalt layer, and the site features buildings, a weighing scale, and miscellaneous storage piles. Figure 4-1 displays the general site arrangement. Currently, the DRMO is used as a storage and collection facility for items such as computers, file cabinets, and other office equipment to be sold during auctions and sales held periodically during the year.

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

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

During a site inspection on September 30, 1988, it was noted that metal and wood products were stored throughout most of the site. Buildings 355 and Building 479 are located in the southern, paved portion of the site and are primarily used for storage. A large scrap yard is located north of Building 479.

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

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

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

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

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

action were evaluated during the Phase II RI. Additional details of the TCRA are provided in Section 4.3.2.1.

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

An FS (B&RE, 1997f) was completed for soil and groundwater at the DRMO, and the selected remedial alternative (institutional controls and monitoring) was documented in an Interim ROD (B&RE, 1998b).

O&M of the cover system at the DRMO is being performed in accordance with the final O&M Manual for Installation Restoration Program Sites (TtNUS, 2006a). A groundwater monitoring program began at the DRMO in April 1998 in accordance with the Groundwater Monitoring Plan (B&RE, 1998a) and is ongoing. The results of the program are being used to verify the effectiveness of the cap in reducing infiltration and leaching of contaminants and to confirm that contamination is not migrating from soil to groundwater and eventually to the Thames River. To date, the monitoring results have not shown any significant contaminant migration issues.

Based on the positive results of the monitoring program, a final ROD for Site 6 was signed in December 2006 (Navy, 2006). The selected remedial alternative is similar to the interim remedy selected in 1998. The remedy includes institutional controls, monitoring, and five-year reviews.

## 4.3 REMEDIAL ACTIONS

A TCRA was completed in January 1995 to remove soil containing elevated concentrations of lead, PAHs, and PCBs from the northern half of the DRMO. Additional soil and groundwater sampling was conducted during the Phase II RI after the TCRA. Based on the results of the Phase II RI, NFA was recommended for the DRMO. An Interim ROD (B&RE, 1998b) was signed for Site 6 soil and groundwater (OU2). Institutional controls and monitoring were selected as the remedial action in the Interim ROD. By implementing institutional controls and maintaining the existing cap [asphalt and geosynthetic clay liner (GCL)], the Navy will protect potential human receptors from adverse health effects of exposure to the underlying contaminants. By implementing monitoring, the Navy will verify that contaminants in the soil are not migrating to the Thames River through the groundwater.

### 4.3.1 Remedy Selection

#### 4.3.1.1 TCRA

Several previous investigations at the DRMO confirmed that a release of contaminants into the environment had occurred and that contamination remained at the site. Moderate concentrations of VOCs and pesticides and higher concentrations of PCBs, SVOCs, and heavy metals were detected.

Target cleanup levels were developed in the Action Memorandum (Atlantic, 1995b) to ensure the following:

- Limited opportunity for individuals to encounter hot spots where contaminants may be present at elevated concentrations.
- Overall human health risks associated with activities at the DRMO are less than acceptable levels.

The proposed TCRA at the DRMO consisted of excavation and off-site disposal of contaminated soil hot spots and an in-ground spent acid tank at a RCRA landfill, followed by the placement of an impervious cap throughout all unpaved areas of the site. Soil PRGs used to identify hot spots included:

- Lead - 500 mg/kg
- PCBs - 10 mg/kg
- Carcinogenic polycyclic aromatic hydrocarbons (CPAHs) - 100 mg/kg

At the DRMO, accessible soil was determined to be soil from the ground surface to a depth of 3 feet. After the tank and hot spot removals were completed, the site was to be covered by an impervious bentonite geocomposite liner between layers of nonwoven geotextile and covered with 12 inches of compacted crushed stone. Access to the site would continue to be restricted via perimeter fencing and security procedures (Atlantic, 1995b).

#### 4.3.1.2 Post TCRA

An FS for the DRMO was completed in response to the Phase II RI. The FS evaluated several remedial alternatives for the DRMO. The recommended interim remedy of institutional controls and monitoring was presented in the Proposed Plan (B&RE, 1997e) and was formally selected in the ROD for the soil and groundwater OU (OU2) that was signed in March 1998. A final ROD was signed for the site in December 2006 (Navy, 2006). The final remedy includes institutional controls, monitoring, and five-year reviews.

Based on information relating to types of contaminants, environmental media of concern, and potential exposure pathways, RAOs were developed to aid in the development of alternatives. The following RAOs were developed to mitigate existing and future potential threats to public health and the environment:

- Prevent unacceptable risks to human receptors from exposure to contaminated soil under either a current industrial or future (although unlikely) residential land use scenario through either institutional controls and/or removal/treatment/disposal.

- Prevent unacceptable risk to ecological receptors in the Thames River from potential migration of contaminants.

The final remedy for the DRMO was selected to meet the RAOs. The selected remedy, as defined in the ROD, consisted of the following components:

- Institutional controls will include maintenance of the existing cap, limitations on site access, restrictions on land use, and monitoring and enforcement of compliance with land use restrictions. Maintenance of the existing asphalt and GCL cap will consist of regular inspections to assess the integrity of the asphalt and GCL cap. Items to be inspected and maintained include fencing, signs, asphalt cap, catch basin, culvert outlet, riprap, and monitoring wells. Record of Findings, Plan of Action, and Completion Reports will be prepared as needed based on each annual inspection. Periodic repair and replacement of the asphalt layer, monitoring wells, and any other remedy components will be performed as needed. Land use restrictions for the DRMO will limit activities such as excavation, drilling, residential use of property, and excessive vehicular use. While the area is under jurisdiction of the Navy, there shall be a Base Instruction [i.e., NSB-NLON Installation Restoration Site Use Restrictions Instruction document (5090.18C) (Navy, 2006b)] or other Navy mechanism that documents the restriction on land use and controls use of the site. The Navy will, at least annually, inspect the area and document compliance with the land use restrictions. This documented compliance will be included in future Five-Year Reviews of the site. If the site is ever transferred from Navy control, the Navy will create a deed for the property that will include the land use restrictions. The restrictions will meet all applicable State property law standards for placing environmental land use restrictions on contaminated property. Although the Navy may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall retain the ultimate responsibility for remedy integrity.

- Groundwater monitoring to be performed in accordance with Volume II - GMP of the O&M Manual (TtNUS, 2006a). Samples collected under the new monitoring program will be analyzed for VOCs,

SVOCs, PAHs, and metals (total) to evaluate whether contamination is migrating to the Thames River and potentially causing adverse effects to the ecological receptors. As appropriate, the monitoring program may be revised based on the analytical data collected from the previous sampling events. Data will be evaluated to determine the need for additional remedial action at the site or the need to modify the monitoring program.

- A site review will be conducted every 5 years for as long as contamination onsite poses a CERCLA risk to evaluate the site status and determine whether further action is necessary.

### 4.3.2 Remedy Implementation

#### 4.3.2.1 TCRA

OHM Remediation Services Corporation (OHM), the Navy's RAC, completed a TCRA at the DRMO in January 1995 (OHM, 1995a). During the TCRA, soils containing concentrations of lead, PAHs, and PCBs in excess of PRGs were excavated and removed from the northern half of the DRMO. The PRGs used for soil screening of lead, PCBs, and PAHs were 500 mg/kg, 10 mg/kg, and 100 mg/kg, respectively. Excavation extended to a maximum depth of approximately 3 feet below the ground surface or to the water table. Approximately 4,700 tons of soil were excavated and transported to a RCRA landfill located in Grand View, Idaho. Residual contamination in excess of PRGs remained after excavation was completed because the excavation was limited to 3 feet by the shallow water table and because of exceedances of the allotted time for the project (B&RE, 1997e). Additionally, a steel-walled, spent-acid-storage tank was excavated, cut into manageable pieces, and disposed off site with the contaminated soil.

The excavated area was backfilled with clean borrow material from an off-site location. A cap consisting of woven geotextile fabric, a GCL, and nonwoven geotextile fabric was installed. Approximately 12 inches of crushed stone and 3 inches of asphalt were placed over the clay/geotextile cover. This cap does not meet RCRA Title C requirements. The remaining (unpaved) portion of the DRMO was also upgraded via placement of an asphalt layer. The total cost of the TCRA was approximately $2,500,000.

#### 4.3.2.2 Post TCRA

Groundwater monitoring for the DRMO began in April 1998, and results were included in the Interim Groundwater Monitoring Report (B&RE, 1998e). Three new monitoring wells (6MW9S, 6MW10S, and 6MW10D) were installed in accordance with the DRMO Groundwater Monitoring Plan (B&RE, 1998a) during the field investigation activities. Further details of the long-term monitoring and O&M are discussed in Section 4.3.3.

To meet the land use control requirements in the interim ROD, the Navy prepared and implemented an instruction [i.e. SOPA (ADMIN) New London Instruction 5090.18B (Navy, 2003)] to restrict use at IR sites at NSB-NLON. The instruction defines the Navy's policy regarding ground surface disturbance of soils and any subsurface disturbance of soils and/or groundwater at IR sites. To meet the requirements in the final ROD, the navy prepared and implemented SOPA (ADMIN) New London Instruction 5090.18C (Navy, 2006).

Access to Site 6 is restricted. A security fence prevents on-base access from Amberjack Road. Building 397 serves as the DRMO office, where personnel must receive permission for access to the area. A sign located at the front gate warns personnel not to dig at the DRMO. North of the DRMO, another fence deters trespassers from coming onto NSB-NLON. To the east, the site is bounded by an active railroad line and a fence is also located between the railroad line and the DRMO. To improve security, a fence was installed in 2006 along the Thames River from the DRMO office to the northern boundary of the DRMO where it connects with existing fencing. This fencing was added to deter trespassers from accessing the DRMO site from the Thames River.

### 4.3.3 System Operations/Operation and Maintenance

#### 4.3.3.1 Monitoring Program

The Navy implemented a groundwater monitoring program at Site 6 in April 1998. The results of the program are being used to verify the effectiveness of the cap installed as part of the TCRA to reduce precipitation infiltration and leaching of contaminants and to confirm that contamination is not migrating through soil into groundwater and ultimately discharging to the Thames River. Sampling has been completed at the site in accordance with the final Groundwater Monitoring Plan for DRMO (B&RE, 1998a) from the initiation of the program through 2005. Future sampling activities at the site will be completed in accordance with Volume II – Groundwater Monitoring Plan of the O&M Manual (TtNUS, 2006a).

Monitoring at the DRMO was initially conducted quarterly, and during Year 4, the monitoring frequency was reduced to semi-annually. During Year 5, the monitoring frequency was further reduced to annually. Groundwater samples collected under the original monitoring plan were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals (total and dissolved). Samples collected under the new monitoring program will be analyzed for VOCs, SVOCs, PAHs, and metals (total).

Seven annual reports (TtNUS, 1999g; TtNUS 2000a; TtNUS, 2002b; TtNUS, 2003d; ECC, 2004f; EEC, 2005g; and ECC, 2006a) have been issued that summarize the results of the monitoring program. The annual reports include a thorough evaluation of each year of data collected under the program.

Numerous round-specific reports have also been prepared to document the results of the monitoring program. The round-specific reports provide a brief screening-level assessment of the sampling round data. All of the monitoring reports have been submitted to the USEPA and CTDEP for review and comment. The results of the monitoring program during this five-year review period are discussed in Section 4.5.2.1.

#### 4.3.3.2 Operation and Maintenance

The Navy issued a draft O&M Manual for the IR Program Sites at NSB-NLON, which included the DRMO, in September 2002 (TtNUS, 2002c). Volume IV of the five-volume manual included site-specific instructions for O&M activities and an inspection checklist for the DRMO. Due to an extended comment resolution period, O&M inspections of the DRMO were conducted from 2003 through 2005 (3 years) based on the draft O&M Manual. The O&M Manual was finalized in 2006 (TtNUS, 2006a), and it will provide the basis for future O&M activities at DRMO.

The O&M process for the site includes annual inspections, reporting of results, and correcting any identified problems. The findings of the inspections are documented in the field on inspection checklists and then summarized in Annual LIRs (ECC, 2004c; ECC, 2005j; and ECC, 2005n). The inspections of the landfill focused on institutional controls, the asphalt cap, stormwater features, and monitoring wells. Deficiencies noted during the inspections are addressed through the preparation of a Plan of Action and then executing the Plan of Action. Typically, the inspections are conducted in the fall, and corrective actions are completed during the following summer. The results of the three inspections conducted during this five-year review period are discussed in Section 4.5.2.2.

## 4.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of the DRMO. The recommendations from the First Five-Year Review Report (TtNUS, 2001c) are provided below along with the actions that were taken to address the recommendations.

<u>Prepare and implement an O&M plan for the DRMO to address the noted deficiencies.</u>

- A draft O&M Manual for the IR Program Sites at NSB-NLON, which included the DRMO, was issued on September 2002. Due to an extended comment resolution period, O&M activities were conducted from 2003 through 2005 (3 years) based on the draft O&M Manual. The O&M Manual was finalized in 2006 and will provide the basis for future O&M activities at the DRMO.

An area of possible settlement was discovered in the asphalt

- No documentation is available that indicates any action was taken to repair the area of settlement found during the first five-year review approximately 50 feet southwest of Building 491. The depression is located along the line of the large crack that was repaired at this same location.

Monitoring wells and dedicated sampling equipment have not been maintained and are in need of maintenance and/or repair.

- Limited maintenance has been performed on the monitoring wells located at the DRMO. The 6MW11D road box has been repaired and the associated depression filled with cold patch.

Continue the groundwater monitoring program, but optimize the sampling frequency, monitoring well network, and analytical parameter list.

- By comparing the original Groundwater Monitoring Plan (B&RE, 1998a) to the new plan included in Volume IV of the O&M Manual (TtNUS, 2006a), the following steps have been taken to optimize the monitoring program at the DRMO:

  - The sampling frequency of the monitoring program has been reduced from quarterly to annually.

  - 2,3,3',4,5,6-hexachlorobiphenyl, pesticides, PCBs, and dissolved metals have been removed from the analytical parameter list.

  - Groundwater sampling at 3 of the 10 monitoring wells (6MW2D, 6MW10D, and 6MW11D) has been eliminated from the monitoring program.

  - The SWPC criterion for phenanthrene was corrected.

Continued enforcement of New London Instruction 5090.18.

- The instruction was updated to include the Goss Cove Landfill and was reissued in 2003 (Instruction 5090.18B). The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information for Site 2A - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON.

- The instruction has been followed by personnel at NSB-NLON, and no disturbances of the cap at the DRMO have occurred.

Using the results of 3 years of groundwater monitoring, determine if a final ROD for all media at the DRMO can be prepared.

- The Navy prepared and signed a final ROD for Site 6 in December 2006. The results of 7 years of groundwater monitoring were used to support selection of the final remedy of institutional controls and monitoring.

## 4.5 FIVE-YEAR REVIEW FINDINGS

### 4.5.1 Document Review

The documents reviewed for the second five-year review are listed below, and key information obtained from the documents is summarized in the following sections.

| | |
|---|---|
| Year 3 Annual GMR completed. | March 2002 |
| Year 4 Annual GMR completed. | August 2003 |
| 2003 Annual LIR | November 2004 |
| Year 5 Annual GMR completed. | December 2004 |
| 2004 Annual LIR | September 2005 |
| Year 6 Annual GMR completed. | August 2005 |
| 2005 Annual LIR | October 2005 |
| Draft Year 7 Annual GMR completed. | January 2006 |
| Final O&M Manual – Volumes I, II, and IV | January 2006 |
| SOPA (ADMIN) New London Instruction 5090.18C | December 2006 |

### 4.5.2 Data Review

#### 4.5.2.1 Monitoring Data Review

Groundwater monitoring is being conducted as part of post-closure activities associated with Site 6 to evaluate the effectiveness of the remedial action. The monitoring program was designed to determine the following:

- The effectiveness of the remedial action in preventing the migration of COPCs at concentrations greater than monitoring criteria to underlying groundwater and ultimately to surface water in the adjacent Thames River.
- The effectiveness of the remedial action in eliminating health risks.
- Whether the criteria used for evaluating the data have been met.
- Whether a groundwater plume exists and/or interferes with any existing use of groundwater.

The ultimate goal of the monitoring program is to show compliance with the selected monitoring criteria for those COPCs migrating or having the potential to migrate from the site. The screening criteria used for data evaluation are a combination of site-specific SWPC, CTDEP Volatilization Criteria, Connecticut WQSs, federal AWQCs, and background groundwater concentrations. In the future, federal AWQC will not be considered as screening criteria.

Data from Years 3 through 7 of the monitoring program are presented and evaluated in this Second Five-Year Review. The results of Years 1 and 2 of the program were presented in the First Five-Year Review Report (TtNUS, 2001).

Year 3

Four quarterly rounds of sampling (Rounds 9, 10, 11, and 12) were conducted during 2000/2001 (Year 3). Figure 4-2 shows groundwater data that exceeded criteria during Year 3 of the monitoring program. The results obtained for Year 3 indicated no exceedances of primary criteria. The following constituents exceeded secondary criteria: BEHP, benzo(a)pyrene, benzo(k)fluoranthene, arsenic, copper, lead, silver, and zinc.

A statistical evaluation of data from Year 3 indicated increases in 1,2-dichloroethene, vinyl chloride, arsenic, barium, chromium, lead, and silver concentrations when comparing data from upgradient and downgradient of the landfill. None of the detected concentrations of COPCs were in excess of primary monitoring criteria, indicating that no significant contaminant migration was occurring from the DRMO.

The average arsenic and barium concentrations for each round were plotted as a function of time to determine trends in the data. The plots did not show any significant trends in arsenic or barium detections that would indicate a contaminant migration problem from the DRMO site. The correlation between arsenic and barium detections and oxidation-reduction potential (ORP) was also tested as part of the analysis. The results of the evaluation indicated that concentrations of these metals in downgradient wells were only weakly to moderately correlated with ORP values.

Year 4

Two rounds of sampling (Rounds 13 and 14) were conducted during 2001/2002 (Year 4). Figure 4-3 shows groundwater data that exceeded criteria during Year 4 of the monitoring program. The results obtained during Rounds 13 and 14 of groundwater monitoring for VOCs, SVOCs, pesticides/PCBs, and inorganics indicated no exceedances of primary criteria. None of the VOCs exceeded secondary criteria. BEHP was detected at concentrations that exceeded the secondary monitoring criterion in several

samples. No pesticides or PCBs were detected in any of the groundwater samples collected during Year 4. Concentrations of arsenic, copper, silver, and zinc detected in some groundwater samples were in excess of secondary screening criteria. Concentrations of arsenic and zinc detected in some samples also exceed background concentrations.

Statistical comparisons indicated that downgradient concentrations of some COPCs were statistically greater than concentrations detected in upgradient wells. However, none of the detected concentrations of COPCs were in excess of primary monitoring criteria, indicating that no significant contaminant migration is occurring from the DRMO. The evaluation also indicated that no temporal increases in BEHP, arsenic, and silver concentrations were evident over the two sampling rounds.

Year 5

One round of sampling (Round 15) was conducted during 2003 (Year 5). The Round 15 results showed that 11 of the 21 COPCs were detected in groundwater. Screening of the analytical data against the current primary and secondary criteria showed no exceedances of primary criteria, but concentrations of BEHP, copper, and zinc exceeded secondary criteria. Figure 4-4 shows groundwater data that exceeded criteria during Year 5 of the monitoring program.

The Year 5 monitoring results were generally similar to the results of the first 4 years of groundwater monitoring. The results do not indicate significant contaminant migration from Site 6.

Year 6

One round of sampling (Round 16) was conducted during 2004 (Year 6). The results obtained during Round 16 of groundwater monitoring showed no exceedances of primary criteria, but concentrations of BEHP, arsenic, copper, silver, and zinc exceeded secondary criteria, and arsenic and lead concentrations exceeded background levels. Figure 4-5 shows groundwater data that exceeded criteria during Year 6 of the monitoring program.

Statistical comparisons indicated that two COPCs (vinyl chloride and total copper) were detected in downgradient wells at concentrations that were statistically higher than concentrations in upgradient wells; however, the levels and history of these COPCs do not indicate that significant concentrations of COPCs are migrating from Site 6.

Year 7

One round of sampling (Round 17) was conducted during 2005 (Year 7). The results obtained during Round 17 of groundwater monitoring showed no exceedances of primary criteria, but detected concentrations of BEHP and copper exceeded secondary criteria, and detected concentrations of zinc exceeded secondary criteria and the NSB-NLON background concentration. Figure 4-6 shows groundwater data that exceeded criteria during Year 7 of the monitoring program.

Although downgradient results for three COPCs (BEHP, pyrene, and copper) are statistically greater than upgradient concentrations, these results are consistent with historical results and do not indicate that significant contaminant migration is occurring from Site 6.

#### 4.5.2.2 O&M Data Review

Inspections are being conducted as part of post-closure O&M activities associated with Site 6. The goal of the inspections is to determine if appropriate O&M is being performed to maintain the effectiveness of the remedial action. As indicated in the table below, three inspections have been performed at Site 6 since the cap system was installed. All of the inspections were performed during the period being evaluated in this second five-year review. The findings of the annual inspections are summarized below.

| Year | Date of Initial Inspection | Date of Supplemental Inspection | Final Report Date |
|---|---|---|---|
| 2003 | July 11, 2003 | November 4, 2003 | November 2004 |
| 2004 | December 29,2004 | April 26, 2005 | September 2005 |
| 2005 | October 11, 2005 | NA | October 2005 |

NA – Not Applicable

2003

A copy of the completed 2003 Inspection Checklist for the DRMO is provided in Appendix A. The inspection showed that the cap system was in generally good condition and was functioning as designed and was meeting the long-term remedial objectives. However, the inspection identified the following deficiencies:

- Additional signage that identified the site as a capped landfill was recommended.
- Significant water ponding along the western side of the site due to sedimentation around jersey barriers was restricting surface water drainage.
- One sink hole was identified immediately south of the cap limit.

- Monitoring well 6MW2D, in the vicinity of the sinkhole, was leaning toward the river.

- Dense vegetation was observed in the northern portions of the swale, in riprap, and on the security fencing.

- Damaged road boxes and/or missing well caps at wells 6MW6D, 6MW10D, and 6MW11D.

- Several groundwater well road boxes were submerged beneath standing water.

A Plan of Action was prepared to document the steps to be taken to address the identified deficiencies. The following corrective actions were implemented to address the deficiencies: the sinkhole was repaired and vegetation was removed from security fencing, riprap, and the catch basin inlet. The corrective actions were implemented prior to November 2003.

2004

A copy of the completed 2004 Inspection Checklist for the DRMO is provided in Appendix A. The inspection showed that the landfill was generally in good condition, was functioning as designed, and was meeting the long-term remedial objectives. However, the inspection identified the following deficiencies:

- A build-up of sediment along the jersey barriers at the northwestern portion of the site.
- Two depressions in the pavement were observed to the south of 6MW11D.
- Dense vegetation was observed around the catch basin inlet and in the riprap.
- The road box at monitoring well 6MW11D was damaged, and the surrounding concrete had cracked.

A Plan of Action was prepared to document the steps to be taken to address the identified deficiencies. The corrective actions were implemented in July 2005. Actions taken included vegetation and sediment removal and herbicide applications along the jersey barriers, riprap, and catch basin inlet; repair of the well 6MW11D road box, and filling of the depression adjacent to the well 6MW11D road box with cold patch. The depressions to the south of well 6MW11D will be monitored.

2005

A copy of the completed 2005 Inspection Checklist for the DRMO is provided in Appendix A. The inspection showed that the landfill was in generally good condition, was functioning as designed, and was meeting the long-term remedial objectives. However, the inspection identified the following deficiencies:

- Standing water was observed during the inspection along the western portion of the site, parallel to the jersey barriers.

- Depressions in the pavement were observed in the vicinity of jersey barriers along the western site perimeter.

- A piece of concrete was imbedded in the asphalt near 6MW10D.

- Eight inches of sediment were observed in the catch basin.

- Monitoring well 6MW7S was depressed into the asphalt, causing water to pond on top of the road box. Monitoring well 6MW8S was under a pallet, and sediment had built up over the well cover. The concrete surface of 6MW10D was cracked.

- Monitoring well 6MW4S could not be located. This well had not been sampled during previous events.

- Access was not granted to monitoring wells 6MW5S and 6MW5D due to security restrictions.

A Plan of Action was prepared to document the steps to be taken to address the identified deficiencies. It is expected that the corrective actions will be implemented during the summer of 2006.

### 4.5.3 ARAR and Site-Specific Action Level Changes

The final remedial action implemented for soil and groundwater at the DRMO includes monitoring of groundwater and institutional controls. No new human health ARARs have been promulgated that would call into question the protectiveness of the remedy for soil. ARARs and TBCs were reviewed to determine whether there have been changes since the Interim ROD and Groundwater Monitoring Plan were issued. Listings of chemical-specific, location-specific, and action-specific ARARs, advisories and guidance (TBCs) that were considered in the Final ROD are listed in Tables 6-1, 6-2, and 6-3, respectively. With the exception of monitoring criteria, the ARARs were addressed during monitoring well installation or selection of the remedy but they would also be applicable during future operation and maintenance activities for the remedy. Changes associated with monitoring are addressed in the response to Question 2 of Section 4.5.

The presence of the cap effectively eliminated direct contact with contaminated soil at the site, and the soil at the DRMO represents little potential risk to ecological receptors. Therefore, any changes in

screening values since the completion of the ERA would not impact the effectiveness of the remedial action. If the cap would be destroyed in the future due to artificial or natural forces, there could be a potential risk to ecological receptors.

### 4.5.4 Site Inspection

The DRMO was inspected on April 4, 2006. The focus of the inspection was on the engineered cap system installed over the DRMO. Weather conditions during the inspection were cold (mid-40s), overcast, and windy. Representatives from the Navy, USEPA, CTDEP, TtNUS, ECC, and Gannett Fleming participated in the inspection. Photographs taken of site features during the inspection are provided in Appendix B. The site inspection checklist completed during the inspection is provided in Appendix C.

The site inspection included visual observations of the current condition of the cap system at Site 6. During the site inspection, the team found that the land use for the site has remained unchanged since the remedial action and the first five-year review were completed, although it was noted that the land use may change in the future (i.e., the site may become a parking lot for the NSB-NLON Yacht Club). The Navy has continued to use the area for equipment storage. A sign was posted at the gate to the site noting land use restrictions. Visitors to the site were required to sign in, and the inspection team was escorted by site personnel throughout the inspection. In general, the site inspection found that the cap system was working as intended. However, even though the Navy has implemented an O&M program for Site 6 and corrective actions have been taken, a number of items were identified during the site inspection that, if not addressed, could negatively affect the long-term performance of the cap system. These items are noted in the site inspection checklist provided in Appendix C and on Figure 4-1. The items and their potential long-term impacts on the cap system are as follows:

- Jersey barriers along the western portion of the site cause water to pond on the cap.

- The asphalt has a small amount of cracks and depressions. If the cracks are not sealed, surface water will penetrate the asphalt and further deteriorate the asphalt during freeze-thaw cycles. One depression was filled in and others are being monitored to determine whether the problem is progressive or stable.

- Monitoring well 6MW4S cannot be located; stored items adjacent to Building 491 were previously moved and the well could not be located. It is assumed that the well was abandoned during the removal action and cap installation, but no records were prepared to formally document the abandonment.

- Two monitoring wells (6MW5S and 6MW5D) were found to be inaccessible due to security restrictions. If it is determined that these wells are no longer needed in the monitoring program, they should be properly abandoned. Monitoring well 6MW7S is not currently used for the monitoring program and should be considered for abandonment.

### 4.5.5 Site Interviews

No official interviews were conducted as part of the second 5-year review. Relevant discussions with the inspection team regarding the site are documented on the site inspection checklist.

## 4.6 ASSESSMENT

The following conclusions support the determination that the remedy at Site 6 is protective of human health and the environment.

***Question 1. Is the remedy functioning as intended by the decision documents?***

- ***Remedial Action Performance:*** A TCRA was completed and a cap was installed at the DRMO. The cap is currently effective in limiting direct exposure to remaining contaminated soil and minimizing infiltration and contaminant migration from the site. A groundwater monitoring program has been implemented as part of the interim and final remedies for the site to evaluate the performance of the cap regarding minimizing contaminant migration to the Thames River. The results of 7 years of monitoring indicate that no significant contaminant migration is occurring from the DRMO. An eighth year of monitoring is currently being conducted. Should groundwater data indicate the need to evaluate additional remedial actions at some point in the future, the Navy will perform the evaluation at that time. Proper O&M is necessary to maintain proper long-term performance of the cap.

- ***System Operations/O&M:*** An O&M Manual was developed and implemented in 2003. The cap system is still functioning as intended, and O&M of the cap system is being performed annually at the site. The items noted in Section 4.5.4 should be addressed to improve the O&M of the site.

  Actual costs for the monitoring program have ranged from approximately $123,000 per year to $44,200 per year (see table below). Costs have generally decreased due to optimization of the monitoring program. The costs include the costs associated with sampling, analysis, validation, and reporting. Costs associated with preparing and updating the Monitoring Plan and maintaining the groundwater monitoring wells are not included in the costs.

| Source | Cost of Monitoring |
|---|---|
| Projected Annual Cost in ROD | $84,000 for the first 3 years |
| Actual Year 1 Cost (1998/1999) | $120,000 |
| Actual Year 2 Cost (1999/2000) | $120,000 |
| Actual Year 3 Cost (2000/2001) | $123,000 |
| Actual Year 4 Cost (2001/2002) | $62,700 |
| Actual Year 5 Cost (2003) | $44,200 |
| Actual Year 6 Cost (2004) | $45,600 |
| Actual Year 7 Cost (2005) | $48,100 |

The cost for annual O&M estimated during preparation of the ROD was $10,200. O&M of the cap system began in 2003, and costs have ranged from approximately $10,700 to $10,900 per year (see table below). Costs have fluctuated due to the amount of maintenance required and the amount of funding available. The annual O&M costs include the costs for landfill inspections, reporting, and maintenance.

| Source | Cost of O&M |
|---|---|
| Projected Annual Cost in ROD | $10,200 |
| Actual Year 1 Cost (2003) | $10,700 |
| Actual Year 2 Cost (2004) | $10,900 |
| Actual Year 3 Cost (2005) | $10,800 |

- ***Opportunities for Optimization:*** The sampling frequency of the monitoring program was reduced from quarterly to annually. The monitoring frequency should be further reduced to biennial (every 2 years). During Year 4, three monitoring wells were eliminated from the monitoring program, 2,3,3',4,5,6-hexachlorobiphenyl was eliminated as a COPC, and a corrected SWPC for phenanthrene was used to evaluate the monitoring data. During Year 7, monitoring of pesticides and PCBs was discontinued.

- ***Early Indicators of Potential Remedy Failure:*** There were deficiencies noted during the O&M inspections of the cap system. Currently, the deficiencies do not compromise the protectiveness of the remedy, but if they are left unaddressed, they could result in remedy failure in the future.

- ***Implementation of Institutional Controls and Other Measures:*** Institutional controls associated with Site 6 are being implemented in accordance with New London Instruction 5090.18C. The area is secured with fencing and signs are posted warning personnel not to dig in the area.

***Question 2. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?***

- ***Changes in Standards and TBCs***: In the first Groundwater Monitoring Plan for the DRMO (B&RE, 1998), a combination of site-specific SWPC, Connecticut SWPC, and Connecticut Volatilization Criteria were identified as the primary monitoring criteria and a combination of the federal AWQC and the Connecticut WQSs were identified as the secondary monitoring criteria. The monitoring plan and criteria for the DRMO were recently updated during finalization of the O&M Manual (TtNUS, 2006a). The following changes were noted between the plans:

  - The federal AWQC were updated in 2006 and the Connecticut WQSs were updated in December 2002.

  - Site-specific SWPC were updated based on the changes to the Connecticut WQSs and Thames River dilution factors.

  - The SWPC for phenanthrene (0.077 µg/L) in the 1996 CTDEP RSRs was found to be incorrect and was updated to 0.3 µg/L. This correction was confirmed with the CTDEP. None of the other CTDEP SWPC for the COCs have changed.

  A comparison of the old and new primary criteria is presented in Table 2-4. A similar comparison of old and new secondary criteria is presented in Table 2-5. The changes in criteria do not impact the protectiveness of the remedy.

- ***Changes in Exposure Pathways:*** Because a cap was installed at the DRMO, the direct exposure pathway for human and ecological receptors to come into contact with contaminated soil related to the DRMO was eliminated. This change was planned as part of the TCRA. The land use of the DRMO may change in the future to a parking lot for a Yacht Club. The change in site conditions should not effect exposure pathways (i.e., there are no new contaminants, sources, or direct routes of exposure).

- ***Changes in Toxicity and Other Contaminant Characteristics:*** Toxicity and other factors for COCs have not changed.

- ***Changes in Risk Assessment Methods:*** As discussed in Section 1.4, there have been no major changes in HHRA methodologies since the signing of the Interim ROD. In addition, as presented in

Section 1.4, no significant changes have occurred in the ERA methodology since the ERA was conducted.

- ***Expected Progress Towards Meeting RAOs:*** The RAOs for OU2 were met by performing the removal action, installing and maintaining the cap system, and conducting groundwater monitoring.

***Question 3. Has any other information come to light that could call into question the protectiveness of the remedy?***

No additional information has been identified that would call into question the protectiveness of the remedy.

## 4.7 ISSUES

A few O&M deficiencies were noted during the five-year review site inspection that should be resolved. The deficiencies are presented in Sections 4.5.4 and summarized in Table 4-6.

## 4.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Based on the results of the site inspection and review, the following recommendations are made for Site 6.

- Continue O&M of the site and address the O&M deficiencies noted in Sections 4.5.4 and 4.7.

- Continue the monitoring program, but reduce sampling frequency to every 2 years and further optimize the analytical parameter list, as appropriate. Develop and implement a well abandonment program to eliminate wells that are no longer required for the monitoring program (e.g., 6MW5S, 6MW5D, and 6MW7S)

- Develop and implement an equipment storage plan that would prevent storage of equipment on top of active monitoring well(s).

- Address ponding and sediment buildup due to the jersey barriers.

- Continue enforcement of New London Instruction 5090.18C. If the site use changes to yacht club parking, enforcement of New London Instruction 5090.18C should be continued.

- At least yearly monitoring of Institutional Control compliance with the monitoring reports incorporated into future five-year reviews.

- Amend O&M Manual to remove federal AWQC.

Follow-up actions should be completed by the Navy in a timely manner to address the recommendations.

## 4.9 PROTECTIVENESS STATEMENT

The remedy at the DRMO is currently protective of human health and the environment. A majority of the original source was removed during a TCRA, and the remaining source material is contained. The cap system minimizes infiltration and subsequent contaminant migration and prevents direct contact with soil. A groundwater monitoring program is being implemented at the site, and the results of the program indicate that the removal action and cap are performing as planned. Continued implementation of land use controls and O&M will maintain the effectiveness of the remedy into the future.

## TABLE 4-1

## CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE
## SITE 6 - DEFENSE REUTILIZATION AND MARKETING OFFICE
## NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT

| Requirement | Citation | Status | Synopsis of Requirements | Current Status / Applicability |
|---|---|---|---|---|
| **FEDERAL** | | | | |
| Cancer Slope Factors (CSFs) | None | To Be Considered | CSFs are guidance values used to evaluate the potential carcinogenic hazard caused by exposure to contaminants | The selected remedy prevents exposure to contaminated media and thereby minimize human health concerns. This TBC would be used to recalculate risks if the site was altered in the future in a way that would change exposure scenarios. |
| Guidelines for Carcinogen Risk Assessment | EPA/630/P-03/001F (March 2005) | To Be Considered | This is a general guidance document that provides a framework for assessing possible cancer risks from exposures to pollutants or other agents in the environment. The document discusses issues involving hazard identification, dose-response assessment, exposure assessment, and risk characterization with an emphasis on characterization of evidence and conclusions in each area of the assessment. As part of the characterization process, explicit evaluations are made of the hazard and risk potential for susceptible lifestages, including children. | The selected remedy prevents exposure to contaminated media and thereby minimize human health concerns. This TBC would be used to recalculate risks if the site was altered in the future in a way that would change exposure scenarios. |
| Reference Doses (RfDs) | None | To Be Considered | RfDs are guidance values used to evaluate the potential noncarcinogenic hazard caused by exposure to contaminants. | The selected remedy prevents exposure to contaminated media and thereby minimize human health concerns. This TBC would be used to recalculate risks if the site was altered in the future in a way that would change exposure scenarios. |
| Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens | EPA/630/R-03/003F (March 2005) | To Be Considered | The Supplemental Guidance addresses a number of issues pertaining to cancer risks associated with early-life exposures generally, but provides specific guidance on potency adjustment for carcinogens acting through a mutagenic mode of action. This guidance recommends a default approach using estimates from chronic studies (i.e., CSFs) with appropriate modifications to address the potential for differential risk of early-lifestage exposure. | The selected remedy prevents exposure to contaminated media and thereby minimize human health concerns. This TBC would be used to recalculate risks if the site was altered in the future in a way that would change exposure scenarios. |
| **STATE OF CONNECTICUT** | | | | |
| There are no chemical-specific ARARs. | | | | |

## TABLE 4-2

## LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPORPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE
## SITE 6 - DEFENSE REUTILIZATION AND MARKETING OFFICE
## NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT


| Requirement | Citation | Status | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|---|
| **FEDERAL** | | | | |
| Executive Order 11988<br>RE: Floodplain Management | Executive Order 11988 | Applicable | This order requires federal agencies, wherever possible, to avoid or minimize adverse impacts upon floodplains. Requires reduction of risk of flood loss, minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values of the floodplains. | This regulation was addressed during monitoring well installation within the 100-year floodplain. This requirement is applicable during well abandonment and O&M of the remedy. |
| Coastal Zone Management Act | 16 USC Parts 1451 *et seq.* | Applicable | Requires that any actions must be conducted in a manner consistent with state approved management programs. | This site is located in a State coastal flood zone (within the 100-year floodplain). Therefore, applicable State coastal zone management requirements were considered during determination of the Selected Remedy. This regulation would be applicable if the site use was changed or the site was altered. |
| Fish and Wildlife Coordination Act | 16 USC 661 *et seq.*; 40 CFR § 6.302 | Applicable | Requires action to be taken to protect fish and wildlife from projects affecting streams or rivers. Consultation with U.S. Fish & Wildlife Service to develop measures to prevent and mitigate loss. | This regulation was addressed during monitoring well installation within the river's tidal zone. This requirement is applicable during well abandonment and O&M of the remedy. |
| **STATE OF CONNECTICUT** | | | | |
| Coastal Management Act | CGS §§ 22a-92 and 94 | Applicable | Requires projects within a State-designated coastal zone to minimize adverse impacts on natural coastal resources. | This regulation was addressed during monitoring well installation within the 100-year floodplain. This requirement is applicable during well abandonment and O&M of the remedy. |
| Tidal Wetlands | RCSA §§ 22a-30-1 through 17 | Applicable | Activities within or affecting tidal wetlands are regulated. | This regulation was addressed during monitoring well installation within the river's tidal zone. This requirement is applicable during well abandonment and O&M of the remedy. |

## TABLE 4-2

## LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPORPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE
## SITE 6 - DEFENSE REUTILIZATION AND MARKETING OFFICE
## NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT


| Requirement | Citation | Status | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|---|
| **STATE OF CONNECTICUT (Continued)** | | | | |
| Connecticut Endangered Species Act | CGS §§ 26-303 through 314 | Applicable | Regulates activities affecting State-listed endangered or threatened species or their critical habitat. | The State-threatened Atlantic sturgeon inhabits the Thames River. Because monitoring wells were installed in the river's tidal zone, protection of the Atlantic Sturgeon's habiltat was considered during installation. This requirement is applicable during well abandonment and O&M of the remedy. |

## TABLE 4-3

## ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE
## SITE 6 - DEFENSE REUTILIZATION AND MARKETING OFFICE
## NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT


| Requirement | Citation | Status | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|---|
| **FEDERAL** | | | | |
| Guidance on Remedial Actions for Superfund Sites with PCB Contamination | OSWER Directive 9355.4-01 | To Be Considered | This guidance describes how to address PCB contamination issues. | Low levels of PCBs (47.2 ppm or less) remain in the soil at the site. The land use (industrial) was selected in accordance with these regulations. This guidance will be followed when conducting O&M or if the site use changes, such as if the site is used for Yacht Club parking. |
| **STATE OF CONNECTICUT** | | | | |
| Hazardous Waste Management: Generator and Handler Requirements | RCSA § 22a-449 (c) 100-101 | Applicable | These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference. | This regulation was addressed during monitoring well installation. This requirement is applicable during well abandonment and O&M of the remedy. |
| Hazardous Waste Management: TSDF Standards | RCSA § 22a-449 (c) 104 | Applicable | This section establishes standards for groundwater monitoring and post-closure. The standards of 40 CFR 264 are incorporated by reference. | The remedy complies with the post-closure requirements of this section through groundwater monitoring and institutional controls at the Site. |
| Control of Noise Regulations | RCSA § 22a-69-1 through 7.4 | Applicable | These regulations establish allowable noise levels. Noise levels from construction activities are exempt from these requirements. | This regulation was addressed during monitoring well installation. This requirement is applicable during well abandonment and O&M of the remedy. |
| Guidelines for Soil Erosion and Sediment Control | The Connecticut Council on Soil and Water Conservation | To Be Considered | The guidelines provide technical and administrative guidance for the development, adoption, and implementation of a erosion and sediment control program. | This regulation was addressed during monitoring well installation. This requirement is applicable during well abandonment and O&M of the remedy. |
| Water Quality Standards | CGS 22a-426 | Applicable | Connecticut's WQSs establish specific numeric criteria, designated uses, and anti-degradation policies for groundwater and surface water. | The Connecticut WQSs were used to calculate the Alternative SWPC and are being used as secondary monitoring criteria to evaluate monitoring results and determine if further remedial action is required to protect resources. Updates to the Connecticut WQSs are discussed in Section 2.7.2. Changes to the WQSs in the future will need to be considered. |

## TABLE 4-3

## ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE
## SITE 6 - DEFENSE REUTILIZATION AND MARKETING OFFICE
## NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT


| Requirement | Citation | Status | Synopsis of Requirement | Current Status / Applicability |
|---|---|---|---|---|
| **STATE OF CONNECTICUT (Continued)** | | | | |
| Remediation Standards Regulations | RCSA § 22a-133k-3 | Applicable | These regulations provide specific numeric cleanup criteria for a wide variety of contaminants in soil, groundwater, and soil vapor. These criteria include volatilization criteria, pollutant mobility criteria, direct exposure criteria, and SWPCs. | Although no groundwater plume has been identified at this site, groundwater monitoring will continue to be conducted to confirm no COCs are migrating off site at levels above Alternative Surface Water Protection Criteria or CTDEP Volatilization Criteria. Maintenance of the cap and continued implementation of institutional controls will satisfy the CTDEP RSRs for soil. The Alternative SWPC for COCs at the DRMO were calculated following the CTDEP RSRs and are protective of receptors in the Thames River. |

**TABLE 4-4**

**COMPARISON OF PRIMARY MONITORING CRITERIA**
**SITE 6 - DEFENSE REUTILIZATION AND MARKETING OFFICE**
**NAVAL SUBMARINE BASE NEW LONDON**
**NSB-NLON, GROTON, CONNECTICUT**

| Chemical | Background Concentration[1] | Primary Monitoring Criteria | | | | | |
|---|---|---|---|---|---|---|---|
| | | Site-Specific SWPC[2,3] | | CTDEP SWPC[4] | | CTDEP Volatilization[5] | |
| | | 1998[2] | 2006[3] | 1998[2] | 2006[3] | 1998[2] | 2006[3] |
| **VOCs (µg/L)** | | | | | | | |
| 1,1,2,2-Tetrachloroethane | NA | **1,100** | **6,050** | 110 | 110 | **100** | **64** |
| 1,2-Dichloroethane | NA | **29,700** | **54,500** | 2,970 | 2,970 | **90** | **68** |
| 1,2-Dichloroethene (total) | NA | NA | NA | NA | NA | **NA** | **24,000** |
| Trichloroethene | NA | **23,400** | **42,700** | 2,340 | 2,340 | **540** | **67** |
| Vinyl chloride | NA | **157,500** | **289,000** | 15,750 | 15,750 | **2** | **52** |
| **SVOCs and PAHs (µg/L)** | | | | | | | |
| Benzo(a)anthracene | NA | **3** | **270** | 0.3 | 0.3 | NA | NA |
| Benzo(a)pyrene | NA | **3** | **27** | 0.3 | 0.3 | NA | NA |
| Benzo(b)fluoranthene | NA | **3** | **270** | 0.3 | 0.3 | NA | NA |
| Benzo(k)fluoranthene | NA | **3** | **270** | 0.3 | 0.3 | NA | NA |
| Benzoic acid | NA | NA | NA | NA | NA | NA | NA |
| Bis(2-ethylhexyl)phthalate | NA | **590** | **3,250** | 59 | 59 | NA | NA |
| Fluoranthene | NA | **37000** | **704** | 3,700 | 3,700 | NA | NA |
| Fluorene | NA | **1,400,000** | **27,100** | 140,000 | 140,000 | NA | NA |
| Naphthalene | NA | NA | 11,300,000 | NA | NA | NA | NA |
| Phenanthrene | NA | **1** | **27,000** | **0.077** | **0.3** | NA | NA |
| Pyrene | NA | **1,100,000** | **27,000** | 110,000 | 110,000 | NA | NA |
| **Inorganics (µg/L)** | | | | | | | |
| Arsenic | 1.92/2.55 | **40** | **11.6** | 4 | 4 | NA | NA |
| Barium | 227/124 | NA | NA | NA | NA | NA | NA |
| Cadmium | NA | **60** | **5,120** | 6 | 6 | NA | NA |
| Chromium (hexavalent) | 49.9/16.0 | **1,100** | **25,500** | 110 | 110 | NA | NA |
| Copper | 107/39.4 | **480** | **1,710** | 48 | 48 | NA | NA |
| Lead | 6.63/2.52 | **130** | **4,460** | 13 | 13 | NA | NA |
| Silver | NA | **120** | **59,200,000** | 12 | 12 | NA | NA |
| Zinc | 131/109 | **1,230** | **44,600** | 123 | 123 | NA | NA |

Notes:
1 - Total/dissolved inorganic background concentrations from the BGOURI (TtNUS, 2002).
2 - Groundwater Monitoring Plan for Defense Reutilization and Marketing Office (B&RE, 1998).
3 - Volume II of the O&M Manual for IRP Sites at NSB-NLON (TtNUS, 2006).
4 - SWPC for substances in groundwater (CTDEP, 1996).
5 - Industrial/commercial volatilization criteria for groundwater (CTDEP, 1996 and 2003).
Shading indicates that the criteria has changed.

**TABLE 4-5**

**COMPARISON OF SECONDARY CRITERIA**
**SITE 6 - DEFENSE REUTILIZATION AND MARKETING OFFICE**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

| Chemical | CTDEP WQSs[1] | | | |
|---|---|---|---|---|
| | Aquatic Life[2] | | Human Health[3] | |
| | May 1992 | December 2002 | May 1992 | December 2002 |
| **VOCs (µg/L)** | | | | |
| 1,1,2,2-Tetrachloroethane | NA | NA | 11 | 11 |
| 1,2-Dichloroethane | NA | NA | 99 | 99 |
| cis-1,2-Dichloroethene | NA | NA | NA | NA |
| trans-1,2-Dichloroethene | NA | NA | NA | NA |
| Trichloroethene | NA | NA | 81 | 81 |
| Vinyl Chloride | NA | NA | 525 | 525 |
| **SVOCs (µg/L)** | | | | |
| Benzo(a)anthracene | NA | NA | **0.031** | **0.49** |
| Benzo(a)pyrene | NA | NA | **0.031** | **0.049** |
| Benzo(b)fluoranthene | NA | NA | **0.031** | **0.49** |
| Benzo(k)fluoranthene | NA | NA | **0.031** | **0.49** |
| Benzoic Acid | NA | NA | NA | NA |
| Bis(2-ethylhexyl)phthalate | NA | NA | 5.9 | 5.9 |
| Fluoranthene | NA | NA | **370** | **1.28** |
| Fluorene | NA | NA | **14,000** | **49.2** |
| Naphthalene | NA | NA | **NA** | **20513** |
| Phenanthrene | NA | NA | **0.031** | **49.17** |
| Pyrene | NA | NA | **11,000** | **49** |
| **Pesticides/PCBs (µg/L)** | | | | |
| 4,4'-DDD | NA | NA | 0.00084 | 0.00084 |
| Aroclor-1254 | 0.03 | 0.03 | **0.000045** | **0.00017** |
| Aroclor-1260 | 0.03 | 0.03 | **0.000045** | **0.00017** |
| Heptachlor Epoxide | **0.0008** | **0.0036** | 0.00011 | 0.00011 |
| **Inorganics (total/dissolved) (µg/L)** | | | | |
| Arsenic | 36 | 36 | **0.14** | **0.021** |
| Barium | NA | NA | NA | NA |
| Cadmium | 9.3 | 9.3 | **170** | **10769** |
| Chromium | 50 | 50 | **3400** | **2019** |
| Copper | **2.9** | **3.1** | NA | NA |
| Lead | **8.5** | **8.1** | NA | NA |
| Silver | **2.3[4]** | **1.96[4]** | **65000** | **107692** |
| Zinc | **86** | **81** | **NA** | **68740** |

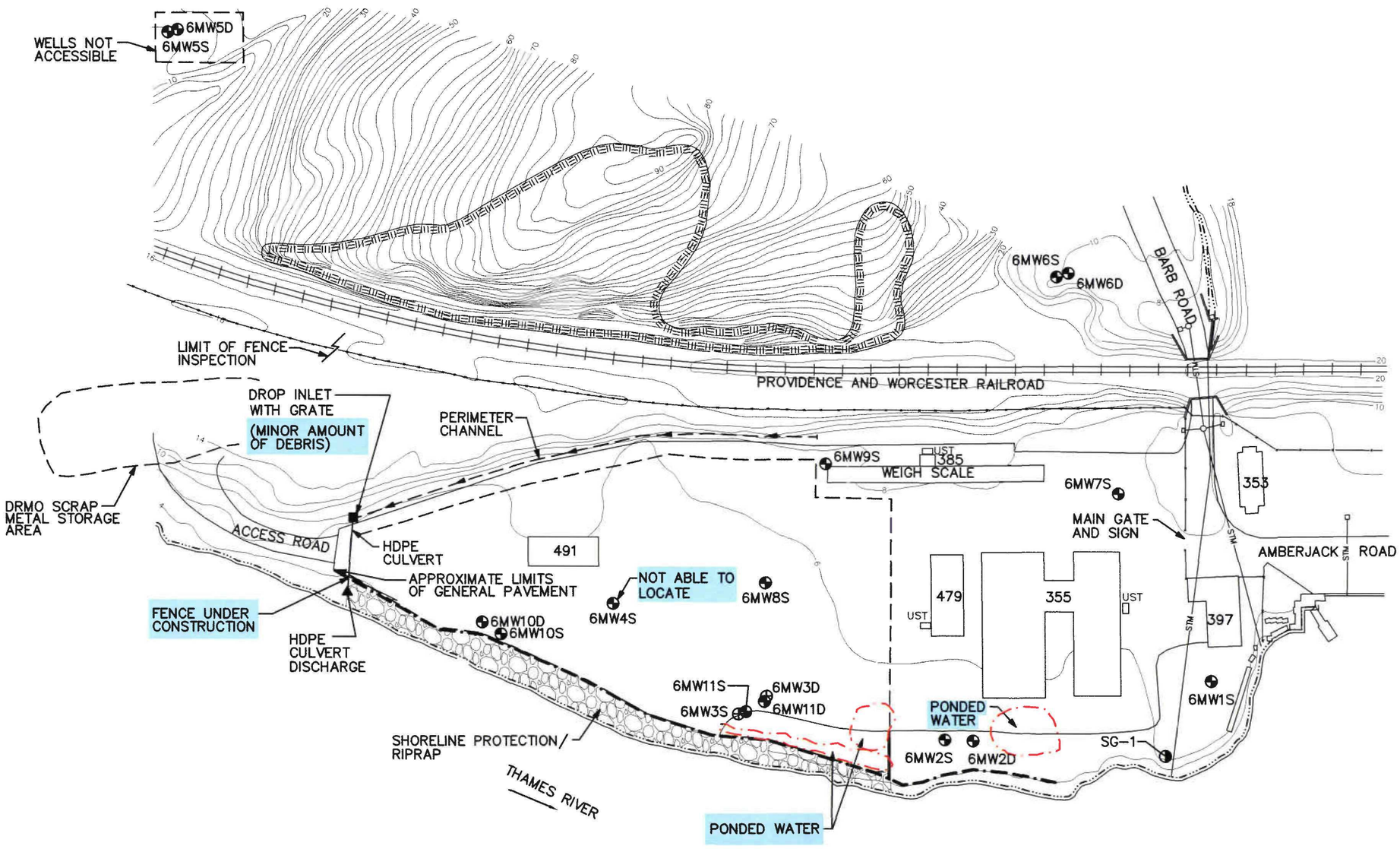
NA - Not available.
1 - Water Quality Standards.
2 - Criterion for saltwater at a chronic concentration.
3 - Criterion for consumption of organisms only.
4 - Criterion for saltwater at an acute concentration.
Shading indicates that the criterion has changed.

**TABLE 4-6**

**SITE 6 DEFICIENCIES**
**SITE 6 – DEFENSE REUTILIZATION AND MARKETING OFFICE**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

| Deficiency | Effects Protectiveness | |
|---|---|---|
| | Current | Future |
| Ponding of water along jersey barriers | N | Y |
| Cracks and depressions in asphalt | N | Y |
| Maintenance of monitoring wells and dedicated sampling equipment | N | Y |
| Abandonment of unused monitoring wells | N | Y |

ACAD: 0083CM09.dwg 12/12/06 DT PIT




LEGEND:

- MONITORING WELL
- ABANDONED MONITORING WELL*
- STAFF GUAGE
- APPROXIMATE LIMIT OF CAP
- APPROXIMATE LOCATION OF JERSEY BARRIER
- APPROXIMATE LOCATION OF PONDED WATER NOTED DURING APRIL 2006 SITE INSPECTION

NOTES:

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

* LOCATION EXISTS WITH WELL GROUTED TO SURFACE

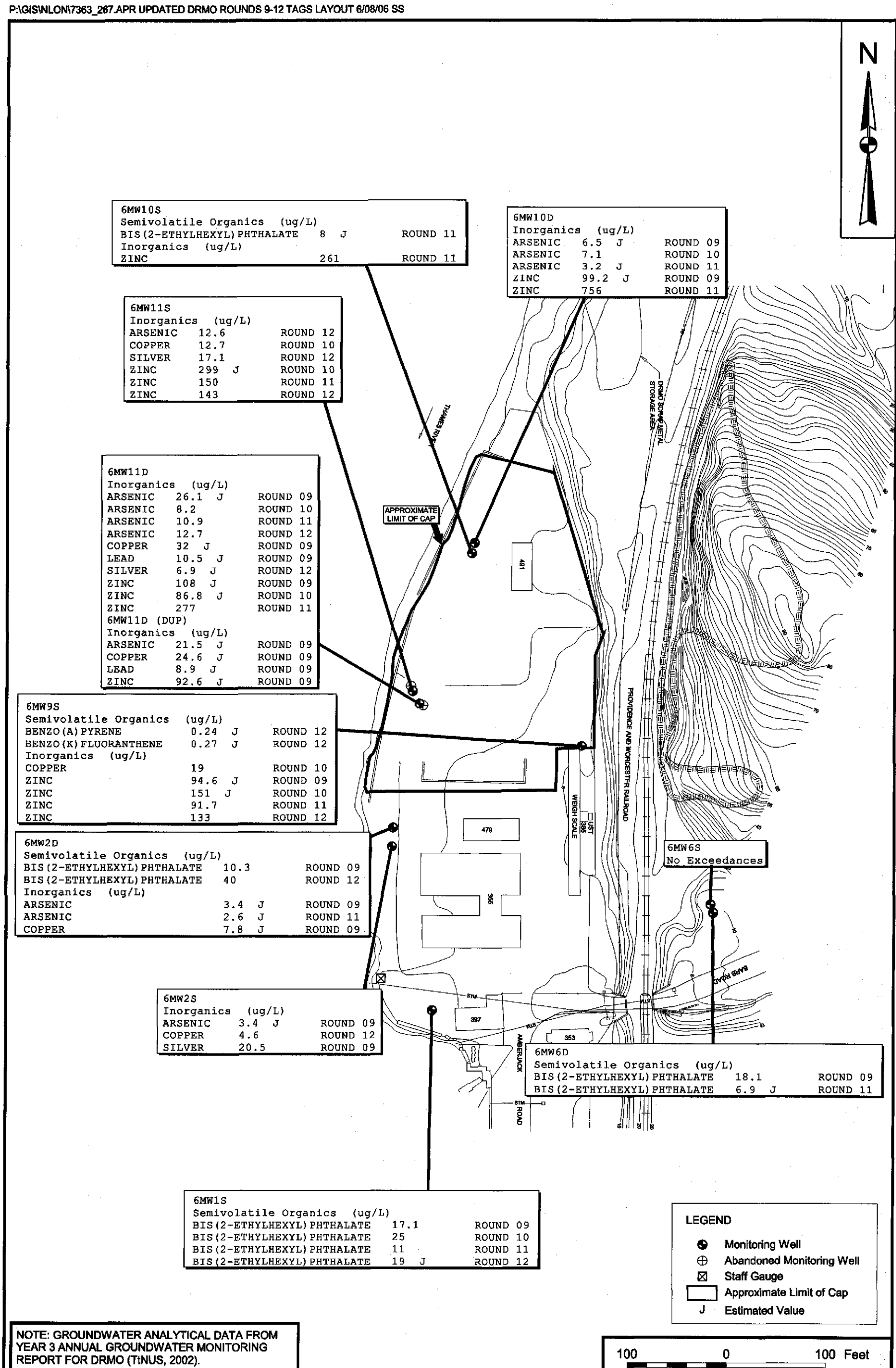
0 80 160
SCALE IN FEET

| | | | |
|---|---|---|---|
| DRAWN BY DT | DATE 5/17/06 | Tetra Tech NUS, Inc. | SITE PLAN FOR SITE 6 - DRMO NSB-NLON GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

| | |
|---|---|
| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAR | DATE 12/13/06 |
| DRAWING NO. FIGURE 4-1 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG – REV 1 – 9/10/98

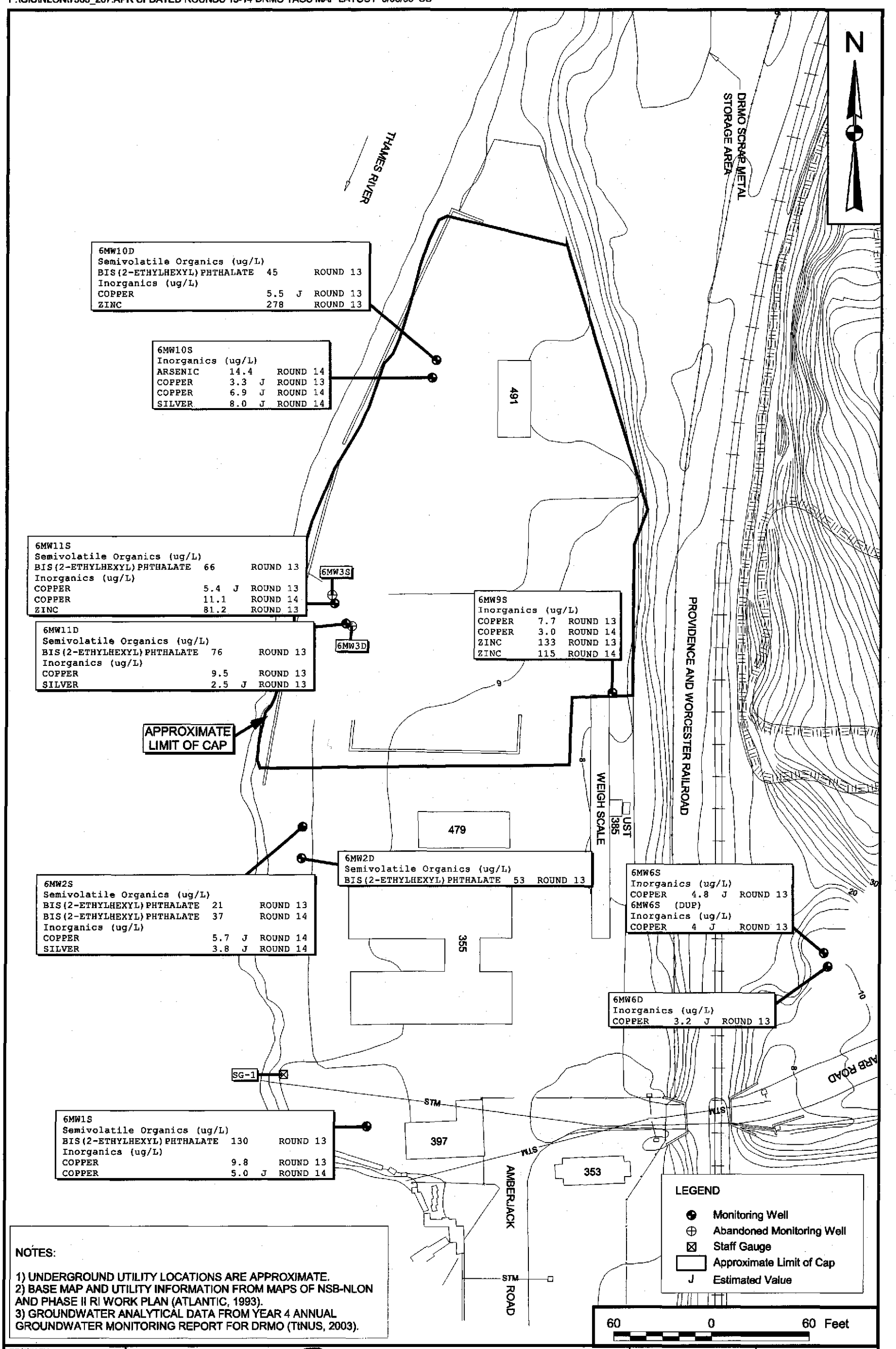
P:\GIS\NLON\7363_267.APR UPDATED DRMO ROUNDS 9-12 TAGS LAYOUT 6/08/06 SS




NOTE: GROUNDWATER ANALYTICAL DATA FROM YEAR 3 ANNUAL GROUNDWATER MONITORING REPORT FOR DRMO (TtNUS, 2002).

| | | | |
|---|---|---|---|
| DRAWN BY S. STROZ DATE 4/27/06 | Tetra Tech NUS, Inc. | CONTRACT NUMBER 0083 | OWNER NUMBER 038 |
| CHECKED BY N. BALSAMO DATE 6/08/06 | COPC EXCEEDANCES OF MONITORING CRITERIA<br>YEAR 3 GROUNDWATER SAMPLING<br>SITE 6 - DRMO<br>NSB-NLON<br>GRONTON, CONNECTICUT | APPROVED BY CAR DATE 6/08/06 | |
| COST/SCHEDULE-AREA | | APPROVED BY — DATE — | |
| SCALE AS NOTED | | DRAWING NO. FIGURE 4-2 | REV 0 |

P:\GIS\NLON\7363_267.APR UPDATED ROUNDS 13-14 DRMO TAGS MAP LAYOUT 6/08/06 SS




NOTES:

1) UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE.
2) BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON AND PHASE II RI WORK PLAN (ATLANTIC, 1993).
3) GROUNDWATER ANALYTICAL DATA FROM YEAR 4 ANNUAL GROUNDWATER MONITORING REPORT FOR DRMO (TtNUS, 2003).

| | | | |
|---|---|---|---|
| DRAWN BY S. STROZ DATE 4/27/06 | Tetra Tech NUS, Inc. | CONTRACT NUMBER 0083 | OWNER NUMBER 038 |
| CHECKED BY N. BALSAMO DATE 6/08/06 | COPC EXCEEDANCES OF MONITORING CRITERIA<br>YEAR 4 GROUNDWATER SAMPLING<br>SITE 6 -DRMO<br>NSB-NLON<br>GROTON, CONNECTICUT | APPROVED BY CAR | DATE 6/8/06 |
| COST/SCHEDULE-AREA | | APPROVED BY — | DATE — |
| SCALE AS NOTED | | DRAWING NO. FIGURE 4-3 | REV 0 |

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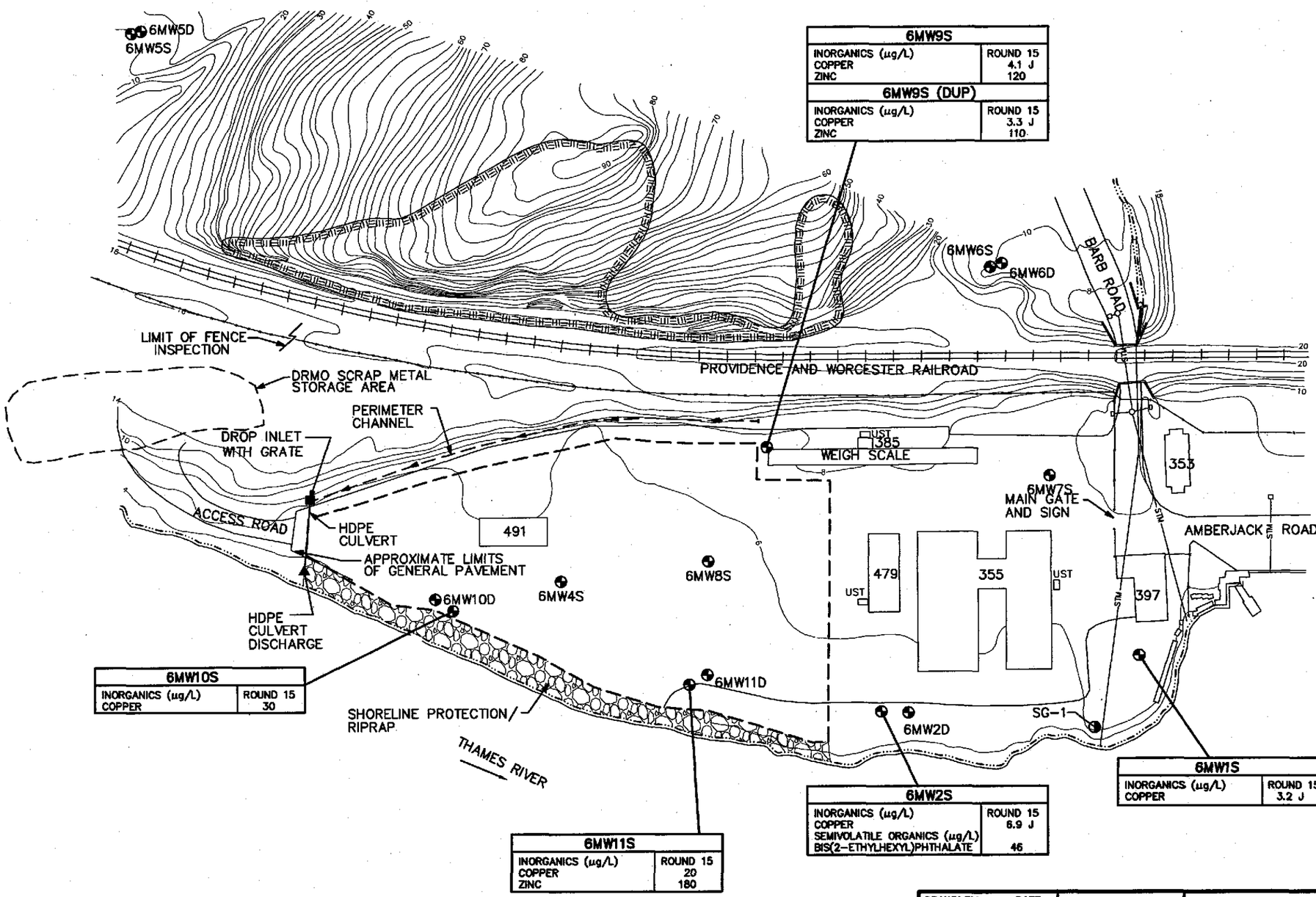



| 6MW9S | |
|---|---|
| INORGANICS (µg/L) | ROUND 15 |
| COPPER | 4.1 J |
| ZINC | 120 |

| 6MW9S (DUP) | |
|---|---|
| INORGANICS (µg/L) | ROUND 15 |
| COPPER | 3.3 J |
| ZINC | 110 |

| 6MW10S | |
|---|---|
| INORGANICS (µg/L) | ROUND 15 |
| COPPER | 30 |

| 6MW11S | |
|---|---|
| INORGANICS (µg/L) | ROUND 15 |
| COPPER | 20 |
| ZINC | 180 |

| 6MW2S | |
|---|---|
| INORGANICS (µg/L) | ROUND 15 |
| COPPER | 6.9 J |
| SEMIVOLATILE ORGANICS (µg/L) | |
| BIS(2-ETHYLHEXYL)PHTHALATE | 46 |

| 6MW1S | |
|---|---|
| INORGANICS (µg/L) | ROUND 15 |
| COPPER | 3.2 J |

**LEGEND:**

- MONITORING WELL
- STAFF GUAGE
- APPROXIMATE LIMIT OF CAP

**NOTE:**

GROUNDWATER ANALYTICAL DATA FROM FINAL YEAR 5 ANNUAL GROUNDWATER MONITORING REPORT FOR DRMO (ECC, 2004).

0 80 160
GRAPHIC SCALE IN FEET

| DRAWN BY | DATE |
|---|---|
| HJB | 5/1/06 |
| CHECKED BY | DATE |
| REVISED BY | DATE |
| SCALE AS NOTED | |

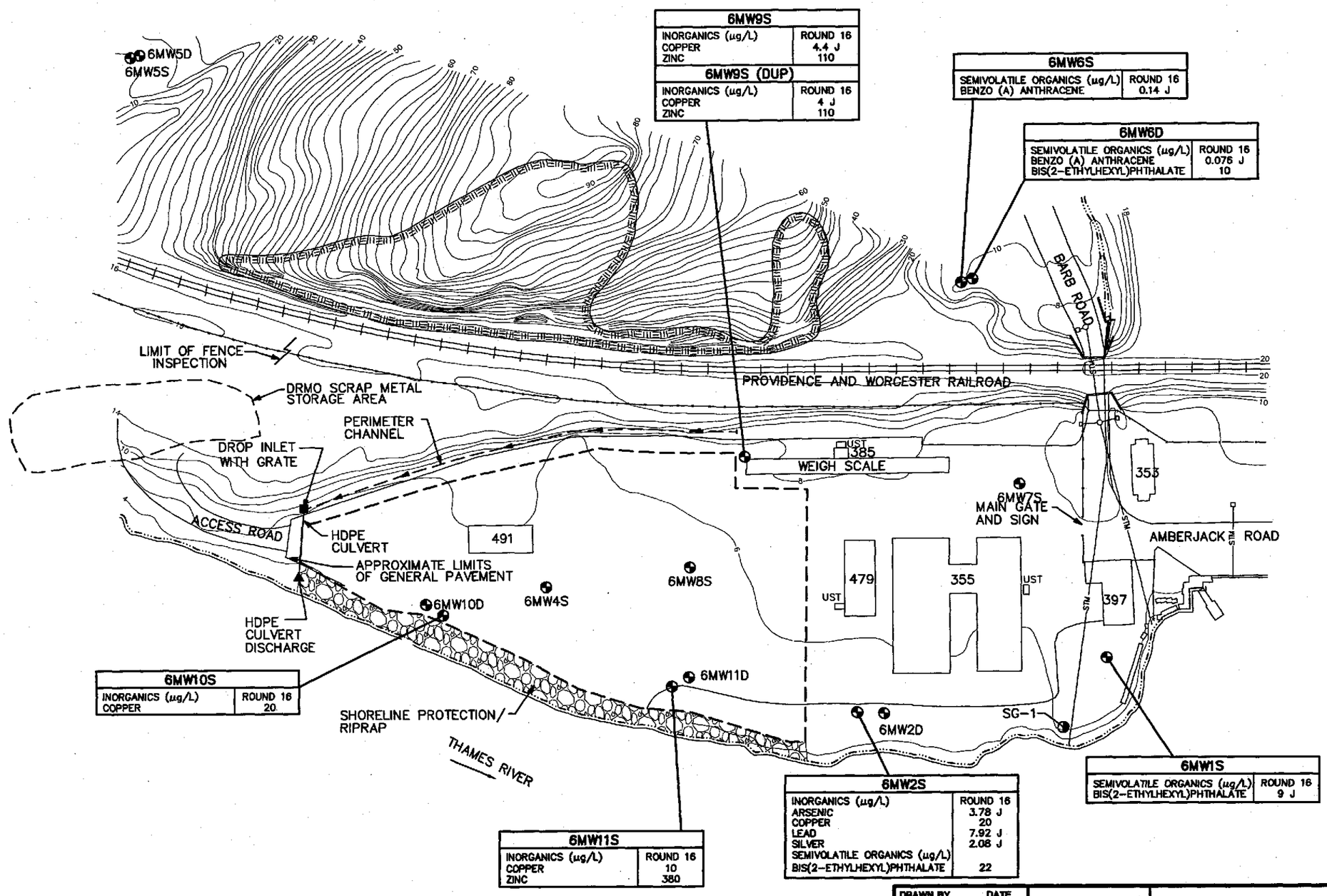
Tetra Tech NUS, Inc.

COPC EXCEEDANCES OF MONITORING CRITERIA
YEAR 5 GROUNDWATER SAMPLING
SITE 6 - DRMO
NSB-NLON
GROTON, CONNECTICUT

CONTRACT NO. 0083
OWNER NO. 038
APPROVED BY CAL DATE 6/7/06
DRAWING NO. FIGURE 4-4
REV. 0

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

ACAD: 0083GT06.dwg 06/06/06 MF PIT




| 6MW9S | |
|---|---|
| INORGANICS (µg/L) | ROUND 16 |
| COPPER | 4.4 J |
| ZINC | 110 |
| **6MW9S (DUP)** | |
| INORGANICS (µg/L) | ROUND 16 |
| COPPER | 4 J |
| ZINC | 110 |

| 6MW6S | |
|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 16 |
| BENZO (A) ANTHRACENE | 0.14 J |

| 6MW6D | |
|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 16 |
| BENZO (A) ANTHRACENE | 0.076 J |
| BIS(2-ETHYLHEXYL)PHTHALATE | 10 |

| 6MW10S | |
|---|---|
| INORGANICS (µg/L) | ROUND 16 |
| COPPER | 20 |

| 6MW11S | |
|---|---|
| INORGANICS (µg/L) | ROUND 16 |
| COPPER | 10 |
| ZINC | 380 |

| 6MW2S | |
|---|---|
| INORGANICS (µg/L) | ROUND 16 |
| ARSENIC | 3.78 J |
| COPPER | 20 |
| LEAD | 7.92 J |
| SILVER | 2.08 J |
| SEMIVOLATILE ORGANICS (µg/L) | |
| BIS(2-ETHYLHEXYL)PHTHALATE | 22 |

| 6MW1S | |
|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 16 |
| BIS(2-ETHYLHEXYL)PHTHALATE | 9 J |

**LEGEND:**

- MONITORING WELL
- STAFF GUAGE
- APPROXIMATE LIMIT OF CAP

**NOTE:**

GROUNDWATER ANALYTICAL DATA FROM YEAR 6 ANNUAL GROUNDWATER MONITORING REPORT FOR DRMO (ECC, 2005).

0 80 160
GRAPHIC SCALE IN FEET

| DRAWN BY | DATE |
|---|---|
| DLT | 5/1/06 |
| CHECKED BY | DATE |
| REVISED BY | DATE |
| SCALE AS NOTED | |

Tetra Tech NUS, Inc.

COPC EXCEEDANCES OF MONITORING CRITERIA
YEAR 6 GROUNDWATER SAMPLING
SITE 6 - DRMO
NSB-NLON
GROTON, CONNECTICUT

| CONTRACT NO. 0083 | |
|---|---|
| OWNER NO. 038 | |
| APPROVED BY CAR | DATE 6/7/06 |
| DRAWING NO. FIGURE 4-5 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

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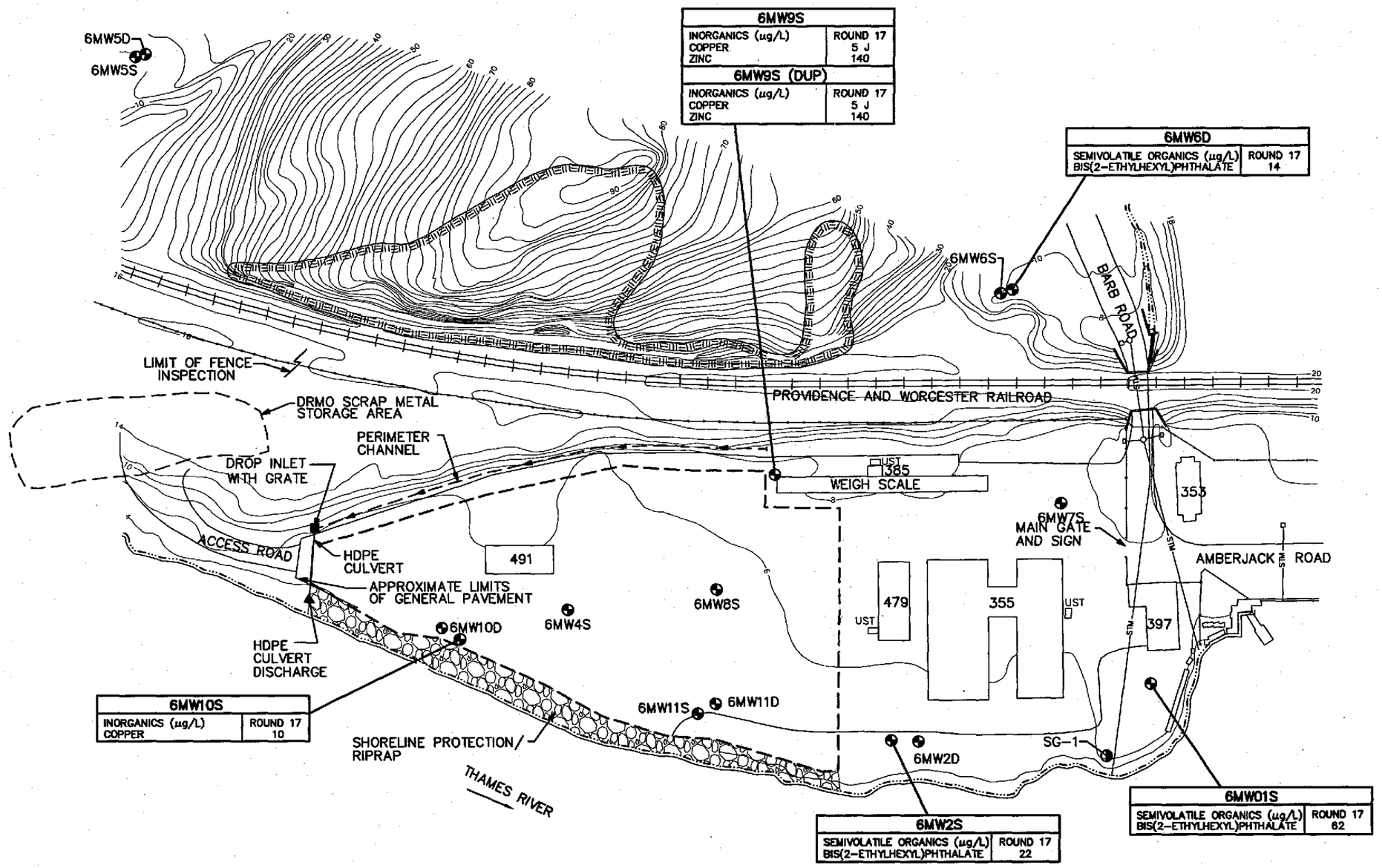


**LEGEND:**

- MONITORING WELL
- STAFF GUAGE
- APPROXIMATE LIMIT OF CAP

**NOTE:**

GROUNDWATER ANALYTICAL DATA FROM YEAR 7 ANNUAL GROUNDWATER MONITORING REPORT FOR DRMO (ECC, 2006).

0 80 160
GRAPHIC SCALE IN FEET

| | | | |
|---|---|---|---|
| DRAWN BY DLT | DATE 5/2/06 | Tetra Tech NUS, Inc. | COPC EXCEEDANCES OF MONITORING CRITERIA YEAR 7 GROUNDWATER SAMPLING SITE 6 - DRMO NSB-NLON GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

CONTRACT NO. 0083
OWNER NO. 038
APPROVED BY CAL DATE 6/7/06
DRAWING NO. FIGURE 4-6 REV. 0

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

# 5.0 SITE 7 – TORPEDO SHOPS (OU8 AND OU9)

Site 7 under the Navy's IRP includes the Torpedo Shops. This five-year review of Site 7 is required by statute because hazardous substances, pollutants, or contaminants remain in the groundwater at concentrations that do not allow for unlimited use or unrestricted exposure. Since the First 5-Year Review Report, the Proposed Plan (Navy, 2004) and ROD (Navy, 2004) for Site 7 soil and the Proposed Plan (Navy, 2004) and Interim ROD (Navy, 2004) for Site 7 groundwater have been completed. The selected remedial action for the soil OU (OU8) was excavation and off-site disposal. The remedial action for the soil was completed in May 2006, and the Remedial Action Report is under preparation. The selected remedy for the Site 7 groundwater OU, which is a portion of OU9, was institutional controls with monitoring. The selected remedy for the groundwater at this site is an interim remedy, but it is expected that it will be the final remedy after remedial actions are selected for all portions of OU9.

## 5.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 7 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Building 325 – torpedo overhaul facility built. | 1955 |
| Building 450 – torpedo overhaul/assembly facility built. | 1974 |
| Building 325 leach field abandoned. | 1975 |
| New leach field used until sanitary sewers installed. | 1983 |
| Hazardous waste sump decommissioned. | 1987 |
| Visual inspection of Building 325 observed solvents. | 1989 |
| Phase I RI completed. | August 1992 |
| Underground No. 2 fuel oil tank closed (one of two) and above-ground tank removed under RCRA. | 1995 |
| Investigation of two fuel oil tanks and removal action of TPH-contaminated soil completed under RCRA. | 1996 |
| Phase II RI completed. | March 1997 |
| First Five-Year Review completed. | December 2001 |
| BGOURI completed. | January 2002 |
| BGOURI Update/FS completed. | July 2004 |
| Proposed Plan for Site 7 Torpedo Shops and Site 14 OBDANE Soil (OU8) completed. | July 2004 |
| ROD for Site 7 - Torpedo Shops and Site 14 – OBDANE Soil (OU8) signed. | September 2004 |
| Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 Groundwater (OU9) completed. | September 2004 |

| Event | Date |
|---|---|
| Interim ROD for Sites 3, 7, 14, 15, 18, and 20 Groundwater signed. | December 2004 |
| LUC RD for Sites 3 and 7 Groundwater completed. | June 2005 |
| Final O&M Manual - Volumes I, II, III, IV and V | January 2006 |
| Remedial Action Work Plan/Design for Site 7 soil (OU8) completed. | February 2006 |
| Work Plan for Remedial Action at Sites 3 and 7 (Groundwater) completed. | March 2006 |
| Remedial Action for Site 7 soil completed. | May 2006 |
| Round 1 of groundwater monitoring at Sites 3 and 7 completed. | May 2006 |
| SOPA (ADMIN) New London Instruction 5090.18C issued. | December 2006 |

## 5.2 BACKGROUND

The Torpedo Shops (Site 7) are located in the northern portion of NSB-NLON on the northern side of Triton Road. Figure 5-1 shows the general site arrangement. The site location with respect to other IR sites at NSB-NLON is shown on Figure 1-2. The site covers approximately 7 acres and is bordered on the east and north by 60-foot-high bedrock cliffs. The remainder of the site slopes to the southwest toward the Area A Downstream Watercourses (Site 3). An earthen berm extends along the base of the eastern portion of the exposed rock face. Three buildings (325, 450, and 477) exist at the site.

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

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

closed in 1995. A third tank, which was located above ground adjacent to the building, was used for temporary storage of No. 2 fuel oil but, based on field reconnaissance, had been removed as of March 15, 1995.

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

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

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

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

the previous tank and is located south of the building. No construction is planned for the immediate future at Building 450.

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

During the Phase II RI, sampling results included notable detections of contamination in soil and groundwater near the abandoned leach field. Minimal contamination was detected in surface water and sediment. The contamination detected in soil and groundwater at the site warranted further characterization; however, relatively low human health and ecological risks were present at the site. The HHRA showed that non-cancer risks were below acceptable levels except for the construction worker and future resident, and cancer risks were below acceptable levels except for a hypothetical future resident. Minimal exceedances of State criteria were observed for sediment, and no chemicals detected in surface water exceeded the State human health AWQC for the consumption of organisms and/or water and organisms. The Phase II RI recommended that further characterization of the Torpedo Shops be completed before determining whether or not the site should proceed to the FS stage.

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

The BGOURI (TtNUS, 2002a) was completed based on the recommendation of the Phase II RI. The objectives of the BGOURI at Site 7 were to further characterize the nature and extent of soil and groundwater contamination in the vicinity of the abandoned septic system and to quantify the risks to human receptors from the soil and groundwater. Organic contaminant detections in soils were scattered and were primarily PAHs. Metals detections were scattered and were in general only slightly greater than background concentrations. Groundwater sampling results from the BGOURI indicated only sporadic, low concentrations of contaminants in groundwater. A small plume of chlorobenzenes was detected west of Building 325, but there were no other discernable contaminant plumes of any size, indicating that there are no significant sources leaching contamination to groundwater at Site 7. Concentrations of BEHP and/or TCE in several wells located within the western portion of Site 7 exceeded MCLs. The HHRA

showed that the risks posed from exposure to contaminated soil at Site 7 were generally low; however, the risks posed by two chemicals exceeded CTDEP's target level for individual chemicals, and there were several chemicals detected at concentrations greater than CTDEP's direct exposure criteria. The risk assessment also determined that risks to current receptors from exposure to groundwater at Site 7 are within acceptable levels, but future residential groundwater usage could result in unacceptable risks.

An FS (TtNUS, 2004) was completed to identify and evaluate appropriate remedial alternatives for soil and groundwater at Site 7. Separate Proposed Plans and RODs were prepared to document the selected remedies for soil and groundwater. The remedy selected for soil was excavation and off-site disposal. A Remedial Action Work Plan was prepared for Site 7 soil in 2006 and the remedial action for the soil was completed in May 2006. The general tasks completed during the remedial action included the following:

- Excavating soil and stockpiling on site.
- Performing confirmation sampling of the excavations.
- Dewatering excavations as necessary.
- Sampling stockpiled soil for waste characterization purposes.
- Backfilling excavated areas.
- Transporting and disposing of excavated soil.

The remedy selected for groundwater was institutional controls with monitoring. A Remedial Design for Land Use Controls was subsequently completed for Site 7 groundwater in June 2005. The Navy began implementation of the groundwater monitoring program as described in the Remedial Action Work Plan (TtNUS, 2006b) and Site 7 GMP (TtNUS, 2006a) in May 2006.

## 5.3 REMEDIAL ACTIONS

### 5.3.1 Remedy Selection

An FS was prepared to address Site 7 soil contaminated with PAHs, soil potentially contaminated with chlorobenzene (CB), dichlorobenzene (DCB), and benzene, and groundwater known to be contaminated with CB, DCB, and benzene. Chemicals such as TCE and hexachlorobenzene (HCB) found in Site 7 groundwater are of regional concern and were addressed with Site 3 groundwater.

The excavation and off-site disposal alternative for Site 7 soil was presented in the Proposed Plan in July 2004 (Navy, 2004b) and was formally selected in the ROD was signed in September 2004 (Navy, 2004f). The institutional controls and monitoring alternative for Site 7 groundwater was presented in the Proposed

Plan in September 2004 (Navy, 2004d) and was formally selected in the Interim ROD that was signed in December 2004 (Navy, 2004h).

#### 5.3.1.1 Soil

Based on the results of the HHRA completed for the BGOURI, the evaluation of the HHRA results in the BGOURI Update, and the ERA completed during the Phase II RI, the following RAOs were developed for Site 7 soil:

- Protect current receptors (construction worker and full-time employee) from incidental exposure to soil contaminated with PAHs and potentially contaminated with benzene, CB, and DCB at concentrations greater than the PRGs. The HHRA identified potential risks to full-time employees from exposure to benzo(a)pyrene in surface soil. In addition, benzo(a)pyrene was detected in subsurface soil at concentrations that exceed the Connecticut Industrial/Commercial RSR for direct exposure. The concentrations of benzene, CB, and DCB in soil will not be known until additional sampling is conducted near the septic tank.

- Protect existing groundwater quality by preventing the leaching of PAHs, benzene, CB, and DCB in soil at concentrations greater than PRGs. Available site data indicate that soil to groundwater migration of PAHs is not significant, but soil to groundwater migration of benzene, CB, and DCB may be significant.

- Protect aquatic ecological receptors by preventing the erosion of soil containing COCs at concentrations greater than PRGs. Potential risks to aquatic ecological receptors were not identified and therefore PRGs were not selected.

- Protect potential future receptors (residential use) from incidental exposure to soil contaminated with PAHs and potentially with benzene, CB, and DCB at concentrations greater than PRGs. The HHRA identified potential risks to a hypothetical future child resident from exposure to benzo(a)pyrene in soil. In addition, maximum concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene in soil exceed the Connecticut Residential RSRs for direct exposure. The concentrations of benzene, CB, and DCB in soil will not be known until additional sampling is conducted near the septic tank.

The remedial goals identified to address the RAOs associated with Site 7 soil contaminants are presented in Table 5-1 and are based on risk assessment results and the CTDEP RSRs including direct contact and groundwater protection considerations.

The selected remedy for Site 7 soil was excavation and off-site disposal for two areas adjacent to Building 325. The PAH excavation area was located near the southeastern corner of Building 325, and the benzene, CB, and DCB excavation area was located at the septic tank along the western side of Building 325. The cost of implementing the alternative was estimated at $440,200 in the ROD. The selected remedy for Site 7 consisted of the following components:

- Finalize Delineation - To determine the final horizontal and vertical extent of soil contamination at Site 7, approximately 10 soil borings will be advanced in the area of PAH-contaminated soils and approximately 5 soil borings will be advanced in the area of suspected benzene-, CB-, and DCB-contaminated soil. It is expected that two soil samples will be collected from each boring for a total of approximately 30 soil samples. These soil samples will be sent to a laboratory for analysis. The samples collected from the PAH area will be analyzed for PAHs; the remaining samples will be analyzed for VOCs. It was also expected that a sample of the contents of the septic tank will be collected and analyzed. A sampling plan will be developed to provide the details of the predesign investigation sampling program.

- Excavation - Following final delineation, excavation equipment will be used to excavate the contaminated soil from Site 7 (approximately 1,600 cubic yards of PAH-contaminated soil and 90 cubic yards of benzene-, CB-, and DCB-contaminated soil and the septic tank). The excavated soil will be characterized to determine the appropriate disposal facility. Due to the depth of excavation (5 to 8 feet), it is anticipated that the excavation side walls will have to be laid back to provide for safe working conditions. Therefore, it is anticipated that approximately 200 cubic yards of additional soil outside the extent of contamination will need to be excavated to provide a safe operation. The additional soil will be disposed off site along with the contaminated soil. The total volume of soil to be excavated and disposed off site is approximately 1,900 cubic yards. Groundwater may also be encountered during excavation of contaminated soil. If encountered, the water may need to be removed from the excavation, pre-treated, and discharged to the publicly-owned treatment works (POTW).

- Transportation - Upon determination of the appropriate disposal facility, the contaminated soil will be loaded into trucks for transportation to the off-site disposal or recycling center.

- Verification Sampling - After the excavation of contaminated soil, soil samples will be collected from the bottom and sidewalls of each excavation area. The soil samples will be analyzed for their respective sets of COCs to verify the removal of the COCs or to verify that the remaining COC concentrations are less than remedial goals. Table 5-1 provides the COCs for each excavation area and the remedial goals for each COC. Due to the size of each excavation, it was anticipated that 10

verification samples will be collected from each excavation area. In the event that COCs remain at concentrations greater than the remediation goals, additional soil will be excavated where appropriate, and additional verification samples will be collected. The final details of the verification sampling program will be provided as part of the remedial design documentation.

- Restoration - After verification that the COCs were removed from Site 7 or that COC concentrations remaining in Site 7 soil are less than remedial goals, clean soil will be brought to the site to backfill the excavations. Following backfilling of the excavations, the surface will be returned to pre-excavation conditions (e.g., grassed, paved, or gravel).

#### 5.3.1.2 Groundwater

Based on the results of the HHRA completed for the BGOURI and the evaluation of the HHRA results in the BGOURI Update, the following RAOs were developed in the FS to address the COCs detected in groundwater at Sites 3 and 7:

- Protect current receptors (construction workers) from incidental exposure to groundwater contaminated with petroleum and chlorinated hydrocarbons at concentrations greater than PRGs. The HHRA did not identify excessive risk to construction workers associated with exposure to groundwater.

- Protect potential future receptors (potable water supply) from regular ingestion of groundwater contaminated with chlorinated hydrocarbons at concentrations greater than PRGs.

- Protect aquatic ecological receptors by preventing the migration of groundwater contaminated with petroleum hydrocarbons at concentrations greater than PRGs to surface water.

The following RAOs were developed to address the COCs detected exclusively at Site 7 (i.e., 1,4-DCB, benzene, and CB):

- Protect current receptors (construction workers) from incidental exposure to groundwater contaminated with organics at concentrations greater than PRGs. The HHRA did not identify excessive risk to construction workers associated with exposure to groundwater, and therefore PRGs were not selected.

- Protect potential future receptors (potable water supply) from regular ingestion of groundwater contaminated with benzene and chlorinated hydrocarbons at concentrations greater than PRGs.

- Protect aquatic ecological receptors by preventing the migration of groundwater contaminated with COCs at concentrations greater than PRGs to surface water. Potential risks to aquatic ecological receptors were not identified, and therefore PRGs were not selected.

The remedial goals identified to address the RAOs associated with Site 7 groundwater contaminants are presented in Table 5-2 and are based on risk assessment results and CTDEP RSRs.

Site 7 groundwater was not identified to represent a significant risk to current receptors or ecological receptors in adjacent water bodies. However, CB, DCB, benzene, TCE, and HCB are present in groundwater at concentrations that could represent a risk to potential future receptors through regular consumption of groundwater. The selected remedy for Site 7 groundwater was institutional controls and monitoring. It is expected that the selected remedy for groundwater will be the final remedy after remedial actions are selected for all portions of OU9. The selected remedy complies with regulatory requirements and includes the following major components:

- Implementation of institutional controls that identify the location and magnitude of groundwater contamination and restrict extraction and use of the groundwater. The details of the administration of the institutional controls will be provided in the Remedial Design documentation. In the event of property transfer and with confirmation that contaminated groundwater remains at the sites, a deed restriction would be used to prohibit the use of groundwater.

- Monitoring the degradation and potential migration of groundwater contaminants until concentrations decrease to the remedial goals in Table 5-2 by natural processes and the resulting concentrations are shown to be protective of human health and the environment. Additional details regarding the scope and duration of the monitoring program will be provided in the groundwater monitoring plan.

The estimated cost of the selected remedy for Site 7 groundwater in the ROD was $303,800, which included capital, monitoring, and O&M costs. A Remedial Design for Land Use Controls was subsequently completed for Site 7 groundwater in June 2005. The Navy also prepared the Remedial Action Work Plan (TtNUS, 2006b) and Site 7 Groundwater Monitoring Plan (TtNUS, 2006a) to address implementation of the groundwater monitoring program at Site 7.

### 5.3.2 Remedy Implementation

Soil

Implementation of the Site 7 soil remedial action of excavation and off-site disposal was completed in May 2006. Documentation for the remedial action is currently being prepared and was not available at the time this report was prepared.

Groundwater

A Remedial Design for Land Use Controls was completed for Site 7 groundwater in June 2005. The Navy incorporated the information in the Remedial Design into the New London Instruction 5090.18C (Navy, 2006b).

The objective of the Site 7 groundwater monitoring program is to conduct long-term monitoring of the degradation and potential migration of COCs until the concentrations decrease to the remedial goals by natural processes and the resulting concentrations are shown to be protective of human health and the environment. The monitoring program will continue until compliance with the remedial goals within the site boundaries is shown and it is confirmed that contamination is not migrating from the site at concentrations in excess of remedial goals. The groundwater at Site 7 is designated as GB by the State of Connecticut; however, the Navy's goal for groundwater remediation at the Site 7 is to meet GA requirements to eliminate groundwater use restrictions in the future. Based on State regulations, monitoring can be discontinued after 3 years of data that show compliance with the applicable criteria. After the monitoring program can be discontinued, the groundwater use restrictions can be eliminated, and five-year reviews will no longer be necessary at the site. Annual reports will be issued to summarize the results of the monitoring program. The annual reports will include a thorough evaluation of each year of data collected under the program.

The Navy began implementation of the groundwater monitoring program as described in the Remedial Action Work Plan (TtNUS, 2006b) and Site 7 Groundwater Monitoring Plan (TtNUS, 2006a) in May 2006. Four new monitoring wells were installed at Site 7 to complete the monitoring well network. A total of eight monitoring wells (four existing and four new) were then sampled and analyzed for VOCs under the program. Sampling will continue to be conducted quarterly for the first year of the program. The analytical program and monitoring well network will be modified as necessary in the future.

### 5.3.3 System Operations/Operation and Maintenance

#### 5.3.3.1 Operation and Maintenance

O&M will not be required for Site 7 soil because the remedial action removed all soil with COC concentrations greater than remedial goals that allow for unrestricted use.

No O&M costs have been incurred yet for the groundwater remedy. The estimated present worth cost of groundwater monitoring activities at Site 7 for the first 5 years is $98,600. This cost estimate was presented in the BGOURI Update/FS and assumes quarterly sampling the first year, annual monitoring the next 4 years, and minimal maintenance of the monitoring wells.

## 5.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of Site 7. The recommendations from the First Five-Year Review Report are provided below along with the actions taken to address the recommendations.

Prepare an NFA decision document for the soil, sediment, and surface water OUs at Site 7.

- An evaluation of soil data in the BGOURI Update/FS (TtNUS, 2004) indicated that the soil posed potential risks to human receptors. A Proposed Plan, ROD, and Remedial Action Work Plan were subsequently completed to address Site 7 soil. Implementation of the selected remedy for Site 7 soil (excavation and off-site disposal) was completed in May 2006.

- Surface water and sediment data from the Phase II RI did not indicate significant risks to ecological receptors. No decision document was prepared for these media.

Prepare an FS for the groundwater OU associated with Site 7.

- An FS, Proposed Plan, Interim ROD, Remedial Design for Land Use Controls, Remedial Action Work Plan, and Groundwater Monitoring Plan for Site 7 groundwater were completed. The Navy is currently implementing the Remedial Action Work Plan and Groundwater Monitoring Plan.

Enforce of the New London Instruction 5090.18B.

- The New London Instruction was updated to include the Goss Cove Landfill and was reissued in 2003 (Instruction 5090.18B). The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information for Site 2 - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON. The instruction has

been followed by personnel at NSB-NLON, and no uncontrolled disturbances of the soil or groundwater at Site 7 have occurred.

## 5.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 5.5.1 Document Review

The documents that were reviewed for the second five-year review are listed below, and key information obtained from the documents is summarized in the following sections.

| | |
|---|---|
| BGOURI | January 2002 |
| BGOURI Update/FS | July 2004 |
| Proposed Plan for Site 7 Torpedo Shops and Site 14 OBDANE Soil (OU8) | July 2004 |
| ROD for Site 7 - Torpedo Shops and Site 14 – OBDANE Soil (OU8) | September 2004 |
| Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 Groundwater (OU9) | September 2004 |
| Interim ROD for Sites 3, 7, 14, 15, 18, and 20 Groundwater | December 2004 |
| LUC RD for Sites 3 and 7 Groundwater | June 2005 |
| Final O&M Manual - Volumes I and II | January 2006 |
| Remedial Action Work Plan/Design for Site 7 Soil | February 2006 |
| Work Plan for Remedial Action at Sites 3 and 7 (Groundwater) | March 2006 |
| SOPA (ADMIN) New London Instruction 5090.18C | December 2006 |

### 5.5.2 Data Review

Additional soil data were collected by Tetra Tech ECI, Inc. (TtECI, 2005) during preparation of the Remedial Action Work Plan to finalize the extent of contamination.

The latest groundwater data for Site 7 were collected during the BGOURI. These data were used to determine the remedial approach for the site. The groundwater monitoring program at Site 7 was initiated in May 2006; therefore, no new data were available for review during this Second Five-Year Review.

### 5.5.3 ARAR and Site-Specific Action Level Changes

#### 5.5.3.1 Soil

The remedial action implemented for soil at the Torpedo Shops was excavation and off-site disposal. ARARs and TBCs were reviewed to determine whether there have been changes since the ROD was signed. Listings of chemical-specific and action-specific ARARs, advisories, and guidance (TBCs) considered in the ROD are listed on Tables 5-3 and 5-4, respectively. The ARARs were either addressed during selection or implementation of the remedy and are no longer applicable or have not been amended since the ROD.

#### 5.5.3.2 Groundwater

The remedial action implemented for groundwater at the Torpedo Shops was institutional controls and monitoring. ARARs and TBCs were reviewed to determine whether there have been changes since the ROD and Groundwater Monitoring Plan were issued. Listings of chemical-specific and action-specific ARARs, advisories, and guidance (TBCs) considered in the ROD are listed on Tables 5-5 and 5-6, respectively. The ARARs were either addressed during selection or implementation of the remedy and are no longer applicable or have not been amended since the ROD and Groundwater Monitoring Plan were issued. A Land Use Control Use Control Remedial Design was completed, and controls have been implemented through the New London Instruction 5090.18C.

### 5.5.4 Site Inspection

Site 7 was inspected on April 4, 2006. The inspection focused primarily on the soil remedial action (i.e., excavations) that was being conducted at the site and the proposed monitoring well locations for the planned groundwater monitoring program. Weather conditions during the inspection were cold (mid-40s), overcast, and windy. Representatives from the Navy, USEPA, CTDEP, TtNUS, ECC, and Gannett Fleming participated in the inspection. Site 7 is located within a high-security gated area. The area consists of buildings, parking lots, and grassy areas. There is no short-term or long-term plan to convert this area to any other use. Appendix A contains photographs taken of the site during the site inspection.

Open excavations were present to the west and south of Building 325 on the day of the inspection. Soil from these two excavations was being stockpiled on site to the west of Building 325 until confirmation and waste characterization results were available. Groundwater had filled the excavation along the western side of Building 325, and the contractor was in the process of obtaining a permit to dewater the excavation and discharge the water into the sanitary sewer.

Two of the four proposed monitoring well locations (stakes and flagging) for the groundwater monitoring program were observed at the site. The remaining two well locations will be in the vicinity of the excavation on the western side of Building 325.

### 5.5.5 Site Interviews

No official interviews were conducted as part of the second five-year review. Issues discussed by the inspection team during the inspection included the soil remedial action and the proposed well locations.

## 5.6 ASSESSMENT

The following conclusions support the determination that the remedy for the Site 7 soil OU (OU8) is protective of human health and the environment and the remedy for the Site 7 groundwater OU will be protective of human health and the environment upon completion.

***Question 1. Is the remedy functioning as intended by the decision documents?***

- ***Remedial Action Performance:*** All contaminated soil in excess of remedial goals (Table 5-1) were excavated and disposed off site. The effectiveness of the remediation will be documented in the completion report. Groundwater monitoring was recently initiated at the site to monitor the natural attenuation of contaminants until they reach the selected remedial goals (Table 5-2). The groundwater water data will be summarized and evaluated in subsequent monitoring reports.

- ***System Operations/O&M:*** For the groundwater OU, four new monitoring wells were installed to complete the monitoring well network, and four existing wells were redeveloped as part of the groundwater monitoring program. Costs for groundwater monitoring at Site 7 over the first 5 years of the program were expected to range from $ 48,300 (Year 1) to $13,441 (Years 2 through 5). These cost estimates were presented in the FS. Because the monitoring program was initiated in May 2006, actual costs were not available at the time of preparation of this report.

- ***Opportunities for Optimization:*** Site 7 monitoring wells that are not being used for the monitoring program can be abandoned. The monitoring network can be reduced as necessary in the future.

- ***Early Indicators of Potential Remedy Failure:*** There are no indications of potential remedy failure.

- ***Implementation of Institutional Controls and Other Measures:*** Institutional controls associated with the Site 7 are discussed in the New London Instruction 5090.18C. The site is within the designated ESQD of the Area A Weapons Center; therefore, further development is not planned for

the area. A Land Use Control Remedial Design for Site 7 groundwater was completed, and the controls will be implemented through the New London Instruction 5090.18B.

***Question 2. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?***

- ***Changes in Standards and TBCs***: ARARs and TBCs considered during preparation of the soil and groundwater RODs were reviewed to determine if there were any changes. As presented in Section 5.5.3, there have been no changes to ARARs.

- **Changes in Exposure Pathways:** Because all soil with contaminant concentrations greater than remedial goals was excavated and disposed off site, the direct exposure pathway for human receptors to soil was eliminated. Groundwater at Site 7 is not currently used as a drinking water source, and municipal potable water is available at the site, which would minimize the likelihood that groundwater would be used as a drinking water source in the future.

- ***Changes in Toxicity and Other Contaminant Characteristics:*** There have been no changes in the human health toxicity criteria that would impact the soil or groundwater remedial goals.

- ***Changes in Risk Assessment Methods:*** As discussed in Section 1.4, there have been no major changes in HHRA methodology since the signing of the RODs that would impact the protectiveness of the remedies.

- ***Expected Progress Towards Meeting RAOs:*** The RAOs for Site 7 soil (OU8) were met by excavating the soil with contaminant concentrations greater than the remedial goals and disposing of it at an approved off site disposal facility. RAOs for Site 7 groundwater, a portion of OU9, are in the process of being met. Land use controls and a groundwater monitoring program are currently being implemented at the site. A Remedial Design for LUCs was prepared for groundwater and was incorporated in the New London Instruction 5090.18C.

***Question 3. Has any other information come to light that could call into question the protectiveness of the remedy?***

No additional information has been identified that would call into question the protectiveness of the soil or groundwater remedies.

## 5.7 ISSUES

Remedies for Site 7 soil and groundwater were recently implemented, and no documentation was available for review. Based on the limited available information, the following deficiency was identified during this review:

- New London Instruction 5090.18C was issued in 2006 and includes the latest information from the Land Use Control Remedial Design for Site 7 groundwater. The Instruction should continue to be enforced.

## 5.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Based on the results of the site inspection and review, the following recommendations are made for Site 7:

- Prepare and issue the completion report for the soil remedial action.
- Continue implementation of the Groundwater Monitoring Plan.
- Continue enforcement of the New London Instruction 5090.18C.
- Maintain the existing monitoring well network and/or properly abandon unnecessary monitoring wells.
- At least yearly monitoring of Institutional Control compliance with the monitoring reports incorporated into future five-year reviews.

Follow-up actions should be implemented by the Navy in a timely manner to address the recommendations.

## 5.9 PROTECTIVENESS STATEMENT

The soil remedy at Site 7 is currently protective of human health and the environment. Excavation and off-site disposal of soil eliminated direct contact by human and ecological receptors and prevented soil to groundwater migration issues. The groundwater remedy at Site 7 is expected to be protective of human health and the environment. Institutional controls were implemented to prevent the consumption of groundwater, and a groundwater monitoring program is being conducted to verify the protectiveness of the remedy and determine when concentrations are at levels that are protective of human health and the environment. Implementation of the controls and monitoring program until acceptable groundwater concentrations are reached will maintain the effectiveness of the remedy in the future.

**TABLE 5-1**

**SUMMARY OF REMEDIAL GOALS FOR SITE 7 SOIL**
**SITE 7 - TORPEDO SHOPS**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

| Area of Concern | Chemical of Concern | Remedial Goal (mg/kg) |
|---|---|---|
| West of Building 325 | Benzene | 0.02 |
| | Chlorobenzene | 2.0 |
| | 1,4-Dichlorobenzene | 1.5 |
| South of Building 325 | Benzo(a)anthracene | 1.0 |
| | Benzo(a)pyrene | 1.0 |
| | Benzo(b)fluoranthene | 1.0 |
| | Indeno(1,2,3-cd)pyrene | 1.0 |

**TABLE 5-2**

**SUMMARY OF REMEDIAL GOALS FOR SITE 7 GROUNDWATER**
**SITE 7 – TORPEDO SHOPS**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

| Contaminant of Concern | Remedial Goal for Protection of Future Potential Receptors [(1)] |
|---|---|
| **Volatile Organic Compounds** | |
| 1,4-Dichlorobenzene | 75 µg/L |
| Benzene | 1 µg/L |
| Chlorobenzene | 100 µg/L |
| Trichloroethene | 5 µg/L |
| **Semivolatile Organic Compounds** | |
| Hexachlorobenzene | 1 µg/L |

1 Future potential receptors consist of residents living at the site who may use groundwater as a source of potable water. Human health RGs are based on federal and State of Connecticut drinking water/groundwater quality standards.

**TABLE 5-3**

**CHEMICAL-SPECIFIC ARARs AND TBCs FOR SITE 7 SOIL**
**SITE 7 – TORPEDO SHOPS**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

**FEDERAL**

| Requirement | Citation | Status | Synopsis of Requirement | Current Status/Applicability |
|---|---|---|---|---|
| Cancer Slope Factors (CSFs) | Not applicable | TBC | These are guidance values used in risk assessment to evaluate the potential carcinogenic or non-carcinogenic hazard caused by exposure to contaminants. | Contaminated soils were excavated and properly managed off site. The remedial action eliminated soil contamination that could adversely impact human health; therefore, this requirement is no longer applicable. |
| Reference Doses (RfD) | Not applicable | TBC | These are guidance values used in risk assessment to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants. | Contaminated soils were excavated and properly managed off site. The remedial action eliminated soil contamination that could adversely impact human health; therefore, this requirement is no longer applicable. |

**STATE OF CONNECTICUT**

| Requirement | Citation | Status | Synopsis of Requirement | Current Status/Applicability |
|---|---|---|---|---|
| Remediation Standard Regulations | CGS 22a-133k; RCSA 22a-133k - 1 thru 3 | Applicable | These regulations provide specific numerical cleanup criteria for contaminants in soil. Requirements are based on groundwater in the area being classified by the State as GB. | Contaminated soils were excavated and properly managed off site. The remedial action eliminated soil contamination that could adversely impact human health; therefore, this ARAR is no longer applicable. |

**TABLE 5-4**

**ACTION-SPECIFIC ARARs AND TBCs FOR SITE 7 SOIL**
**SITE 7 – TORPEDO SHOPS**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


**FEDERAL**

| Requirement | Citation | Status | Synopsis of Requirement | Evaluation/Action to be Taken |
|---|---|---|---|---|
| RCRA Subtitle C - Hazardous Waste Identification and Listing Regulations | 40 CFR Parts 260-262 and 264 | Relevant and Appropriate | These rules are used to identify, manage, and dispose of hazardous waste. | Excavated soils were tested for hazardous waste characteristics (i.e., TCLP criteria). Any soils that exceeded applicable limits were managed in accordance with Subtitle C regulations. Because the remedial action has been completed, this regulation is no longer applicable. |
| RCRA Subtitle D | 40 U.S.C. 6901 | Relevant and Appropriate | These are regulations that govern the disposal of non-hazardous wastes. | Excavated soils that were determined to be nonhazardous were managed in accordance with Subtitle D regulations. Because the remedial action has been completed, this regulation is no longer applicable. |
| Clean Water Act, Section 402, National Pollution Discharge Elimination System (NPDES) | 40 CFR 122 through 125, 131 | Applicable | NPDES permits are required for any discharges to navigable waters. If remedial activities include such a discharge, the NPDES standards would be ARARs. Standards would be enforced through the State program. | Water management was required during soil excavation; however, the water was not discharged directly to a surface water body. Therefore, treatment in accordance with these regulations was not required. Because the remedial action has been completed, this regulation is no longer applicable. |
| Clean Water Act, Section 403, Pretreatment Regulations | Section 403 | Applicable | General pretreatment requirements for discharge to a POTW. If remedial activities include such a discharge to the local sanitary sewer, pre-treatment standards would be ARARs. Standards would be enforced through the State program. | Water management was required during soil excavation and the water was discharged to the sanitary sewer system. Testing was done that verified treatment in accordance with these regulations was not required prior to discharge to the POTW. Because the remedial action has been completed, this regulation is no longer applicable. |

**TABLE 5-4**

**ACTION-SPECIFIC ARARs AND TBCs FOR SITE 7 SOIL**
**SITE 7 – TORPEDO SHOPS**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


**STATE OF CONNECTICUT**

| Requirement | Citation | Status | Synopsis of Requirement | Evaluation/Action to be Taken |
|---|---|---|---|---|
| Hazardous Waste Management: Generator and Handler Requirements | RCSA § 22a-449(c) 100-102 and 104 | Applicable | These sections establish standards for listing, identification, and management of hazardous waste. The standards of 40 CFR 260 to 262 and 264 are incorporated by reference. | Excavated soils were tested for hazardous waste characteristics (i.e., TCLP criteria). Any soils that exceeded applicable limits were managed in accordance with these regulations. Because the remedial action has been completed, this regulation is no longer applicable. |
| Solid Waste Management Regulations | RCSA § 22a-209-1 to 15 | Applicable | These sections establish standards for management of non-hazardous waste. | Excavated soils that were determined to be nonhazardous were managed in accordance with these regulations. Because the remedial action has been completed, this regulation is no longer applicable. |
| Connecticut Water Pollution Control Act | RCSA § 22a - 416 to 599 | Applicable | These regulations govern the treatment and discharge of water into surface water bodies in the State. | Water management was required during soil excavation and the water was discharged to the sanitary sewer system. Testing was done that verified treatment in accordance with these regulations was not required prior to discharge to the POTW. Because the remedial action has been completed, this regulation is no longer applicable. |

**TABLE 5-5**

**CHEMICAL-SPECIFIC ARARs AND TBCs FOR SITE 7 GROUNDWATER**
**SITE 7 – TORPEDO SHOPS**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

**FEDERAL**

| Requirement | Citation | Status | Synopsis of Requirement | Evaluation/Action to Be Taken |
|---|---|---|---|---|
| Cancer Slope Factors (CSFs) | Not Applicable | TBC | These are guidance values used in risk assessment to evaluate the potential carcinogenic hazard caused by exposure to contaminants. | A remedy of land use controls with monitoring is being implemented. The controls will prevent exposure to contaminated groundwater and the monitoring will track contaminant migration and degradation of contaminants until concentrations are below acceptable levels. |
| Reference Doses (RfDs) | Not Applicable | TBC | These are guidance values used in risk assessment to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants. | A remedy of land use controls with monitoring is being implemented. The controls will prevent exposure to contaminated groundwater and the monitoring will track contaminant migration and degradation of contaminants until concentrations are below acceptable levels. |

**STATE OF CONNECTICUT**

| Requirement | Citation | Status | Synopsis of Requirement | Evaluation/Action to Be Taken |
|---|---|---|---|---|
| Remediation Standard Regulations | CGS 22a-133k; RCSA 22a-133k - 1 thru 3 | Applicable | This regulation provides specific numerical cleanup criteria for contaminants in groundwater. Requirements are based on groundwater in the area being classified by the state as GB. | The remedy of land use controls and monitoring complies with ARAR. Land use controls will prevent exposure to and use of contaminated groundwater. Monitoring will track the location, migration, and degradation of contaminants until concentrations are below acceptable levels. |

**TABLE 5-6**

**ACTION-SPECIFIC ARARs AND TBCs FOR SITE 7 GROUNDWATER**
**SITE 7 – TORPEDO SHOPS**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


**FEDERAL**

| Requirement | Citation | Status | Synopsis of Requirement | Evaluation/Action to Be Taken |
|---|---|---|---|---|
| SDWA MCLs | 42 USC 300f et. seq. 40 CFR Parts 141 to 143 | Relevant and Appropriate | MCLs established under this act are health-based limits for certain chemical substances in drinking water. Site groundwater is not a current or planned future drinking water source. However, in the future, the site groundwater could be used as a potable water supply. | A remedy of land use controls with monitoring is being implemented. The controls will prevent exposure to contaminated groundwater and monitoring will track the migration and degradation of contaminants until concentrations are less than acceptable levels. |
| Clean Water Act, Section 403, Pretreatment Regulations | Section 403 | Applicable | General pretreatment requirements for discharge to a publicly-owned treatment works. | Groundwater extracted during groundwater monitoring activities is being tested and disposed off site. Discharge to a publicly-owned treatment works may be considered in the future for disposal of the groundwater and these requirements will be met if it is determined to be applicable. |

**TABLE 5-6**

**ACTION-SPECIFIC ARARs AND TBCs FOR SITE 7 GROUNDWATER**
**SITE 7 – TORPEDO SHOPS**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


**STATE OF CONNECTICUT**

| Requirement | Citation | Status | Synopsis of Requirement | Evaluation/Action to Be Taken |
|---|---|---|---|---|
| Hazardous Waste Management: Generator and Handler Requirements | RCSA § 22a-449(c) 100-101 | Applicable | Connecticut is delegated to administer the Federal Resource Conservation and Recovery Act 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. | Waste generated during the installation of monitoring wells and monitoring activities under the selected alternative was characterized for disposal and determined to be nonhazardous. These requirements are not applicable. |
| Hazardous Waste Management: Treatment, Storage, or Disposal Facility Standards | RCSA § 22a-449(c) 104 | Applicable | These sections establish standards for treatment, storage, and disposal facilities. The standards of 40 CFR 264 are incorporated by reference. | Waste generated during the installation of monitoring wells and monitoring activities under the selected alternative was characterized for disposal and determined to be nonhazardous. These requirements are not applicable. |
| Water Quality Standards | CGS 22a-426 (Connecticut General Statutes) | Applicable | These standards specify Connecticut WQSs, classifications of water of the state, and anti-degradation policies for surface water and groundwater. Groundwater at the site is classified as GB. | A remedy of land use controls with monitoring is being implemented. The controls will prevent exposure to contaminated groundwater and monitoring will track the migration and degradation of contaminants until concentrations are less than acceptable levels. |

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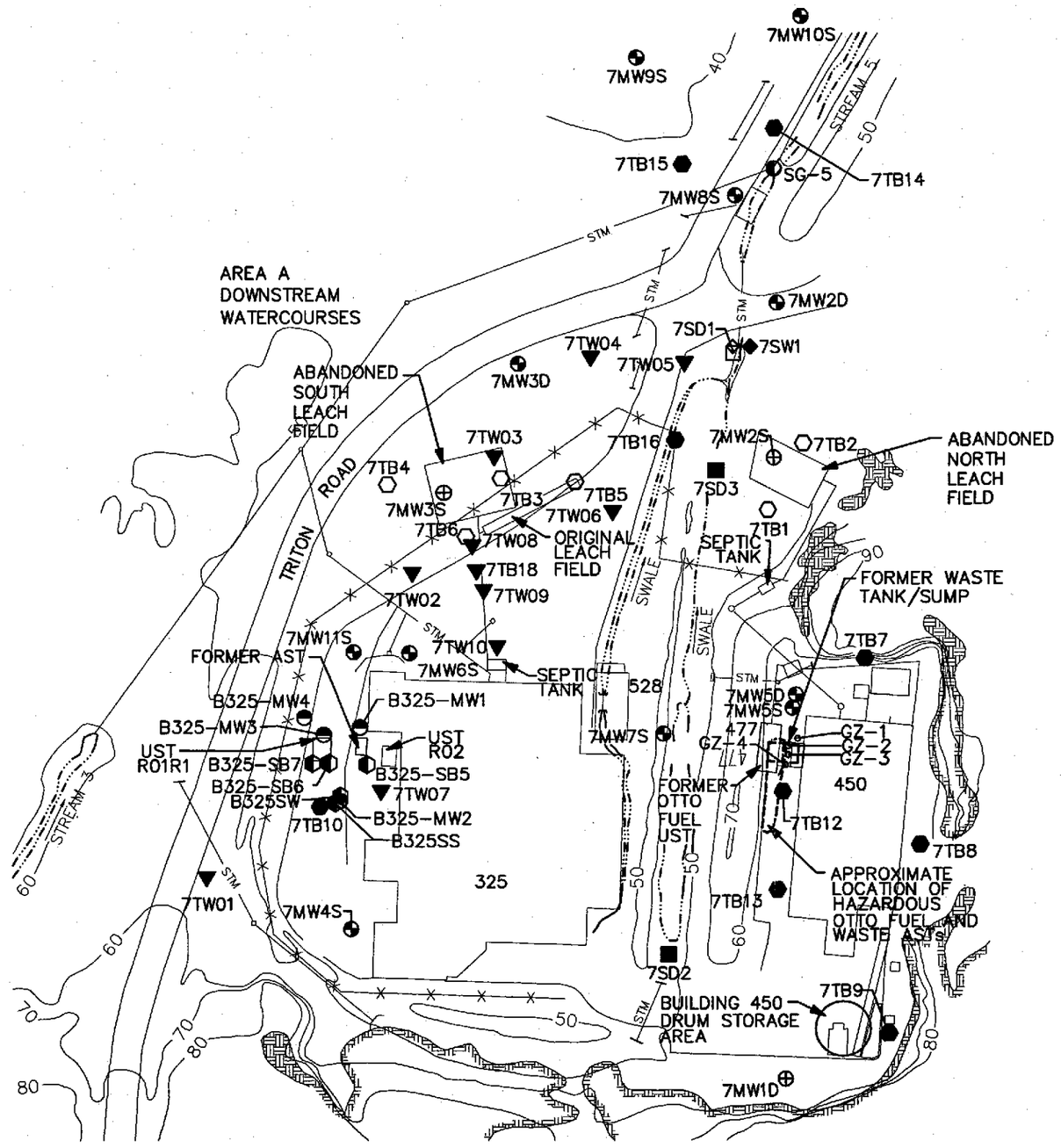



## NOTES

UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE.

## LEGEND

| | |
|---|---|
| ⊕7MW2S | PHASE I RI MONITORING WELL |
| ⊕7MW7S | PHASE II RI MONITORING WELL |
| ⊕B325-MW1 | SITE CHARACTERIZATION MONITORING WELL |
| ⬡7TB1 | PHASE I RI TEST BORING |
| ⬢7TB12 | PHASE II RI TEST BORING |
| ⬢B325-SB6 | SITE CHARACTERIZATION SOIL BORING |
| ◇7SW1 | PHASE I RI SURFACE WATER SAMPLE |
| ◆7SW1 | PHASE II RI SURFACE WATER SAMPLE |
| □7SD1 | PHASE I RI SEDIMENT SAMPLE |
| ■7SD3 | PHASE II RI SEDIMENT SAMPLE |
| ◐SG-5 | PHASE II RI STAFF GAUGE |
| ▼7TB17 | BGOURI TEST BORING LOCATION |
| ▼7TW02 | BGOURI TEMPORARY WELL |
| —10— | TOPOGRAPHIC CONTOUR |
| 123 | BUILDING No. |
| -·····- | WATERCOURSE |
| —STM—□— | STORM SEWER AND CATCH BASIN |
| | EXPOSED BEDROCK |
| ×—× | FENCE |

0 100 200
GRAPHIC SCALE IN FEET

BASE MAP SOURCE: PREPARED BY THE NAVAL SUBMARINE BASE PUBLIC WORKS DEPT., ENGINEERING DIVISION. MARCH 2006, DRAWING NO. A-687.

| | | | |
|---|---|---|---|
| DRAWN BY MF | DATE 5/19/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 7 - TORPEDO SHOPS<br>NSB-NLON<br>GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

| | |
|---|---|
| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAL | DATE 6/7/06 |
| DRAWING NO. FIGURE 5-1 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG – REV 1 – 9/10/98

# 6.0 SITE 8 – GOSS COVE LANDFILL (OU5)

This five-year review of the Site 8 – Goss Cove Landfill is required by statute because hazardous substances, pollutants, or contaminants remain on site that do not allow for unlimited use or unrestricted exposure. A remedial action for the Site 8 soil OU (i.e., installation of an engineered cap system) was completed in June 2001. OU5 includes the soil, sediment, groundwater, and surface water at Site 8. The site has been monitored since the remedial action was completed to assess its effectiveness. As of this second five-year review, groundwater has been monitored quarterly for 4 years, and the landfill cap has been inspected annually for 3 years. Data collected during the monitoring and inspection programs are evaluated within this section.

## 6.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 8 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Landfill operations. | 1946 to 1957 |
| Final IAS completed. | March 1983 |
| Phase I RI completed. | August 1992 |
| Phase II RI finalized. | March 1997 |
| Proposed Plan for soil and sediment issued. | June 1999 |
| Public Meeting conducted. | June 1999 |
| FS for soil and sediment issued. | September 1999 |
| ROD for soil and sediment signed. | September 1999 |
| Remedial Action for soil began. | September 2000 |
| Remedial Design for soil completed. | November 2000 |
| Final GMP for Goss Cove issued. | March 2001 |
| Remedial Action for soil completed. | June 2001 |
| First Five-Year Review Report completed. | December 2001 |
| BGOURI completed. | January 2002 |
| Groundwater Monitoring Program initiated | January 2002 |
| Final RA Report issued. | September 2002 |
| Draft Final O&M Manual - Volumes I, III, IV, and V completed. | September 2002 |
| SOPA (ADMIN) New London Instruction 5090.18B issued. | February 2003 |
| Draft O&M Manual - Volume II completed. | March 2003 |
| Year 1 GMR issued. | August 2003 |
| 2003 Annual LIR issued. | November 2004 |
| Year 2 GMR issued. | December 2004 |
| Year 3 GMR issued. | August 2005 |

| Event | Date |
|---|---|
| 2004 Annual LIR issued. | September 2005 |
| 2005 Annual LIR issued. | October 2005 |
| Final O&M Manual - Volumes I, II, III, IV and V completed. | January 2006 |
| SOPA (ADMIN) New London Instruction 5090-18C issued. | December 2006 |

## 6.2 BACKGROUND

The Goss Cove Landfill (Site 8) is located in the southwestern corner of NSB-NLON, adjacent to the Thames River. It is west of Shark Boulevard and the intersection of Crystal Lake Road and Military Highway, east of the Thames River, and north of Goss Cove. Figure 6-1 displays the general site arrangement. The landfill encompasses approximately 3.5 acres. The Nautilus Museum and a paved parking lot are constructed directly over the site of the former landfill. The Nautilus Museum is a submarine museum operated by the Navy and is open to the public.

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

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

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

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

The Phase II RI was conducted from 1993 to 1995 (B&RE, 1997a). This investigation included the collection of surface and subsurface soil samples from well borings. Surface and subsurface soil samples were also collected from test borings. Shallow and deep monitoring wells were installed. Groundwater samples were collected from Phase I and Phase II monitoring wells during each of two rounds of sampling. Surface water and sediment samples were also collected during the Phase II RI from the perimeter of Goss Cove. Additional sediment sampling was conducted in Goss Cove to perform a supplemental toxicity identification evaluation (TIE). Three rounds of air sampling were performed, with air samples collected from within and around the Nautilus Museum.

Full-time employees, older child trespassers, construction workers, and future residents were evaluated as potential human receptors in the site-specific HHRA completed during the Phase II RI. The results of the risk assessment showed that no unacceptable human health risks are associated with exposure to various media based on exposure to average contaminant concentrations. All estimated Hazard Indices (HIs) for incidental ingestion, inhalation, and dermal contact with contaminated media were less than 1.0. All estimated incremental lifetime cancer risks (ILCRs) for these exposure routes were within the USEPA target risk range and less than the cumulative CTDEP target risk of 1.0E-05. Human health risks were also calculated under conditions involving exposure to maximum contaminant concentrations [i.e., the reasonable maximum exposure (RME) scenario] for all potential human receptors. Estimated HIs for the construction worker, older child trespasser, and future resident exceeded 1.0. Elevated risks for the construction worker were primarily attributable to tetrachloroethene (PCE) in groundwater, and risks for the future resident were primarily attributable to PCBs, arsenic, and antimony in soil. Estimated ILCRs for the full-time employee, older child trespasser, construction worker, and future resident all exceeded Connecticut's cumulative target cancer risk of 1.0E-05. Except for the construction worker, elevated risks were associated with soil ingestion resulting from exposure to PAHs and arsenic. An additional exposure route of concern was dermal contact with groundwater for the construction worker. PCE was the main contributor to the carcinogenic risks for dermal contact with groundwater. Quantitative risks associated with exposure to ambient air at the Nautilus Museum were calculated for a full-time employee under RME conditions only. The estimated HI (0.28) was significantly less than unity for a full-time employee. The

cumulative ILCR (1.0E-05) was within the USEPA acceptable risk range and was equal to the CTDEP target risk value.

Results of the Phase II RI ERA, conducted on samples of surface water and sediments collected in the cove, indicated that several inorganics and organic compounds (i.e., pesticides) were found at concentrations in excess of benchmark values protective of aquatic biota, suggesting that aquatic biota inhabiting the cove could be adversely impacted. In response to the results of the studies conducted during Round I of the Phase II RI, additional sampling was conducted in Goss Cove during the supplemental ecological sampling round. The results indicated that four COCs (aluminum, copper, nickel, and heptachlor) were present in surface water at concentrations that represent a potential risk to aquatic biota. A number of chemicals also had Hazard Quotients (HQs) greater than 1.0, suggesting that benthic macroinvertebrates were potentially at risk. The results of toxicity tests confirmed that chemicals were biologically available in concentrations that could adversely impact aquatic biota. Results of the simultaneous extracted metals/acid volatile sulfide (SEM/AVS) analyses conducted to determine the biological availability of copper, cadmium, nickel, lead, and zinc, demonstrated that these five metals are not biologically available.

A DGI was conducted in January 1997 (B&RE, 1997c) to determine the source of PCE contamination detected in groundwater samples collected during the Phase II RI. The DGI concluded that the source of PCE contamination detected in groundwater is off site and upgradient of the site and is likely a neighboring dry cleaning establishment. The CTDEP conducted a Phase I/II Environmental Site Assessment of the dry cleaners in 1998 (CTDEP, 1999a). The assessment involved interviewing the operator of the dry cleaners and collecting medium-specific samples. The results of the investigation conclusively showed that the dry cleaners released PCE to the environment. This information indicates that the dry cleaner is the source of the PCE detected in downgradient groundwater at the Goss Cove Landfill.

An FS for the soil/waste and sediment at Site 8 (TtNUS, 1999d) was prepared in 1999. Additional investigations conducted as part of the FS are as follows:

- A desktop modeling effort was performed to evaluate the potential for migration of COCs from the former Goss Cove Landfill into Goss Cove. Results of this modeling effort showed that migration of COCs is unlikely to occur in the future.

- A Wetlands Functions and Values Assessment was completed to evaluate if the ecological stress in the Goss Cove water body was a result of natural conditions or due to migration of contaminants from NSB-NLON sites. This study evaluated the marginal cove vegetation in terms of its ecological

functions and values and identified the wetland species associated with the fringing belt. The results of the assessment were that the contrast between the Thames River and cove was dramatic due to the lack of tidal flushing. Although some tidal action occurs within the cove, it does not appear adequate to aid in supporting a rich, viable, intertidal algal population and invertebrate biota. This may be related to water quality because it appears that estuarine organisms can and have become established in the cove in the past but have failed to thrive.

- Because the Phase II RI ERA showed potential risks to ecological receptors from Goss Cove sediment, further investigation and evaluation of the sediment was completed. An Evaluation of Chemical and Toxicological Data study was conducted in 1998 (SAIC, 1998) to evaluate chemical and toxicological relationships for sediments in Goss Cove. The objectives of the study were to establish toxicological response relationships for contaminants in Goss Cove sediments, describe the extent of ecological risks associated with chemical contaminants in Goss Cove sediments, and identify risks for biological effects. Based on data needs, sediment samples from 10 stations were collected and chemical, toxicological, and TIE tests were performed on the samples. The study supported the conclusion that a complete pathway did not exist between contaminants and observed ecological effects. It may be possible to improve benthic habitat quality by reducing the hypoxic conditions in the cove, thereby reducing the ammonia concentrations that appear to cause the depauperate aquatic community.

The investigations showed that the contaminant levels detected in sediment and surface water in Goss Cove did not pose potential adverse risks to human health or the environment. Based on these findings, NFA was recommended for these media. The two remedial alternatives evaluated for the soil/waste in the FS were no action and installation of an engineered control cap (presumptive remedy) with institutional controls and monitoring. The capping alternative was selected for Site 8, and the ROD for this site was signed by the Navy and regulators in September 1999.

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

The BGOURI was completed (TtNUS, 2002a) to further evaluate the potential risks identified in the Phase II RI associated with exposure to groundwater by human receptors. The field work for the BGOURI was completed prior to construction of the engineered cap system. Groundwater samples were collected from existing permanent monitoring wells to further characterize the site. The analytical data from the BGOURI indicate that sources of VOCs, SVOCs, and metals within the fill material are continuing to impact the

shallow groundwater at the site. It is likely that these chemicals are mobile and being transported in the groundwater to the Thames River. However, the results of the HHRA showed that all risks for construction workers exposed to groundwater at Site 8 were less than or within target risk ranges. The BGOURI recommended that the Navy complete the Remedial Action for the soil, implement land use controls, and begin groundwater monitoring in accordance with the Groundwater Monitoring Plan (TtNUS, 2001b) as soon as the action is finalized. It was recommended that the decision for preparation of an FS for groundwater at Site 8 be postponed until site conditions stabilize and trends in groundwater contaminant concentrations are determined based on results of the groundwater monitoring program.

O&M of the cap system at Site 8 is being performed in accordance with the O&M Manual for IR Program Sites (TtNUS, 2006a). The groundwater monitoring program for Site 8 began in 2001 (TtNUS, 2001a) and is ongoing (TtNUS, 2006a). The results of the program are being used to verify the effectiveness of the cap in reducing infiltration and leaching of contaminants and to confirm that contamination is not migrating from soil to groundwater and eventually to the Thames River. A remedy for Site 8 groundwater will be selected in the future.

## 6.3 REMEDIAL ACTIONS

As discussed previously, OU5 includes the soil, sediment, groundwater, and surface water at Site 8.

A ROD (TtNUS, 1999e) was signed for the soil and sediment OU at Site 8. Based on the ROD, a remedial action was required for soil, and no further action was required for sediment. The following sections describe the remedial action for soil at Site 8.

The results of the RI and FS concluded that surface water associated with Site 8 did not pose any unacceptable risks to potential human or ecological receptors. However, no decision document has been prepared to document the NFA decision for the surface water OU. This OU is not addressed in this five-year review.

The groundwater OU at Site 8 is still being investigated under CERCLA, and final recommendations for the OU will be determined when sufficient data has been collected under the groundwater monitoring program.

### 6.3.1 Remedy Selection

Based on ARARs and risk assessment results, the following RAOs were selected for soil at Goss Cove Landfill:

- Protect potential receptors (i.e., full-time employees, construction workers, older child trespassers, and future residents) from exposure to contaminated soil.

- Prevent unacceptable risk to ecological receptors in the Thames River and Goss Cove from potential migration of contaminants.

To meet the RAOs, the presumptive remedy of containment was selected for soil. The basis for use of the presumptive remedy was the guidance document entitled Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills (Interim Guidance) (USEPA, 1996b). The key decision points are as follows:

- Based on the available information for Goss Cove Landfill, the waste/fill is heterogeneous, consisting of ashes, cinders, and inert debris such as glass, brick, wood, etc. The wastes are mainly non-hazardous debris, which can be considered municipal wastes. The contamination mainly consists of PAHs and inorganics that can be attributed to incomplete combustion of fossil fuel and to incinerator ash. The effectiveness of either above-ground treatment for physical separation of the wastes from the fill or in-situ treatment for removal of contaminants is limited because many different treatment processes would be required to address various heterogeneous constituents in the landfill. In addition, due to the large volume of fill material (107,000 cubic yards), such treatment would not be cost effective. As indicated by fate and transport modeling results, the contaminants from the landfill are not currently migrating via the groundwater pathway, and because a majority of the surface of the existing landfill is paved, none of the contaminants are likely to migrate via surface soil erosion.

- The landfill site is currently serving as a museum and a parking lot. The land use in the foreseeable future is expected to remain the same.

- The available historical information suggests that no military munitions were disposed at this landfill.

- The estimated volume of waste/fill, 107,000 cubic yards, exceeds 100,000 cubic yards, which is typically considered to be the limit for an excavation remedy to be suitable.

The selected remedy for the soil and waste/fill material within the Goss Cove Landfill consisted of containment using an engineered control cap, institutional controls, groundwater monitoring, O&M, and five-year reviews. The remedy also included the replacement of a storm sewer system that consisted of three 42-inch-diameter corrugated metal pipes (CMPs) that served the southern portion of NSB-NLON and the Goss Cove Landfill parking lot and surrounding area. The existing storm sewer pipes were

under-sized and in a deteriorated condition. A 4-foot by 10-foot reinforced concrete box culvert was selected for the new storm sewer system.

Under the selected remedy, the grass-covered areas around the Nautilus Museum were to be excavated and handled in accordance with all applicable environmental laws and regulations. If visual evidence or instrument readings indicated that hazardous constituents may be present, the soil was to be tested for hazardous characteristics. The excavated soil was to be spread over the landfill and compacted. The excavated area was to be backfilled and capped by the placement of a soil-type multi-layered cap consisting of the following components in ascending order: (1) a geonet gas collection layer, (2) a synthetic membrane with a maximum permeability of $10^{-6}$ centimeters/second (cm/sec), (3) coarse sand for drainage, (4) a geotextile layer for separation, (5) a layer of fill as a root-penetration zone, and (6) a layer of top soil cover with vegetation. The grass islands in the parking lot were also to be capped with a similar multi-layered soil-type cap overlying the compacted layer of waste.

An asphalt-type multi-layered cap was to be placed over compacted waste in paved areas. The cap was to consist of the following components in ascending order: (1) a geonet gas collection layer, (2) a synthetic membrane having a maximum permeability of $10^{-6}$ cm/sec, (3) a layer of coarse sand for drainage, (4) a geotextile layer for separation, (5) a layer of gravel sub-base, and (6) a layer of asphalt paving material. The geonet gas layer, geomembrane layer, drainage layer, and the bottom geotextile layer were to be common throughout the parking lot, including in the grass islands.

Institutional controls were to be recorded in the Base IR Instruction to restrict or control future activities at the site so that potential receptors are not adversely affected. If the Navy leases or transfers title to the property, thereby creating a lease or deed, restrictions will be included in the transfer document to notify future owners of the risk of potential exposure to the contaminants under the cap and the prohibitions on residential development or disruption of the cap. In addition, Environmental Land Use Restrictions (ELURs) would be recorded on the property according to applicable State and local requirements.

Periodic maintenance of the cap was to be performed under the selected remedy. Appropriate material components were to be included in the design of the asphalt layers to reduce the extent of reflective cracking and to minimize maintenance of the asphalt-type cap. Maintenance of the soil-type cap was to include care for the vegetation on the soil cover. Periodic grading and drainage maintenance were to be completed for both types of caps.

Finally, long-term monitoring of groundwater was to be conducted as part of the selected remedy to ensure that contaminant migration is not occurring. Five-year site reviews of the remedy were also to be completed because wastes will remain on site.

### 6.3.2 Remedy Implementation

The Remedial Design for soil at Goss Cove Landfill began in October 1999. Additional field work (i.e., field survey, geotechnical field investigation, and geotechnical laboratory testing program) was conducted to collect the necessary data to complete the design. The remedial design was completed in phases (e.g., 30%, 100%, and bidding document). The Remedial Design for the Goss Cove Landfill was finalized in November 2000 (TtNUS, 2000b). Based on comments received from the USEPA and normal refinement of details during the design, the cap components included in the final design were slightly different than the components presented in the ROD. A comparison of the components is provided below.

**Grass-Covered Areas**

| Cap Components in ROD | Cap Components in Final Design |
|---|---|
| • Geonet gas collection layer | • Gas management layer (6-inch-thick select waste/fill and 24-ounce/square yard non-woven geotextile) |
| • Synthetic membrane (maximum permeability of $10^{-6}$ cm/sec) | • 60-mil smooth linear low-density polyethylene (LLDPE) geomembrane |
| • Coarse sand drainage layer | • Geosynthetic drainage layer (geonet with non-woven geotextile on either side) |
| • Geotextile layer | • 12-inch-thick sub-base layer |
| • Layer of fill as a root-penetration zone | • Non-woven geotextile |
| • Layer of topsoil cover with vegetation | • 6-inch-thick base course layer |
| | • Non-woven geotextile |
| | • 6-inch-thick select fill material layer |
| | • 6-inch-thick vegetative cover layer |

**Asphalt-Covered Areas**

| Cap Components in ROD | Cap Components in Final Design |
|---|---|
| • Geonet gas collection layer | • Gas management layer |
| • Synthetic membrane (maximum permeability of $10^{-6}$ cm/sec) | • 60-mil smooth LLDPE geomembrane |
| • Coarse sand drainage layer | • Geosynthetic drainage layer |
| • Geotextile layer | • 12-inch-thick sub-base layer |
| • Gravel sub-base layer | • Woven geotextile |
| • Asphalt paving material layer | • 6-inch-thick base course layer |
| | • 3-inch-bituminous concrete surface layer |

The Navy's RAC began preliminary construction activities at the site in September 2000. The RAC completed installation of the new storm sewer system and the engineered cap system in June 2001. The

final report for the remedial action at Goss Cove Landfill was completed in 2002 (FWEC, 2002c) and includes construction details and QA/QC procedures. Some of the changes that occurred during installation of the cap and storm sewer system included changes to the supports (piles) for the box culvert, modifications to the limits of the cap system, and changes to the landscaping (sprinkler system).

To ensure the quality of the remedial action, QC testing and inspection were completed during the remedial action in accordance with the CQC Plan. One non-conformance was noted during the QC testing and inspection (i.e., the compressive strength of grout used in four pipe piles for the box culvert did not meet the required 5,000 pounds per square inch strength). Further analysis indicated that the compressive strength of the installed grout was sufficient to support the box culvert.

The Navy's cost estimate for implementation of the remedial design was approximately $3,300,000. The approximate total cost of the remedial action was $5,450,000. The changes in cost were associated with modifications to the storm sewer system, accelerated work schedules, and landscaping.

Other components of the remedial action, including long-term monitoring and O&M, are discussed in Section 6.3.3.

To meet the land use control requirements in the ROD, the Navy prepared and implemented an instruction to restrict use at IR sites at NSB-NLON. The instruction was updated to include the Goss Cove Landfill and was reissued in 2003 [SOPA (ADMIN) New London Instruction 5090.18B, (Navy, 2003)]. The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information for Site 2 - Area A Landfill. The instruction defines the Navy's policy regarding ground surface disturbance of soils and any subsurface disturbance of soils and/or groundwater at IR sites.

### 6.3.3 System Operations/Operation and Maintenance

#### 6.3.3.1 Monitoring Program

The results of the groundwater monitoring program are being used to assess the effectiveness of the remedial action. Sampling was completed at the site in accordance with the final Groundwater Monitoring Plan for Goss Cove Landfill (TtNUS, 2001a) from the initiation of the program in January 2002 through 2005. Future sampling activities at the site will be conducted in accordance with Volume II – Groundwater Monitoring Plan of the O&M Manual (TtNUS, 2006a).

Monitoring at the Goss Cove Landfill was conducted quarterly for the first 4 years (2002 through 2005). Groundwater samples were collected at low tide to ensure that groundwater is discharging to the Thames

River. A tidal study was performed to determine optimum sampling times. The samples were analyzed for Target Compound List (TCL) VOCs, SVOCs, and pesticides/PCBs, PAHs, total and dissolved TAL metals, anions (sulfate and nitrate), and hardness. Field measurements of temperature, pH, specific conductance, dissolved oxygen, ORP, turbidity, and ferrous iron were also taken during each monitoring round. Samples collected under the new monitoring program will be analyzed for the same suite of parameters with the exception of ferrous iron, which was eliminated from the program.

Three annual reports (TtNUS, 2003c; ECC, 2004g; and ECC, 2005h) have been issued that summarize the results of the monitoring program. The annual reports include a thorough evaluation of each year of data collected under the program. Numerous round-specific reports have also been prepared to document the results of the monitoring program. The round-specific reports provide a brief screening-level assessment of the sampling round data. All of the monitoring reports have been submitted to the USEPA and CTDEP for review and comment. The results of the monitoring program during this five-year review period are discussed in Section 6.5.2.1.

#### 6.3.3.2 Operation and Maintenance

The Navy issued a draft O&M Manual for the IR Program Sites at NSB-NLON, which included Goss Cove Landfill, in September 2002 (TtNUS, 2002c). Volume V of the five-volume manual included site-specific instructions for O&M activities and an inspection checklist for the Goss Cove Landfill. Due to an extended comment resolution period, O&M inspections of the Goss Cove Landfill were conducted from 2003 through 2005 (3 years) based on the draft O&M Manual. The O&M Manual was finalized in 2006 (TtNUS, 2006a), and it will provide the basis for future O&M activities at Goss Cove Landfill.

The O&M process for the site includes annual inspections, reporting of results, and correcting any identified problems. The findings of the inspections are documented in the field on inspection checklists and then summarized in Annual LIRs (ECC, 2004d; ECC, 2005k; and ECC, 2005o). The inspections of the landfill focus on institutional controls, landscaping features, cap areas, stormwater features, and maintenance. Deficiencies noted during the inspections are addressed through the preparation of a Plan of Action and then executing the Plan of Action. Typically, the inspections are conducted in the fall, and corrective actions are completed during the following summer. The results of three inspections conducted during this five-year review period are discussed in Section 6.5.2.2.

## 6.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of the Goss Cove Landfill. The recommendations from the First Five-Year Review Report (TtNUS, 2001c) are provided below along with the actions taken to address the recommendations.

Complete preparation of the Final Report for the Remedial Action at Goss Cove Landfill.

- The Remedial Action was completed in June 2001, and the Final Report for the Remedial Action was completed in September 2002.

Implement the Groundwater Monitoring Plan and prepare an appropriate decision document for the groundwater OU when sufficient data has been collected.

- The Final GMP was issued in March 2001, and the monitoring program was initiated in January 2002. Sampling was conducted through 2005 following the GMP. A new GMP, Volume II of the O&M Manual (TtNUS, 2006a), was prepared and issued in 2006. Future sampling will be conducted following the new GMP. By comparing the original GMP to the new plan the following changes were noted; well 8MW8S was replaced by well 8MW10S (This change was made during the Round 1 sampling effort because well 8MW8S was dry; however, the GMP was never updated), sample time adjustments have been determined relative to high and low tides, and ferrous iron was eliminated from the analyte list.

Prepare an NFA Decision Document for the surface water OU.

- An NFA Decision Document has not been prepared for the surface water OU. The Navy will prepare a decision document for the groundwater and surface water OUs at the Goss Cove Landfill after sufficient data have been collected under the groundwater monitoring program. It is anticipated that the decision document will be prepared in 2007.

Prepare and implement an O&M plan.

- A draft O&M Manual for the IR Program Sites at NSB-NLON, which included Goss Cove Landfill, was issued on September 2002. Due to an extended comment resolution period, O&M activities were conducted from 2003 through 2005 (3 years) based on the draft O&M Manual. The O&M Manual was finalized in 2006 and will provide the basis for future O&M activities at Goss Cove Landfill.

- The deficiencies noted during O&M inspections of Site 8 included problems with the perimeter fencing, deteriorated concrete curbing and submarine display support, and damage to several monitoring well road boxes. The actions taken to address the deficiencies were as follows:

- Museum staff replaced missing screen ties and a tension wire on the fence in November 2003. They also removed vegetation growing in the fence and adjusted and secured a mangate located along the western side.
- Repairs were made to several monitoring well road boxes in July 2005.

Continued enforcement of New London Instruction 5090.18.

- The instruction was updated (5090.18B) to include the Goss Cove Landfill and was reissued in 2003. The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information for Site 2A - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON.

- The instruction has been followed by personnel at NSB-NLON, and no disturbances of the soil or cap at the Goss Cove Landfill have occurred since placement of the cap.

## 6.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 6.5.1 Document Review

The documents reviewed for the second five-year review are listed below, and key information obtained from the documents is summarized in the following sections.

| | |
|---|---|
| GMP for Goss Cove Landfill | March 2001 |
| BGOURI | January 2002 |
| Final Remedial Action Report | September 2002 |
| Year 1 GMR | August 2003 |
| 2003 Annual LIR | November 2004 |
| Year 2 GMR I | December 2004 |
| Site Management Plan for NSB-NLON | December 2004 |
| Year 3 GMR | August 2005 |
| 2004 Annual LIR | September 2005 |
| 2005 Annual LIR | October 2005 |
| Final O&M Manual - Volumes I, II, and V | January 2006 |
| SOPA (ADMIN) New London Instruction 5090.18C | December 2006 |

### 6.5.2 Data Review

#### 6.5.2.1 Monitoring Data Review

Groundwater monitoring is being conducted as part of post-closure activities associated with Site 8 to evaluate the effectiveness of the remedial action. The monitoring program was designed to determine the following:

- The effectiveness of the remedial action in preventing the migration of COPCs at concentrations greater than monitoring criteria to underlying groundwater and surface water in the nearby cove and Thames River.
- The effectiveness of the remedial action in eliminating health risks.
- Whether the criteria used for evaluating the data have been met.
- Whether a groundwater plume exists and/or interferes with any existing use of groundwater.

The ultimate goal of the monitoring program is to show compliance with the selected monitoring criteria for those COPCs migrating or having the potential to migrate from the site. The criteria used to screen the data are a combination of site-specific and CTDEP SWPC, CTDEP volatilization criteria, federal AWQC, Connecticut WQSs, and background concentrations.

Data from Years 1 through 4 of the monitoring program are presented and evaluated in this Second Five-Year Review Report.

Year 1

Four quarterly rounds of sampling (Rounds 1, 2, 3, and 4) were conducted during 2002 (Year 1). Figure 6-2 shows groundwater data that exceeded criteria (primary and secondary) during Year 1 of the monitoring program.

The results obtained during Rounds 1 through 4 for shallow downgradient wells indicated that five analytes [benzo(a)anthracene, phenanthrene, total and dissolved arsenic, and total lead] exceeded the primary monitoring criteria and site-specific background concentrations where applicable. Temporal plots for benzo(a)anthracene, total and dissolved arsenic, and total lead did not show any significant increasing trends in concentrations of COPCs when compared to upgradient concentrations. Shallow downgradient wells 8MW2S and 8MW3 had phenanthrene concentrations that exceeded upgradient well concentrations and concentrations in the other downgradient wells (shallow and deep) increased over time.

The results obtained during Rounds 1 through 4 for deep downgradient wells indicated that 12 analytes [benzo(a)anthracene, benzo(a)pyrene benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, phenanthrene, total and dissolved arsenic, total lead and total zinc] exceeded primary monitoring criteria and site-specific background concentrations when applicable. Temporal plots did not show any significant increasing trends in concentrations of COPCs when compared to upgradient concentrations. SVOCs and total zinc concentrations spiked during Rounds 1 and 2, but dropped thereafter.

Several COPCs are present at greater levels in upgradient wells than in downgradient wells. Those COPCs included PCE, total xylenes, BEHP, dissolved mercury, and dissolved zinc. The PCE contamination has been identified as originating from a neighboring dry cleaning establishment (B&RE, 1997b and CTDEP, 1999).

Year 2

Four quarterly rounds of sampling (Rounds 5, 6, 7, and 8) were conducted during 2003 (Year 2). Figure 6-3 shows groundwater data that exceeded criteria (primary and secondary) during Year 2 of the monitoring program.

The results obtained during Rounds 5 through 8 for shallow downgradient wells indicated that 15 analytes [4,4'-DDD, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, phenanthrene, total and dissolved arsenic, total lead, total and dissolved copper, and total mercury] were detected in shallow downgradient wells at concentrations that exceeded the monitoring criteria. A statistical analysis of upgradient and downgradient results indicated that there are 10 COPCs (total xylenes, benzo(b)fluoranthene, carbazole, fluoranthene, phenanthrene, pyrene, total and dissolved arsenic, total lead, and total mercury) with shallow downgradient concentrations that were statistically greater than upgradient concentrations. Of these 10 COPCs, four (phenanthrene, total arsenic, dissolved arsenic, and total lead) were detected at concentrations greater than primary criteria, two [benzo(a)fluoranthene and total mercury] were detected at concentrations greater than secondary criteria, and four (total xylenes, carbazole, fluoranthene, and pyrene) were detected at concentrations less than both criteria.

The results obtained during Rounds 5 through 8 for deep downgradient wells indicated that five analytes (PCE, chrysene, phenanthrene, and total and dissolved arsenic) were detected in deep downgradient wells at concentrations greater than monitoring criteria. Seven COPCs (total xylenes, chrysene, fluoranthene, phenanthrene, pyrene, total arsenic, and dissolved arsenic) were determined to have deep downgradient results statistically greater than upgradient concentrations. Of these seven COPCs, three (phenanthrene, total arsenic, and dissolved arsenic) were detected at concentrations greater than primary

criteria, one (chrysene) was detected at concentrations greater than secondary criterion, and three (total xylenes, fluoranthene, and pyrene) were detected at concentrations less than both criteria.

Temporal plots were generated for the six COPCs (PCE, phenanthrene, total and dissolved arsenic, and total and dissolved copper) that were detected at concentrations greater than primary monitoring criteria to evaluate contaminant trends. In general, the plots did not indicate significant increases in concentration over the first 2 years of monitoring. PCE concentrations appeared to be stable and attributable to a former neighboring dry cleaning facility. Phenanthrene concentrations have spiked several times, but a general trend is not pronounced. Plots of concentrations of metals in shallow downgradient wells appear to show a slightly increasing trend. Conversely, metals concentrations in deep downgradient wells appears to be decreasing significantly.

Year 3

Four quarterly rounds of sampling (Rounds 9, 10, 11, and 12) were conducted during 2004 (Year 3). Figure 6-4 shows groundwater data that exceeded criteria during Year 3 of the monitoring program. The criteria used to evaluate the monitoring data were changed after Round 11 from the criteria in the GMP (TtNUS, 2001) to the criteria in the draft O&M Manual (TtNUS, 2003). The change in criteria significantly reduced the amount of PAHs identified as COPCs in Round 12.

The results obtained during Rounds 9 through 12 for shallow downgradient wells indicated that 15 analytes [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, total antimony, total and dissolved arsenic, total and dissolved copper, and total mercury] were detected in shallow downgradient wells at concentrations that exceeded monitoring criteria. Statistical analysis of the exceedances indicated that shallow downgradient results were statistically higher than upgradient results for two COPCs (fluoranthene and dissolved arsenic). Of these, one COPC (fluoranthene) exceeded the secondary monitoring criterion but was less than the primary monitoring criterion, and one COPC, dissolved arsenic, had concentrations that exceeded both of the respective monitoring criteria. Total antimony was detected at levels greater than the background concentration but less than primary and secondary criteria.

The results obtained during Rounds 9 through 12 for deep downgradient wells indicated that 10 analytes [benzo(a)anthracene, chrysene, phenanthrene, total and dissolved arsenic, total copper, total lead, total nickel, and total and dissolved zinc) were detected in deep downgradient wells at concentrations greater than monitoring criteria. Statistical analysis of the exceedances indicated that deep downgradient results were statistically greater than upgradient results for three COPCs (total arsenic, dissolved arsenic, and dissolved zinc). Of these, one COPC (dissolved zinc) exceeded the secondary monitoring criterion but

was less than the primary monitoring criterion, and total and dissolved arsenic had concentrations that exceeded both of the respective monitoring criteria.

In general, trend plots do not indicate significant increases in concentrations over the first 3 years of monitoring. PCE concentrations appear to be stabilized and have been attributed to a former neighboring dry cleaning facility (CTDEP, 1999). Arsenic concentrations in shallow downgradient wells appear to be increasing slightly. Plots of arsenic concentrations in deep downgradient wells appear to be decreasing.

Year 4

Four quarterly rounds of sampling (Rounds 13, 14, 15, and 16) were conducted during 2005 (Year 4). The final results for all Year 4 sampling rounds were not available at the time this report was prepared. Figure 6-5 is a tag map that shows groundwater data that exceeded criteria during Rounds 13 and 14 of the monitoring program (ECC, 2005l; ECC 2006c). Additional information regarding the Year 4 monitoring results will be presented in the next five-year review.

#### 6.5.2.2 O&M Data Review

Inspections are being conducted as part of post-closure O&M activities associated with Site 8. The goal of the inspections is to determine if appropriate O&M is being performed to maintain the effectiveness of the remedial action. As indicated in the table below, three inspections have been performed at Site 8 since the cap system was installed. All of the inspections were performed during the period being evaluated in this second five-year review. The findings of the annual inspections are summarized below.

| Year | Date of Initial Inspection | Date of Supplemental Inspection | Final Report Date |
|---|---|---|---|
| 2003 | June 4, 2003 | November 4, 2003 | November 2004 |
| 2004 | December 29,2004 | April 26, 2005 | September 2005 |
| 2005 | October 11, 2005 | NA | October 2005 |

NA – Not Applicable

2003

A copy of the completed 2003 Inspection Checklist for Goss Cove Landfill is provided in Appendix A. The inspection showed that the landfill was in very good condition due to proper maintenance and upkeep, was functioning as designed, and was meeting the long-term remedial objectives. The inspection identified the following minor deficiencies:

- Several fencing locations were missing screen ties or had loose or missing upper tension wire.
- Vegetation growing in the perimeter fence.
- Locations of damaged concrete curbing (northeastern portion of the parking lot) and spauling concrete (southwest submarine display).
- Invasive weeds in grassed areas.
- Debris in the floating debris boom around the box culvert discharge.
- Misaligned or dragging gates in perimeter fencing.

A Plan of Action was prepared to document the steps to be taken to address the identified deficiencies. Corrective actions were implemented to address the deficiencies and are discussed in Section 6.4. The corrective actions were implemented by November 2003. Corrective actions included replacing missing screen ties and tension wire and debris and weed removal. Concrete repair would be for aesthetic purposes only, and gates are functional.

<u>2004</u>

A copy of the completed 2004 Inspection Checklist for Goss Cove Landfill is provided in Appendix A. The inspection showed that the landfill was in very good condition due to proper maintenance and upkeep, was functioning as designed and meeting the long-term remedial objectives. The inspection identified the following minor deficiencies:

- Several fencing locations were missing screen ties or loose or missing upper tension wire.
- Vegetation growing in the perimeter fence.
- Locations of damaged concrete curbing (northeastern portion of parking lot) and spauling concrete (southwest submarine display).
- Misaligned or dragging gates in perimeter fencing.
- The covers for several well road boxes are unable to be secured due to damage and/or missing bolts, likely due to snow plowing.

A Plan of Action was prepared to document the steps to be taken to address the identified deficiencies. Fence repairs were performed by the museum staff, and the museum staff was notified regarding the spauling concrete on a display. Gates are functional. Road boxes for 8MW2S, 8MW2D, and 8MW6D were replaced in July 2005.

In addition, a video inspection of the Goss Cove box culvert was performed on August 6, 2004 by Universal Inspection Services. The video inspection concluded that the culvert appeared to be in overall good condition (ECC, 2005e).

2005

A copy of the completed 2005 Inspection Checklist for Goss Cove Landfill is provided in Appendix A. The inspection showed that the landfill was in very good condition due to proper maintenance and upkeep, was functioning as designed, and was meeting the long-term remedial objectives. The inspection identified the following minor deficiencies:

- The concrete circular pad near the Missile Hatch Display presents a tripping hazard.
- Irrigation system pipes and sprinkler heads are exposed and damaged.
- Sediment has accumulated in catch basins, and leaf litter and grass has accumulated in yard drains.
- Well 8MW10S is buried under loam; well 8MW9S is in a depression in the road; well 8MW1S is missing one bolt (broken box); and well 8MW4 is missing both bolts (broken box).
- All gas vents need screens, Gas Vents L and M need gate locks, and there is invasive vegetation on the Gas Vent M enclosure fencing.

A Plan of Action was prepared to document the steps to be taken to address the identified deficiencies. It is expected that the corrective actions will be implemented during the summer of 2006.

### 6.5.3 ARAR and Site-Specific Action Level Changes

The remedial action implemented for soil at the Goss Cove Landfill includes an engineered cap system, land use controls, groundwater monitoring, and O&M. ARARs and TBCs were reviewed to determine whether there have been changes since the Remedial Design Report and final Groundwater Monitoring Plan were issued. Listings of chemical-specific, location-specific, and action-specific ARARs, advisories and guidance (TBCs) that were considered in the ROD are listed in Tables 6-1, 6-2, and 6-3, respectively. With the exception of monitoring criteria, the ARARs have not been amended since the remedial design and final Groundwater Monitoring Plan. Changes associated with monitoring criteria are addressed in the response to Question 2 of Section 6.6.

Investigations/assessments showed that contaminant levels detected in sediment and surface water in Goss Cove did not pose potential adverse risks to ecological receptors. Site soils were capped, which eliminated the exposure pathway to ecological receptors. Therefore, any changes in the ecological soil screening values would not impact the effectiveness of the remedial action.

### 6.5.4 Site Inspection

The Goss Cove Landfill was inspected on April 3 and 4, 2006. The focus of the inspection was on the engineered cap system installed over the Goss Cove Landfill. TtNUS did a preliminary inspection of the site on April 3, 2006 when weather conditions were sunny and pleasant. Weather conditions during the inspection on April 4, 2006 were cold (mid-40s), overcast, and windy. Representatives from the Navy, USEPA, CTDEP, TtNUS, ECC, and Gannett Fleming participated in the inspection on April 4, 2006. Photographs taken of site features during the inspection are provided in Appendix B. The site inspection checklist completed during the inspection is provided in Appendix C.

The site inspection included visual observations of the current condition of the engineered landfill cap system at Site 8. During the site inspection, the team found that the land use for the site has remained unchanged since the remedial action. The Navy has continued to use the area for public vehicle parking. Signs were noticed during the inspection at the entrances to the site, warning that access is only for authorized users and personnel should not dig at the site. In general, the site inspection found that the cap system was working as intended, and that overall, the site is in very good condition. The Navy has implemented an O&M program for Site 8 and corrective actions have been taken to correct the problems that were identified. Minor items were identified during the site inspection that should be addressed but they should not affect the long-term performance of the cap system. These items are noted in the site inspection checklist provided in Appendix C. The items and their potential long-term impacts on the cap system are summarized as follows:

- The gas vents do not have screens on them. The screens will prevent habitation of animals in the vents and prevent unwanted material (e.g., trash) from being deposited in them. The two gas vents that have gates require gate locks.

- The sprinkler system is exposed and is in disrepair. It should be determined whether or not the sprinkler system is used. If used, the sprinkler system should be repaired.

- The road box cover for well 8MW5S is missing a bolt. The road box cover/bolt should be replaced so the well can be secured.

- New internal locking style caps should be installed on all wells.

- Well 8MW10S is buried under loam and needs to be located and/or replaced. Well 8MW9S is located in a depression in the road and should be repaired or abandoned as appropriate.

- Cleanup of vegetation and drain debris is needed.

- The hazardous material storage cabinets in the northern storage area are not kept locked. To prevent unauthorized use or accidents, they should be locked when not being used.

- No signs are posted at the entrance of Site 8 that warn that a cap is in place and no digging is allowed.

### 6.5.5 Site Interviews

No official interviews were conducted as part of the second five-year review. Relevant discussions with the inspection team regarding the site included the following:

- A video inspection or other inspection of the drain pipes leading to the box culvert.
- Permanganate injection treatments have been performed by others at the former Fusconi Dry Cleaners to treat PCE. Soil and groundwater monitoring are ongoing to determine the success of injections. The CTDEP will provide additional progress reports and data to the Navy in the future.

## 6.6 ASSESSMENT

The following conclusions support the determination that the remedy for the Goss Cove Landfill is currently protective of human health and the environment.

***Question 1. Is the remedy functioning as intended by the decision documents?***

- ***Remedial Action Performance:*** An engineered landfill cap system was installed at the Goss Cove Landfill and is currently effective in limiting direct exposure to contaminated soil and minimizing contaminant migration from the site. A groundwater monitoring program is being conducted to evaluate the cap's performance regarding minimizing contaminant migration. The data do not indicate any significant contaminant migration concerns related to the landfill; however, significant contamination (PCE) appears to be migrating on site from an upgradient, off-base source. The CTDEP is addressing the source area of the PCE contamination. They completed injection of an in-situ chemical oxidation agent (permanganate) into the source area and are currently monitoring soil and groundwater concentrations. If future groundwater data from the Goss Cove Landfill indicate the need to evaluate additional remedial actions at some point in the future, the Navy will perform the

evaluation at that time. O&M of the cap system began in 2003, and annual maintenance is being performed to maintain proper long-term performance of the cap system.

- ***System Operations/O&M:*** Installation of the engineered cap system was completed in June 2001. An O&M Manual was developed in 2003, and an O&M program was implemented the same year. The cap system is still functioning as intended, and O&M of the cap system is being performed annually at the site. The items noted in Section 6.5.4 should be addressed to improve the O&M of the site.

  Actual costs for the monitoring program have ranged from approximately $168,600 per year to $191,700 per year (see table below). These costs include the costs associated with sampling, analysis, validation, and reporting. Costs associated with preparing and updating the Monitoring Plan and maintaining the groundwater monitoring wells are not included in the costs.

| Source | Cost of Monitoring |
|---|---|
| Projected Annual Cost in ROD | $20,000 |
| Actual Year 1 Cost (2002) | $173,300 |
| Actual Year 2 Cost (2003) | $168,600 |
| Actual Year 3 Cost (2004) | $174,100 |
| Actual Year 4 Cost (2005) | $191,700 |

  O&M of the cap system began in 2003, and costs have ranged from approximately $13,100 to $21,000 per year (see table below). Costs have fluctuated due to the amount of maintenance required and the amount of funding available. The annual O&M costs include the costs for landfill inspections, reporting, and maintenance.

| Source | Cost of O&M |
|---|---|
| Projected Annual Cost in ROD | $7,400 per year plus $21,500 every 5 years for five-year reviews |
| Actual Year 1 Cost (2003) | $13,100 |
| Actual Year 2 Cost (2004) | $20,300 |
| Actual Year 3 Cost (2005) | $21,000 |

- ***Opportunities for Optimization:*** The sampling frequency of the monitoring program has been quarterly for 4 years. The monitoring results have generally been consistent over the 4 years, and sufficient baseline data have been collected to characterize the site. Therefore, the monitoring frequency should be reduced to annually. In addition, the monitoring results have shown that

pesticides and PCBs are not a significant concern in the groundwater at Site 8; consequently, these parameters should be eliminated from the analytical program.

- ***Early Indicators of Potential Remedy Failure:*** Minor deficiencies were noted during the O&M inspections of the cap system. The deficiencies do not compromise the protectiveness of the remedy, and it is unlikely that they would contribute to remedy failure in the future.

- ***Implementation of Institutional Controls and Other Measures:*** Institutional controls associated with the Goss Cove Landfill are being implemented in accordance with New London Instruction 5090.18C. Fencing is in place around the site. These controls meet the intent of the Access Restriction RAO. However, signs are not posted at the entrance of Site 8 that warn a cap is in place and no digging is allowed.

***Question 2. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?***

- ***Changes in Standards and TBCs***: ARARs and TBCs considered during preparation of the ROD were reviewed to determine changes since the remedial design and Final Groundwater Monitoring Plan were issued. As presented in Section 6.5.3 there have been no changes to currently relevant ARARs with the exception of monitoring criteria.

  The primary monitoring criteria for the Goss Cove Landfill are site-specific SWPC and CTDEP SWPC. As discussed in Section 1.4, the CTDEP SWPC were updated in April 1999 and the SWPC for the COCs at the Goss Cove Landfill were updated in 2006 (Table 6-4). The secondary monitoring criteria for the Goss Cove Landfill are the lesser of the federal AWQC and the Connecticut WQSs. The federal AWQC were last updated in 2006, and the Connecticut WQSs were last updated in December 2002. A comparison of the old and new secondary criteria is presented in Table 6-5. The changes in the AWQC and WQS do not impact the protectiveness of the remedy.

- ***Changes in Exposure Pathways:*** There have been no changes at the site that would have resulted in new exposure pathways to human or ecological receptors.

- ***Changes in Toxicity and Other Contaminant Characteristics:*** There have been no changes in human health toxicity criteria that would impact the primary or secondary monitoring criteria.

- ***Changes in Risk Assessment Methods:*** As discussed in Section 1.4, there have been no major changes in HHRA methodology since the signing of the ROD that would impact the protectiveness of the remedy.

- ***Expected Progress Towards Meeting RAOs:*** The RAOs for the soil at Goss Cove Landfill were met by installing and maintaining the engineered cap and conducting groundwater monitoring. RAOs for the groundwater at Goss Cove Landfill will be defined in the future.

***Question 3. Has any other information come to light that could call into question the protectiveness of the remedy?***

No additional information has been identified that would call into question the protectiveness of the remedy.

## 6.7 ISSUES

A few minor O&M deficiencies were noted during the five-year review site inspection that should be resolved. The deficiencies are presented in Sections 6.5.4 and summarized in Table 6-6.

## 6.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Based on the results of the site inspection and review, the following recommendations are made for Site 8.

- Continue O&M of the site and address the O&M deficiencies noted in Sections 6.5.2.2, 6.5.4, and 6.7 (e.g., repair damaged road boxes found at wells 8MW1 and 8MW4 and extend well 8MW10S to the ground surface or install a replacement well).

- Install screens on every gas vent and add a lock on the gates at Gas Vents M and L.

- Continue the groundwater monitoring program, but reduce the sampling frequency to annually and optimize the analytical parameter list, as appropriate. Develop and implement a well abandonment program to eliminate wells that are no longer required for the monitoring program (e.g., 8MW4S, 8MW8S, and 8MW9S).

- Conduct an inspection of the drains leading into the box culvert (video or by other means).

- Select an appropriate remedial action for the groundwater OU and document the remedy in a Proposed Plan and ROD.

- Continue enforcement of New London Instruction 5090.18C and add signs to the entrance gate that warn about the cap and the restrictions on digging at the site.

- At least yearly monitoring of Institutional Control compliance with the monitoring reports incorporated into future five-year reviews.

- Amend O&M Manual to remove federal AWQC.

Follow-up actions should be completed by the Navy in a timely manner to address the recommendations.

## 6.9 PROTECTIVENESS STATEMENT

The remedy at the Goss Cove Landfill is currently protective of human health and the environment. The source of contamination is contained. The engineered cap system minimizes infiltration and subsequent contaminant migration and prevents direct contact with soil. A groundwater monitoring program is being implemented to verify that the cap is performing as designed, and the results of the program suggest that the cap is performing as planned. Continued implementation of land use controls and O&M will maintain the effectiveness of the remedy into the future

**TABLE 6-1**

**CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 8 - GOSS COVE LANDFILL**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

| Requirement | Citation | Status | Requirement Synopsis | Current Status / Applicability |
|---|---|---|---|---|
| **FEDERAL** | | | | |
| EPA Human Health Cancer Slope Factors (CSFs) | NA | TBC | CSFs are guidance values used to evaluate the potential carcinogenic hazard caused by exposure to contaminants. | The selected remedy prevents exposure to contaminated media and thereby minimizes human health concerns, although any changes to the cap in the future could allow exposure. |
| EPA Reference Dose (RfDs) | NA | TBC | RfDs are guidance values use to evaluate the potential noncarcinogenic hazard caused by exposure to contaminants. | The selected remedy prevents exposure to contaminated media and thereby minimizes human health concerns, although any changes to the cap in the future could allow exposure. |
| **STATE OF CONNECTICUT** | | | | |
| Remediation Standard Regulations | RCSA Section 22a-133k-1 through 3<br><br>(Established pursuant to CGS Section 22a-133k) | Applicable | These regulations provide specific numeric cleanup criteria for a wide variety of contaminants in soil, groundwater, and soil vapor. The regulations include a procedure for establishing criteria where none exist for a particular contaminant and for establishing criteria where those specified in the regulation are not appropriate. | The selected remedy complies with these standards because of employment of the engineered control.<br>Changes in action levels for groundwater are addressed in Section 6.6. |

NA – Not Applicable

**TABLE 6-2**

**LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 8 - GOSS COVE LANDFILL**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Requirement | Citation | Status | Requirement Synopsis | Current Status / Applicability |
|---|---|---|---|---|
| **FEDERAL** | | | | |
| Executive Order 11988<br>RE: Floodplain Management | Executive Order 11988 | Applicable | Requires federal agencies, wherever possible, to avoid or minimize adverse impacts to floodplains. Requires reduction of risk of flood loss, minimization of the impact of floods on human safety, health and welfare, and restoration and preservation of natural and beneficial values of floodplains. | Measures were taken to minimize impacts to Thames River floodplain during remedial activities. Remedial activities did not take place during periods of flooding. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| Fish and Wildlife Conservation Act | 16 USC Part 661 *et seq.*; 40 CFR Section 6.302 | Potentially Applicable | Requires action to be taken to protect fish and wildlife from projects affecting streams or rivers. | This regulation was addressed during construction. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| Coastal Zone Management Act | 16 USC Parts 1451 *et seq.* | Applicable | This act requires that any actions must be conducted in a manner consistent with State-Approved management programs. | This regulation was addressed during construction. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |

**TABLE 6-2**

**LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 8 - GOSS COVE LANDFILL**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Requirement | Citation | Status | Requirement Synopsis | Current Status / Applicability |
|---|---|---|---|---|
| **STATE OF CONNECTICUT** | | | | |
| Coastal Management Act | CGS 22a-90 to 112 | Relevant and Appropriate | Requires facilities conducting activities within the coastal zone to submit a coastal site plan to the municipality. The municipality uses the coastal site plan to determine whether the proposed activity poses unacceptable impact on coastal resources and future water-dependent activities. The municipality may require that all reasonable measures be taken to mitigate such adverse impacts. | Extraction/capping was conducted using approved management programs to minimize impacts to the Thames River. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| Connecticut Endangered Species Act | CGS 26-303 to 314 | Relevant and Appropriate | Regulates activities affecting State-listed endangered or threatened species or their critical habitat. | The State-threatened Atlantic Sturgeon inhabits the Thames River. Excavation/capping activities were conducted with minimal impact on the Thames River and any potential habitats. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |

**TABLE 6-3**

**ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 8 - GOSS COVE LANDFILL**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Requirement | Citation | Status | Requirement Synopsis | Current Status / Applicability |
|---|---|---|---|---|
| **FEDERAL** | | | | |
| Clean Water Act, Section 402, National Pollution Discharge Elimination System (NPDES) | 40 CFR 122 through 125, 131 | Applicable | NPDES permits are required for any discharges to navigable waters. If remedial activities include such a discharge, the NPDES standards would be ARARs. | This regulation was addressed during construction. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| **STATE OF CONNECTICUT** | | | | |
| Hazardous Waste Management: Generator and Handler Requirements | RCSA § 22a-449(c) 100-101 | Relevant and Appropriate | These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference. | This regulation was addressed during construction. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| 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. Storage requirements given at 40 CFR 265.15 are also included. | This regulation was addressed during construction. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| Closing of Solid Waste Facilities | RCSA § 22a-209-13 | Relevant and Appropriate | This section establishes standards for closure of solid waste facilities. | This regulation was addressed during construction. These regulations have not been amended since 1996; therefore compliance is current. |

**TABLE 6-3**

**ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE**
**SITE 8 - GOSS COVE LANDFILL**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Requirement | Citation | Status | Requirement Synopsis | Current Status / Applicability |
|---|---|---|---|---|
| **STATE OF CONNECTICUT (Continued)** | | | | |
| Air Pollution Control | RCSA § 22a-174-1 through 29 | Applicable | These regulations require permits to construct and to operate specified types of emission sources and contain emission standards that must be met prior to issuance of a permit. Pollutant abatement controls may be required. Specific standards pertain to fugitive dust (18b) and control of odors (23). | This regulation was addressed during construction. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| Guidelines for Soil Erosion and Sediment Control | The Connecticut Council on Soil and Water Conservation | TBC | The guidelines provide technical and administrative guidance for the development, adoption, and implementation of erosion and sediment control program. | This regulation was addressed during construction. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| Water Pollution Control | RCSA § 22a-430-1 through 8 | Applicable | These rules establish permitting requirements and criteria for water discharge to surface water. | This regulation was addressed during construction. Now that cap construction has been completed, these requirements are applicable to future operation and maintenance of the remedy. |
| Water Quality Standards | CGS 22a-426 | Applicable | Connecticut's Water Quality Standards establish specific numeric criteria, designated uses, and anti-degradation policies for groundwater and surface water. | Remedial activities, including the disposal of groundwater from excavations, were undertaken in a manner that was consistent with the anti-degradation policy in the Water Quality. Standards are currently being used to evaluate monitoring results to determine if further remedial action is required to protect resources. Changes in groundwater quality criteria are addressed in Section 6.6. |

**TABLE 6-4**

**COMPARISON OF PRIMARY MONITORING CRITERIA**
**SITE 8 - GOSS COVE LANDFILL**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Chemical | Monitoring Criteria | | | | | |
|---|---|---|---|---|---|---|
| | Site-Specific SWPC[1,2] | | CTDEP SWPC[3] | | CTDEP Volatilization[4] | |
| | 2001[1] | 2006[2] | 2001[1] | 2006[2] | 2001[1] | 2006[2] |
| **VOCs (μg/L)** | | | | | | |
| Methylene Chloride | **NA** | **108,100** | 48,000 | 48,000 | **50,000** | **2,200** |
| Tetrachloroethene | **88** | **2,040** | 88 | 88 | **3,820** | **810** |
| Xylenes | NA | NA | NA | NA | **50,000** | **48,000** |
| **SVOCs (μg/L)** | | | | | | |
| Benzo(a)anthracene | **0.3** | **113** | 0.3 | 0.3 | NA | NA |
| Benzo(a)pyrene | **0.3** | **11.3** | 0.3 | 0.3 | NA | NA |
| Benzo(b)fluoranthene | **0.3** | **113** | 0.3 | 0.3 | NA | NA |
| Benzo(g,h,i)perylene | **0.3** | **1,130** | NA | NA | NA | NA |
| Benzo(k)fluoranthene | **0.3** | **113** | 0.3 | 0.3 | NA | NA |
| Bis(2-ethylhexyl)phthalate | **59** | **1,360** | 59 | 59 | NA | NA |
| Carbazole | **29** | **NA** | NA | NA | NA | NA |
| Chrysene | **0.3** | **1130** | NA | NA | NA | NA |
| Dibenzo(a,h)anthracene | **NA** | **2.3** | NA | NA | NA | NA |
| Fluoranthene | **3,700** | **294** | 3,700 | 3700 | NA | NA |
| Indeno(1,2,3-cd)pyrene | **0.3** | **113** | NA | NA | NA | NA |
| Phenanthrene | **0.3** | **11,300** | 0.077 | 0.3 | NA | NA |
| Pyrene | **110,000** | **11,300** | 110,000 | 110,000 | NA | NA |
| **Pesticides/PCBs (μg/L)** | | | | | | |
| 4,4'-DDD | **NA** | **0.193** | NA | NA | NA | NA |
| 4,4'-DDE | **NA** | **0.136** | NA | NA | NA | NA |
| 4,4'-DDT | **NA** | **0.136** | NA | NA | NA | NA |
| Aldrin | **NA** | **0.0322** | NA | NA | NA | NA |
| Aroclor-1248 | **NA** | **0.0391** | 0.5 | 0.5 | NA | NA |
| Aroclor-1254 | **NA** | **0.0391** | 0.5 | 0.5 | NA | NA |
| Aroclor-1260 | **NA** | **0.0391** | 0.5 | 0.5 | NA | NA |
| Dieldrin | **NA** | **0.0322** | 0.1 | 0.1 | NA | NA |
| Heptachlor | **NA** | **0.0483** | 0.05 | 0.05 | NA | NA |

**TABLE 6-4**

**COMPARISON OF PRIMARY MONITORING CRITERIA**
**SITE 8 - GOSS COVE LANDFILL**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Chemical | Monitoring Criteria | | | | | |
|---|---|---|---|---|---|---|
| | Site-Specific SWPC[1,2] | | CTDEP SWPC[3] | | CTDEP Volatilization[4] | |
| | 2001[1] | 2006[2] | 2001[1] | 2006[2] | 2001[1] | 2006[2] |
| **Inorganics (μg/L)** | | | | | | |
| Antimony | **86,000** | **989,000** | 86,000 | 86,000 | NA | NA |
| Arsenic | **4** | **4.83** | 4 | 4 | NA | NA |
| Beryllium | **NA** | **29.9** | 4 | 4 | NA | NA |
| Cadmium | **6** | **2,140** | 6 | 6 | NA | NA |
| Copper | **48** | **713** | 48 | 48 | NA | NA |
| Lead | **13** | **1,860** | 13 | 13 | NA | NA |
| Mercury | **NA** | **216** | 0.4 | 0.4 | NA | NA |
| Nickel | **880** | **1,890** | 880 | 880 | NA | NA |
| Vanadium | NA | NA | NA | NA | NA | NA |
| Zinc | **123** | **18,600** | 123 | 123 | NA | NA |

Notes:
NA - Not available.
SWPC - Surface water protection criteria.
CTDEP - Connecticut Department of Environmental Protection.
1 - Groundwater Monitoring Plan for Goss Cove Landfill (TtNUS, March 2001).
2 - Operation and Maintenance Manual for Installation Restoration Program Sites (TtNUS, January 2006).
3 - SWPC for substances in groundwater (CTDEP, 1996).
4 - Industrial/commercial volatilization criteria for groundwater (CTDEP, 1996, 2003).
Shading indicates that the criteria has changed.

**TABLE 6-5**

**COMPARISON OF SECONDARY MONITORING CRITERIA**
**SITE 8 - GOSS COVE LANDFILL**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

| Chemical | CTDEP WQSs[1] | | | |
|---|---|---|---|---|
| | Aquatic Life[3] | | Human Health[2] | |
| | 2001[4] | 2006[5] | 2001[4] | 2006[5] |
| **VOCs (µg/L)** | | | | |
| Methylene Chloride | **NA** | **470** | **1,600** | **470** |
| Tetrachloroethene | **NA** | **8.85** | 8.85 | 8.85 |
| Xylenes | NA | NA | NA | NA |
| **SVOCs (µg/L)** | | | | |
| Benzo(a)anthracene | NA | NA | **0.031** | **0.49** |
| Benzo(a)pyrene | NA | NA | **0.031** | **0.049** |
| Benzo(b)fluoranthene | NA | NA | **0.031** | **0.49** |
| Benzo(g,h,i)perylene | NA | NA | **0.031** | **4.92** |
| Benzo(k)fluoranthene | NA | NA | **0.031** | **0.49** |
| Bis(2-ethylhexyl)phthalate | NA | NA | 5.9 | 5.9 |
| Carbazole | NA | NA | NA | NA |
| Chrysene | NA | NA | **0.031** | **4.92** |
| Dibenzo(a,h)anthracene | NA | NA | **0.031** | **0.01** |
| Fluoranthene | NA | NA | **370** | **1.28** |
| Indeno(1,2,3-cd)pyrene | NA | NA | **0.031** | **0.49** |
| Phenanthrene | NA | NA | **0.031** | **49.17** |
| Pyrene | NA | NA | **11000** | **49.17** |
| **Pesticides/PCBs (µg/L)** | | | | |
| 4,4'-DDD | NA | NA | 0.00084 | 0.00084 |
| 4,4'-DDE | NA | NA | 0.00059 | 0.00059 |
| 4,4'-DDT | 0.001 | 0.001 | 0.00059 | 0.00059 |
| Aldrin | NA | NA | 0.00014 | 0.00014 |
| Aroclor-1248 | **NA** | **0.03** | **NA** | **0.00017** |
| Aroclor-1254 | **NA** | **0.03** | **NA** | **0.00017** |
| Aroclor-1260 | **NA** | **0.03** | **NA** | **0.00017** |
| Dieldrin | 0.0019 | 0.0019 | 0.00014 | 0.00014 |
| Heptachlor | 0.0036 | 0.0036 | 0.00021 | 0.00021 |
| **Inorganics (µg/L)** | | | | |
| Antimony | NA | NA | 4,300 | 4,300 |
| Arsenic | 36 | 36 | **0.14** | **0.021** |
| Beryllium | NA | NA | 0.13 | 0.13 |
| Cadmium | 9.3 | 9.3 | **170** | **10,769** |
| Copper | **2.4** | **3.1** | NA | NA |
| Lead | 8.1 | 8.1 | NA | NA |
| Mercury | **0.025** | **0.94** | **0.15** | **0.051** |
| Nickel | 8.2 | 8.2 | 4,600 | 4,600 |
| Vanadium | NA | NA | NA | NA |
| Zinc | 81 | 81 | **NA** | **68,740** |

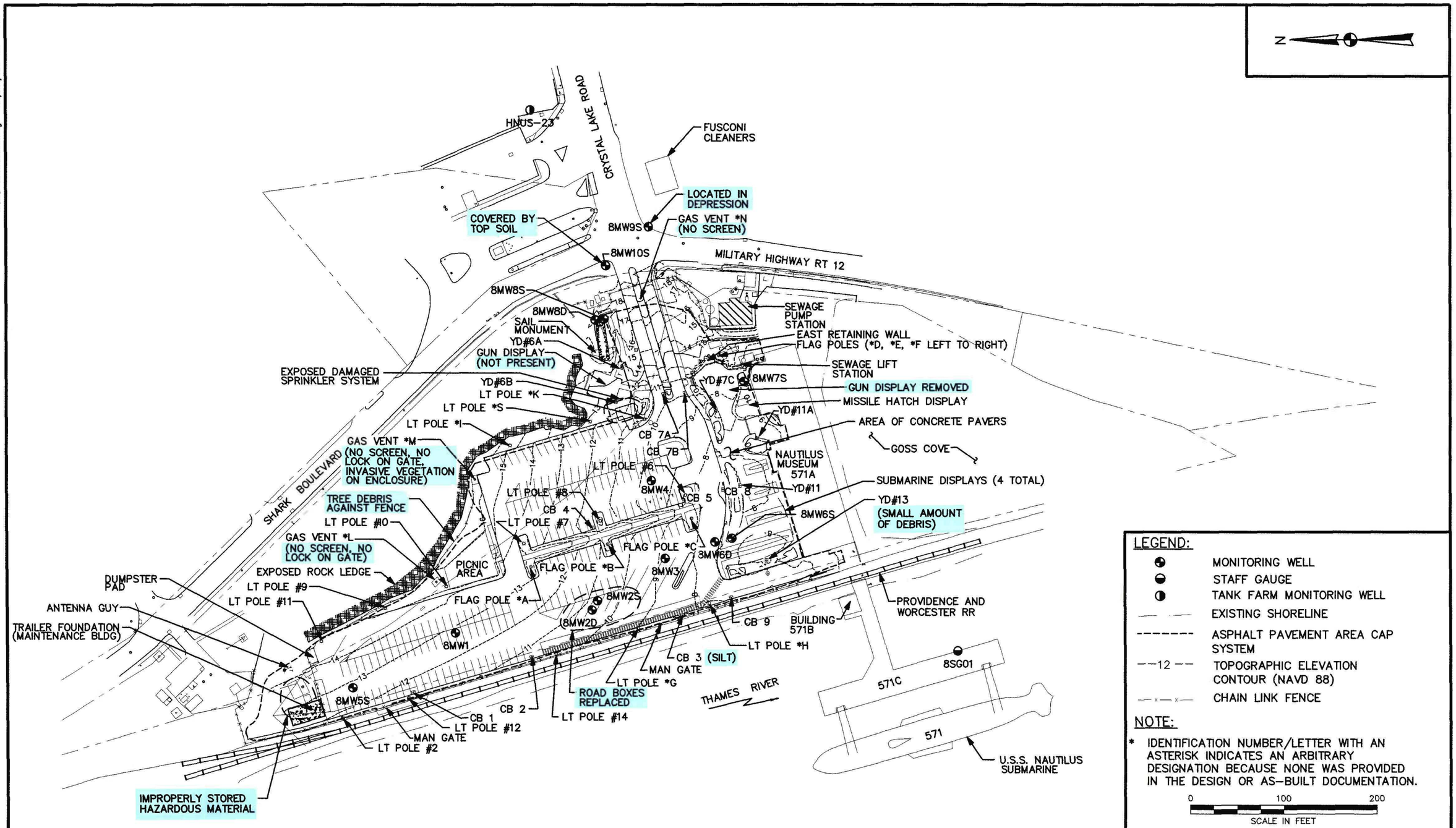
Notes:
NA - Not available.
CTDEP - Connecticut Department of Environmental Protection.
1 - Connecticut Water Quality Standards (CTDEP, 1997, 2002)
2 - Criterion for consumption of organisms only.
3 - Criterion for saltwater at a chronic concentration.
4 - Groundwater Monitoring Plan for Goss Cove Landfill (TtNUS, March 2001).
5 - Operation and Maintenance Manual for Installation Restoration Program Sites (TtNUS, January 2006).
Shading indicates that the criteria has changed.

**TABLE 6-6**

**SITE 8 DEFICIENCIES**
**SITE 8 - GOSS COVE LANDFILL**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

| Deficiency | Effects Protectiveness | |
|---|---|---|
| | Current | Future |
| Gas vents require screens | N | N |
| Sprinkler system requires repair | N | Y |
| Maintenance of monitoring wells and dedicated sampling equipment | N | N |
| Abandonment of unused monitoring wells | N | N |
| Hazardous material not being properly stored in locked storage lockers | N | N |
| No Warning signs | N | Y |

ACAD:0083CM10.dwg 06/06/06 MF PIT




LEGEND:

- MONITORING WELL
- STAFF GAUGE
- TANK FARM MONITORING WELL
- EXISTING SHORELINE
- ASPHALT PAVEMENT AREA CAP SYSTEM
- 12 TOPOGRAPHIC ELEVATION CONTOUR (NAVD 88)
- CHAIN LINK FENCE

NOTE:

* IDENTIFICATION NUMBER/LETTER WITH AN ASTERISK INDICATES AN ARBITRARY DESIGNATION BECAUSE NONE WAS PROVIDED IN THE DESIGN OR AS-BUILT DOCUMENTATION.

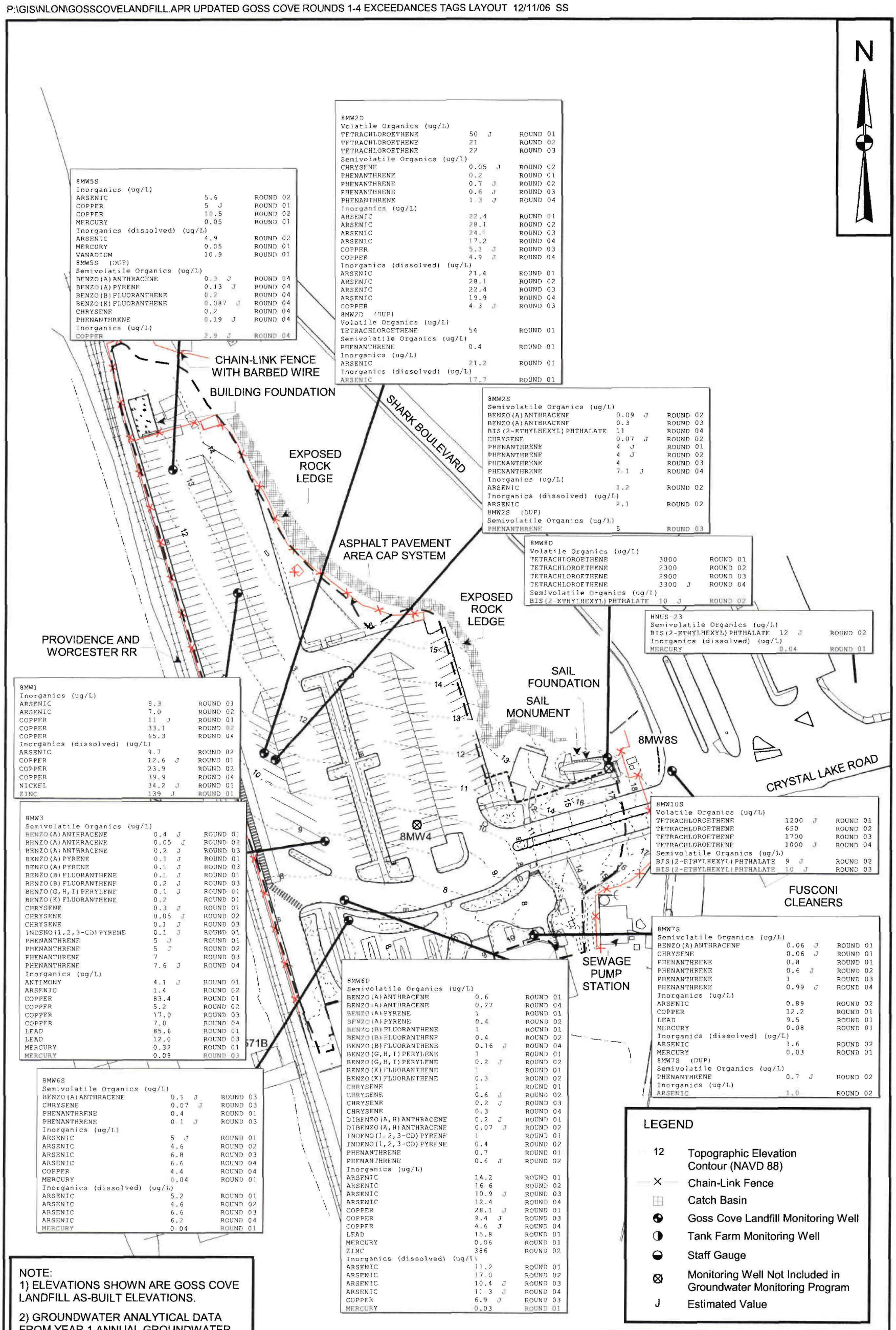
0 100 200
SCALE IN FEET

| | | | |
|---|---|---|---|
| DRAWN BY DT | DATE 5/17/06 | Tetra Tech NUS, Inc. | SITE PLAN FOR SITE 8 - GOSS COVE LANDFILL NSB-NLON GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

| | |
|---|---|
| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAL | DATE 6/7/06 |
| DRAWING NO. FIGURE 6-1 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

P:\GIS\NLON\GOSSCOVELANDFILL.APR UPDATED GOSS COVE ROUNDS 1-4 EXCEEDANCES TAGS LAYOUT 12/11/06 SS

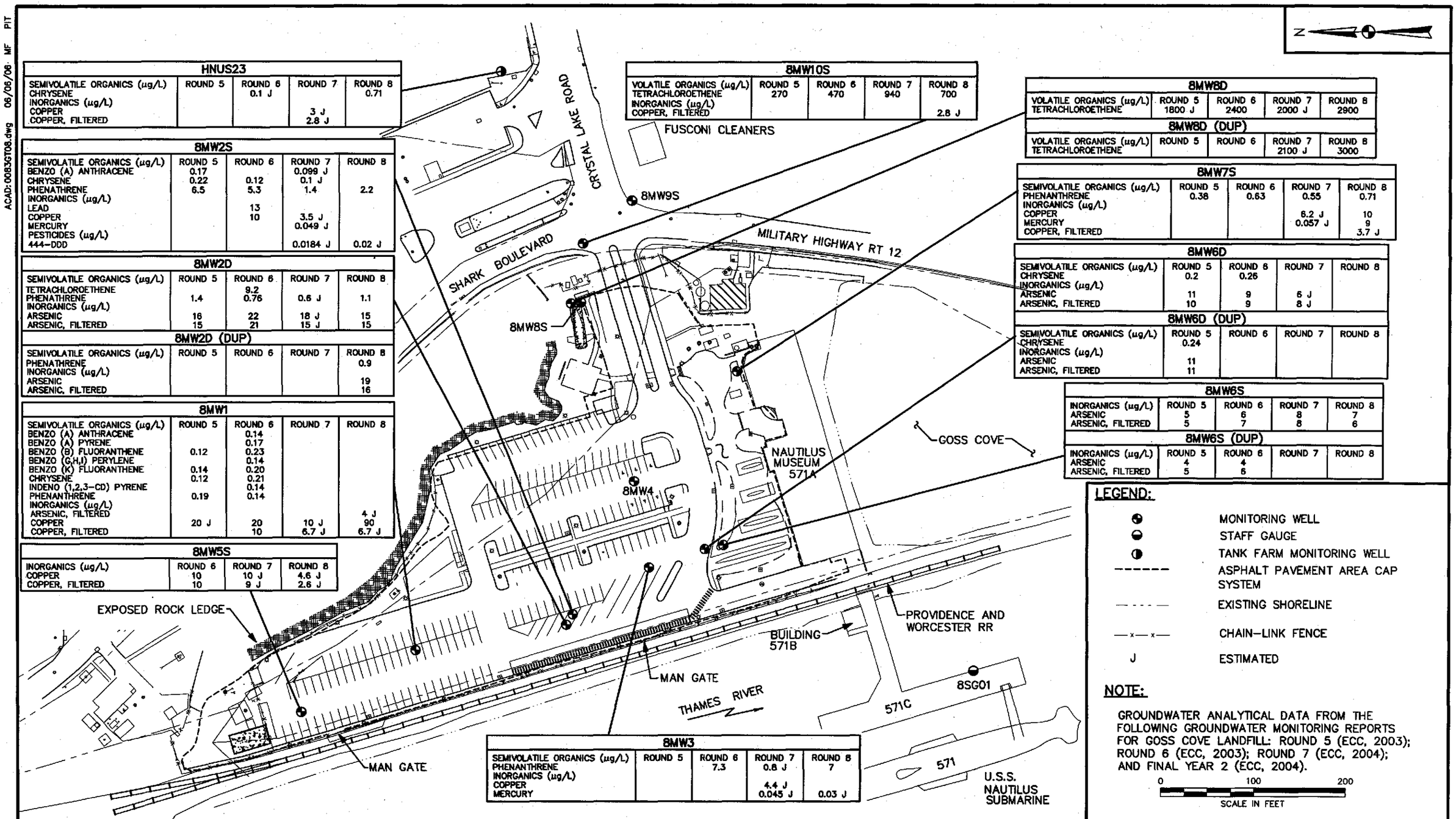



NOTE:
1) ELEVATIONS SHOWN ARE GOSS COVE LANDFILL AS-BUILT ELEVATIONS.

2) GROUNDWATER ANALYTICAL DATA FROM YEAR 1 ANNUAL GROUNDWATER MONITORING REPORT FOR GOSS COVE LANDFILL (TtNUS, 2003).

| | | | |
|---|---|---|---|
| DRAWN BY S. STROZ | DATE 4/27/06 | Tetra Tech NUS, Inc. | CONTRACT NUMBER 0083 / OWNER NUMBER 038 |
| CHECKED BY C. RICH | DATE 12/11/06 | COPC EXCEEDANCES OF MONITORING CRITERIA<br>YEAR 1 GROUNDWATER SAMPLING<br>SITE 8 - GOSS COVE LANDFILL<br>NSB-NLON, GROTON, CONNECTICUT | APPROVED BY CAR / DATE 12/13/06 |
| COST/SCHEDULE-AREA | | | APPROVED BY — / DATE — |
| SCALE AS NOTED | | | DRAWING NO. FIGURE 6 - 2 / REV 0 |

ACAD: 0083GT08.dwg 06/06/06 MF PIT




| HNUS23 | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 5 | ROUND 6 | ROUND 7 | ROUND 8 |
| CHRYSENE | | 0.1 J | | 0.71 |
| INORGANICS (µg/L) | | | | |
| COPPER | | | 3 J | |
| COPPER, FILTERED | | | 2.8 J | |

| 8MW2S | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 5 | ROUND 6 | ROUND 7 | ROUND 8 |
| BENZO (A) ANTHRACENE | 0.17 | | 0.099 J | |
| CHRYSENE | 0.22 | 0.12 | 0.1 J | |
| PHENATHRENE | 6.5 | 5.3 | 1.4 | 2.2 |
| INORGANICS (µg/L) | | | | |
| LEAD | | 13 | | |
| COPPER | | 10 | 3.5 J | |
| MERCURY | | | 0.049 J | |
| PESTICIDES (µg/L) | | | | |
| 444-DDD | | | 0.0184 J | 0.02 J |

| 8MW2D | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 5 | ROUND 6 | ROUND 7 | ROUND 8 |
| TETRACHLOROETHENE | | 9.2 | | |
| PHENATHRENE | 1.4 | 0.76 | 0.6 J | 1.1 |
| INORGANICS (µg/L) | | | | |
| ARSENIC | 16 | 22 | 18 J | 15 |
| ARSENIC, FILTERED | 15 | 21 | 15 J | 15 |

| 8MW2D (DUP) | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 5 | ROUND 6 | ROUND 7 | ROUND 8 |
| PHENATHRENE | | | | 0.9 |
| INORGANICS (µg/L) | | | | |
| ARSENIC | | | | 19 |
| ARSENIC, FILTERED | | | | 16 |

| 8MW1 | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 5 | ROUND 6 | ROUND 7 | ROUND 8 |
| BENZO (A) ANTHRACENE | | 0.14 | | |
| BENZO (A) PYRENE | | 0.17 | | |
| BENZO (B) FLUORANTHENE | 0.12 | 0.23 | | |
| BENZO (G,H,I) PERYLENE | | 0.14 | | |
| BENZO (K) FLUORANTHENE | 0.14 | 0.20 | | |
| CHRYSENE | 0.12 | 0.21 | | |
| INDENO (1,2,3-CD) PYRENE | | 0.14 | | |
| PHENANTHRENE | 0.19 | 0.14 | | |
| INORGANICS (µg/L) | | | | |
| ARSENIC, FILTERED | | | | 4 J |
| COPPER | 20 J | 20 | 10 J | 90 |
| COPPER, FILTERED | | 10 | 6.7 J | 6.7 J |

| 8MW5S | | | |
|---|---|---|---|
| INORGANICS (µg/L) | ROUND 6 | ROUND 7 | ROUND 8 |
| COPPER | 10 | 10 J | 4.6 J |
| COPPER, FILTERED | 10 | 9 J | 2.6 J |

| 8MW10S | | | | |
|---|---|---|---|---|
| VOLATILE ORGANICS (µg/L) | ROUND 5 | ROUND 6 | ROUND 7 | ROUND 8 |
| TETRACHLOROETHENE | 270 | 470 | 940 | 700 |
| INORGANICS (µg/L) | | | | |
| COPPER, FILTERED | | | | 2.8 J |

| 8MW8D | | | | |
|---|---|---|---|---|
| VOLATILE ORGANICS (µg/L) | ROUND 5 | ROUND 6 | ROUND 7 | ROUND 8 |
| TETRACHLOROETHENE | 1800 J | 2400 | 2000 J | 2900 |

| 8MW8D (DUP) | | | | |
|---|---|---|---|---|
| VOLATILE ORGANICS (µg/L) | ROUND 5 | ROUND 6 | ROUND 7 | ROUND 8 |
| TETRACHLOROETHENE | | | 2100 J | 3000 |

| 8MW7S | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 5 | ROUND 6 | ROUND 7 | ROUND 8 |
| PHENANTHRENE | 0.38 | 0.63 | 0.55 | 0.71 |
| INORGANICS (µg/L) | | | | |
| COPPER | | | 6.2 J | 10 |
| MERCURY | | | 0.057 J | 9 |
| COPPER, FILTERED | | | | 3.7 J |

| 8MW6D | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 5 | ROUND 6 | ROUND 7 | ROUND 8 |
| CHRYSENE | 0.2 | 0.26 | | |
| INORGANICS (µg/L) | | | | |
| ARSENIC | 11 | 9 | 6 J | |
| ARSENIC, FILTERED | 10 | 9 | 8 J | |

| 8MW6D (DUP) | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 5 | ROUND 6 | ROUND 7 | ROUND 8 |
| CHRYSENE | 0.24 | | | |
| INORGANICS (µg/L) | | | | |
| ARSENIC | 11 | | | |
| ARSENIC, FILTERED | 11 | | | |

| 8MW6S | | | | |
|---|---|---|---|---|
| INORGANICS (µg/L) | ROUND 5 | ROUND 6 | ROUND 7 | ROUND 8 |
| ARSENIC | 5 | 6 | 8 | 7 |
| ARSENIC, FILTERED | 5 | 7 | 8 | 6 |

| 8MW6S (DUP) | | | | |
|---|---|---|---|---|
| INORGANICS (µg/L) | ROUND 5 | ROUND 6 | ROUND 7 | ROUND 8 |
| ARSENIC | 4 | 4 | | |
| ARSENIC, FILTERED | 5 | 6 | | |

| 8MW3 | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 5 | ROUND 6 | ROUND 7 | ROUND 8 |
| PHENANTHRENE | | 7.3 | 0.8 J | 7 |
| INORGANICS (µg/L) | | | | |
| COPPER | | | 4.4 J | |
| MERCURY | | | 0.045 J | 0.03 J |

## LEGEND:

- MONITORING WELL
- STAFF GAUGE
- TANK FARM MONITORING WELL
- ASPHALT PAVEMENT AREA CAP SYSTEM
- EXISTING SHORELINE
- CHAIN-LINK FENCE
- J — ESTIMATED

## NOTE:

GROUNDWATER ANALYTICAL DATA FROM THE FOLLOWING GROUNDWATER MONITORING REPORTS FOR GOSS COVE LANDFILL: ROUND 5 (ECC, 2003); ROUND 6 (ECC, 2003); ROUND 7 (ECC, 2004); AND FINAL YEAR 2 (ECC, 2004).

0 100 200
SCALE IN FEET

| | | | |
|---|---|---|---|
| DRAWN BY MF | DATE 5/8/06 | Tetra Tech NUS, Inc. | COPC EXCEEDANCES OF MONITORING CRITERIA YEAR 2 GROUNDWATER SAMPLING SITE 8 - GOSS COVE LANDFILL NSB-NLON, GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

CONTRACT NO. 0083
OWNER NO. 038
APPROVED BY CAL DATE 6/1/06
DRAWING NO. FIGURE 6-3
REV. 0

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

ACAD: 0083GT10.dwg 06/07/06 MF PIT

| HNUS23 | | | | |
|---|---|---|---|---|
| INORGANICS (µg/L) | ROUND 9 | ROUND 10 | ROUND 11 | ROUND 12 |
| ARSENIC | 0.46 J | | | |
| COPPER | 2.52 J | 3.4 J | | 4.5 J |

| 8MW8D | | | | |
|---|---|---|---|---|
| VOLATILE ORGANICS (µg/L) | ROUND 9 | ROUND 10 | ROUND 11 | ROUND 12 |
| TETRACHLOROETHENE | 3200 | 2400 | 2900 | 2200 |
| **8MW8D (DUP)** | | | | |
| VOLATILE ORGANICS (µg/L) | ROUND 9 | ROUND 10 | ROUND 11 | ROUND 12 |
| TETRACHLOROETHENE | 3200 | 2700 | 2900 | 2200 |

| 8MW2S | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 9 | ROUND 10 | ROUND 11 | ROUND 12 |
| BENZO(A)ANTHRACENE | 0.17 J | 0.14 J | 0.12 J | |
| BENZO(B)FLUORANTHENE | 0.078 J | | | |
| BENZO(K)FLUORANTHENE | 0.055 J | | | |
| CHRYSENE | 0.17 J | 0.13 J | 0.1 J | |
| FLUORANTHENE | | | | 1.6 |
| PHENATHRENE | 3.6 | 3.4 | 3.5 | |
| INORGANICS (µg/L) | | | | |
| ARSENIC | 0.82 J | | | |
| ARSENIC, FILTERED | 1.1 J | | | |

| 8MW2D | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 9 | ROUND 10 | ROUND 11 | ROUND 12 |
| BENZO(A)ANTRACENE | | 0.066 J | 0.075 J | |
| CHRYSENE | | 0.076 J | 0.086 J | |
| PHENATHRENE | 0.97 | 1.2 | 1.1 | |
| INORGANICS (µg/L) | | | | |
| ARSENIC | 26.5 J | 15 | 8 | 15 |
| ARSENIC, FILTERED | 25.8 J | 17 | | 13 |
| LEAD | 13.2 | | | |

| 8MW1 | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 9 | ROUND 10 | ROUND 11 | ROUND 12 |
| BENZO (A) PYRENE | | | 0.043 J | |
| BENZO (G,H,I) PERYLENE | | | 0.033 J | |
| BENZO (K) FLUORANTHENE | | | 0.048 J | |
| CHRYSENE | | | 0.045 J | |
| PHENANTHRENE | | 0.09 J | 0.079 J | |
| INORGANICS (µg/L) | | | | |
| ARSENIC | 2.9 J | | | |
| ARSENIC, FILTERED | 1.7 J | 3.8 J | | |
| COPPER | 12.2 J | 30 | 20 | 8.4 J |
| COPPER, FILTERED | 7.6 | 20 | 8.3 J | |

| 8MW5S | | | |
|---|---|---|---|
| INORGANICS (µg/L) | ROUND 9 | ROUND 10 | ROUND 12 |
| ARSENIC | 2 J | | |
| ARSENIC, FILTERED | 2.5 J | | |
| COPPER | 20.1 J | 5.9 J | 4.6 J |
| **8MW5S (DUP)** | | | |
| INORGANICS (µg/L) | | ROUND 10 | |
| COPPER | | 5.7 J | |

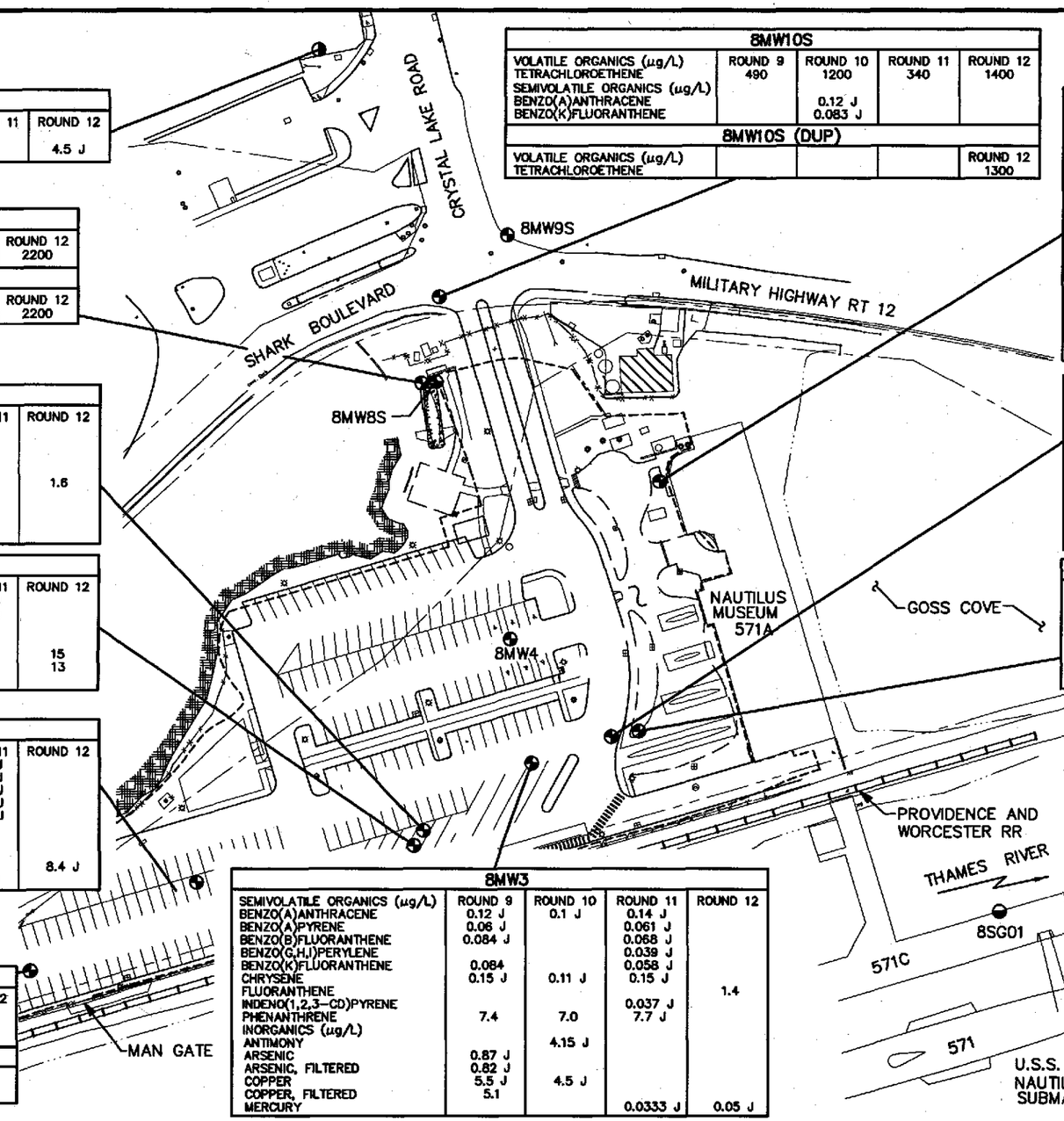
| 8MW10S | | | | |
|---|---|---|---|---|
| VOLATILE ORGANICS (µg/L) | ROUND 9 | ROUND 10 | ROUND 11 | ROUND 12 |
| TETRACHLOROETHENE | 490 | 1200 | 340 | 1400 |
| SEMIVOLATILE ORGANICS (µg/L) | | | | |
| BENZO(A)ANTHRACENE | | 0.12 J | | |
| BENZO(K)FLUORANTHENE | | 0.083 J | | |
| **8MW10S (DUP)** | | | | |
| VOLATILE ORGANICS (µg/L) | | | | ROUND 12 |
| TETRACHLOROETHENE | | | | 1300 |

| 8MW7S | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 9 | ROUND 10 | ROUND 11 | ROUND 12 |
| BENZO(A)ANTHRACENE | | 0.13 J | 0.043 J | |
| BENZO(K)FLUORANTHENE | | 0.11 J | | |
| CHRYSENE | 0.05 J | 0.12 J | | |
| FLUORANTHENE | | | | 1.5 |
| PHENANTHRENE | 0.57 | 0.33 | 0.81 | |
| INORGANICS (µg/L) | | | | |
| ARSENIC | 1.4 J | | | |
| ARSENIC, FILTERED | 0.87 J | | | |
| COPPER | 4.92 J | 8 J | 2.9 J | |
| **8MW7S (DUP)** | | | | |
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 9 | | ROUND 11 | |
| CHRYSENE | | | 0.033 J | |
| PHENANTHRENE | 0.58 | | 0.81 | |
| INORGANICS (µg/L) | | | | |
| ARSENIC | 1.2 J | | | |
| ARSENIC, FILTERED | 1.2 J | | | |
| COPPER | | | 3.6 J | |

| 8MW6D | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 9 | ROUND 10 | ROUND 11 | ROUND 12 |
| CHRYSENE | | 0.055 J | 0.051 J | |
| PHENANTHRENE | | | 0.096 J | |
| INORGANICS (µg/L) | | | | |
| ARSENIC | 15.4 J | 13 | | 6.0 |
| ARSENIC, FILTERED | 12.9 J | 5 | | 5.0 |
| COPPER | 16.2 J | 2.6 J | | |
| LEAD | 7.1 | | | |
| NICKEL | 10 | | | |
| ZINC, FILTERED | 91.1 | | | |
| ZINC | 253.7 | 90 | 100 | |

| 8MW6S | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 9 | ROUND 10 | ROUND 11 | ROUND 12 |
| BENZO(A)ANTHRACENE | 0.07 J | 0.095 J | 0.063 J | |
| CHRYSENE | 0.065 J | 0.082 J | 0.056 J | |
| PHENANTHRENE | | | 0.070 J | |
| INORGANICS (µg/L) | | | | |
| ARSENIC | 3.7 J | 6 | 6 | 8 |
| ARSENIC, FILTERED | 3.9 J | 7 | | 9 |
| COPPER | 2.91 J | 4.3 J | | 3.6 J |

| 8MW3 | | | | |
|---|---|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 9 | ROUND 10 | ROUND 11 | ROUND 12 |
| BENZO(A)ANTHRACENE | 0.12 J | 0.1 J | 0.14 J | |
| BENZO(A)PYRENE | 0.06 J | | 0.061 J | |
| BENZO(B)FLUORANTHENE | 0.084 J | | 0.068 J | |
| BENZO(G,H,I)PERYLENE | | | 0.039 J | |
| BENZO(K)FLUORANTHENE | 0.084 | | 0.058 J | |
| CHRYSENE | 0.15 J | 0.11 J | 0.15 J | |
| FLUORANTHENE | | | | 1.4 |
| INDENO(1,2,3-CD)PYRENE | | | 0.037 J | |
| PHENANTHRENE | 7.4 | 7.0 | 7.7 J | |
| INORGANICS (µg/L) | | | | |
| ANTIMONY | | 4.15 J | | |
| ARSENIC | 0.87 J | | | |
| ARSENIC, FILTERED | 0.82 J | | | |
| COPPER | 5.5 J | 4.5 J | | |
| COPPER, FILTERED | 5.1 | | | |
| MERCURY | | | 0.0333 J | 0.05 J |




## LEGEND:

- MONITORING WELL
- STAFF GAUGE
- TANK FARM MONITORING WELL
- ASPHALT PAVEMENT AREA CAP SYSTEM
- CHAIN-LINK FENCE
- J ESTIMATED VALUE

## NOTE:

1.) GROUNDWATER ANALYTICAL DATA FROM THE FOLLOWING GROUNDWATER MONITORING REPORTS FOR GOSS COVE LANDFILL: ROUND 9 (ECC, 2005); ROUND 10 (ECC, 2005); ROUND 11 (ECC, 2005); AND FINAL YEAR 3 (ECC, 2005).

2.) CRITERIA USED TO IDENTIFY COPCs CHANGED AFTER ROUND 11 TO CRITERIA PRESENTED IN DRAFT O & M MANUAL (TtNUS, 2003).

0 100 200
SCALE IN FEET

| | |
|---|---|
| DRAWN BY MF | DATE 6/7/06 |
| CHECKED BY | DATE |
| REVISED BY | DATE |
| SCALE AS NOTED | |

Tetra Tech NUS, Inc.

COPC EXCEEDANCES OF MONITORING CRITERIA
YEAR 3 GROUNDWATER SAMPLING
SITE 8 - GOSS COVE LANDFILL
NSB-NLON, GROTON, CONNECTICUT

| | |
|---|---|
| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAR | DATE 6/7/06 |
| DRAWING NO. FIGURE 6-4 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

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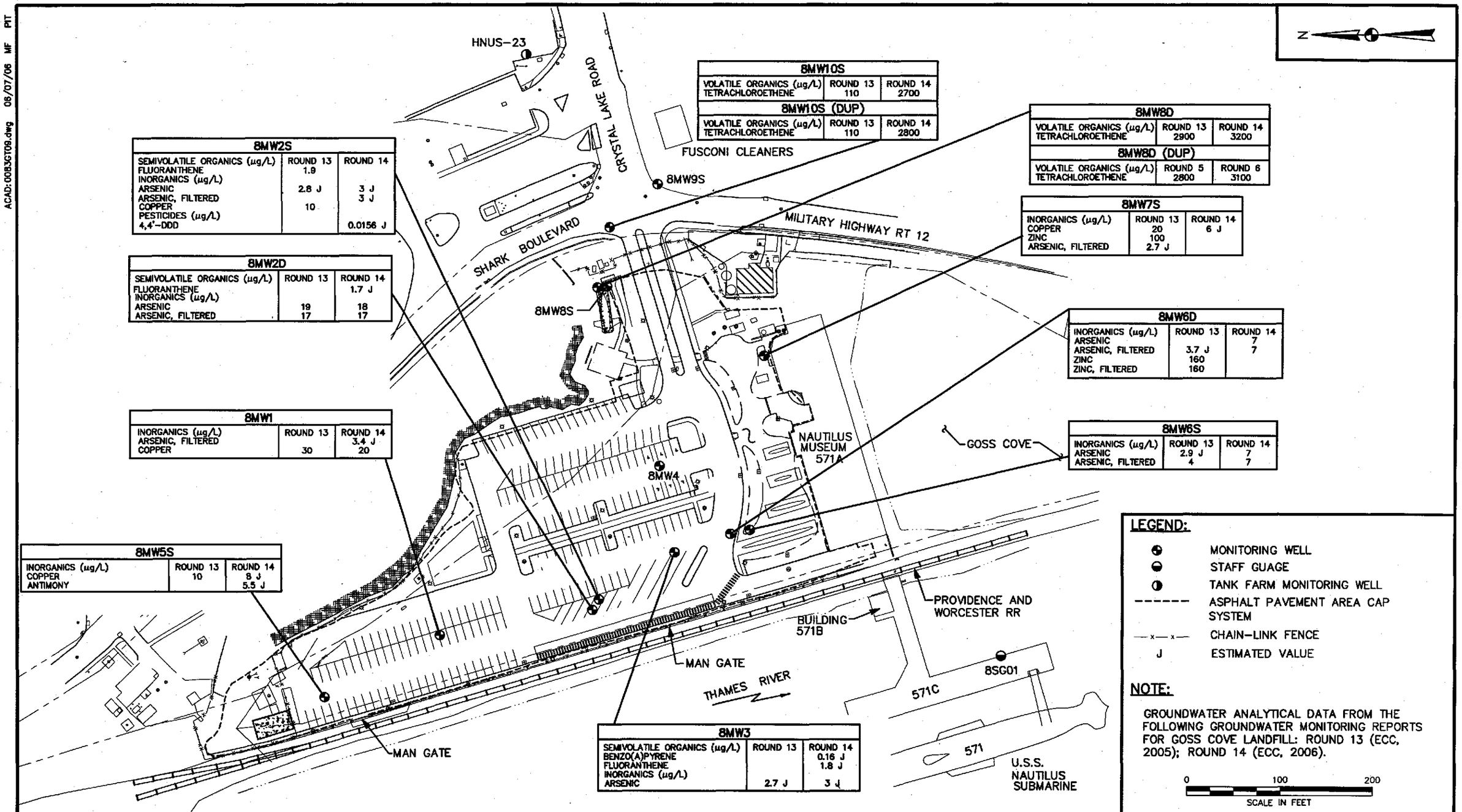



| 8MW10S | | |
|---|---|---|
| VOLATILE ORGANICS (µg/L) | ROUND 13 | ROUND 14 |
| TETRACHLOROETHENE | 110 | 2700 |
| **8MW10S (DUP)** | | |
| VOLATILE ORGANICS (µg/L) | ROUND 13 | ROUND 14 |
| TETRACHLOROETHENE | 110 | 2800 |

| 8MW2S | | |
|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 13 | ROUND 14 |
| FLUORANTHENE | 1.9 | |
| INORGANICS (µg/L) | | |
| ARSENIC | 2.8 J | 3 J |
| ARSENIC, FILTERED | | 3 J |
| COPPER | 10 | |
| PESTICIDES (µg/L) | | |
| 4,4'-DDD | | 0.0156 J |

| 8MW2D | | |
|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 13 | ROUND 14 |
| FLUORANTHENE | | 1.7 J |
| INORGANICS (µg/L) | | |
| ARSENIC | 19 | 18 |
| ARSENIC, FILTERED | 17 | 17 |

| 8MW1 | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 13 | ROUND 14 |
| ARSENIC, FILTERED | | 3.4 J |
| COPPER | 30 | 20 |

| 8MW5S | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 13 | ROUND 14 |
| COPPER | 10 | 8 J |
| ANTIMONY | | 5.5 J |

| 8MW3 | | |
|---|---|---|
| SEMIVOLATILE ORGANICS (µg/L) | ROUND 13 | ROUND 14 |
| BENZO(A)PYRENE | | 0.16 J |
| FLUORANTHENE | | 1.8 J |
| INORGANICS (µg/L) | | |
| ARSENIC | 2.7 J | 3 J |

| 8MW8D | | |
|---|---|---|
| VOLATILE ORGANICS (µg/L) | ROUND 13 | ROUND 14 |
| TETRACHLOROETHENE | 2900 | 3200 |
| **8MW8D (DUP)** | | |
| VOLATILE ORGANICS (µg/L) | ROUND 5 | ROUND 6 |
| TETRACHLOROETHENE | 2800 | 3100 |

| 8MW7S | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 13 | ROUND 14 |
| COPPER | 20 | 6 J |
| ZINC | 100 | |
| ARSENIC, FILTERED | 2.7 J | |

| 8MW6D | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 13 | ROUND 14 |
| ARSENIC | | 7 |
| ARSENIC, FILTERED | 3.7 J | 7 |
| ZINC | 160 | |
| ZINC, FILTERED | 160 | |

| 8MW6S | | |
|---|---|---|
| INORGANICS (µg/L) | ROUND 13 | ROUND 14 |
| ARSENIC | 2.9 J | 7 |
| ARSENIC, FILTERED | 4 | 7 |

**LEGEND:**

- MONITORING WELL
- STAFF GUAGE
- TANK FARM MONITORING WELL
- ASPHALT PAVEMENT AREA CAP SYSTEM
- CHAIN-LINK FENCE
- J ESTIMATED VALUE

**NOTE:**

GROUNDWATER ANALYTICAL DATA FROM THE FOLLOWING GROUNDWATER MONITORING REPORTS FOR GOSS COVE LANDFILL: ROUND 13 (ECC, 2005); ROUND 14 (ECC, 2006).

0 100 200
SCALE IN FEET

| | | |
|---|---|---|
| DRAWN BY MF | DATE 6/7/06 | Tetra Tech NUS, Inc. |
| CHECKED BY | DATE | |
| REVISED BY | DATE | |
| SCALE AS NOTED | | |

COPC EXCEEDANCES OF MONITORING CRITERIA
YEAR 4 GROUNDWATER SAMPLING
SITE 8 - GOSS COVE LANDFILL
NSB-NLON, GROTON, CONNECTICUT

| | |
|---|---|
| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAL | DATE 6/7/06 |
| DRAWING NO. FIGURE 6-5 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

# 7.0 SITE 9 – OT-5

This five-year review is being conducted for Site 9 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure.

A removal action was conducted for the soil OU at Site 9, Waste OT-5, under RCRA, but a remedy for the groundwater OU has not yet been selected under CERCLA. The soil at Site 9 was investigated and remediated under the CTDEP RCRA UST Program; therefore, no decision documents were required or prepared for the soil OU. Groundwater associated with the site (OU9) is currently being investigated under CERCLA.

## 7.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 9 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Crystal Lake drained and dredged to allow for construction of nine concrete USTs. | 1940s |
| Waste OT-5 converted to storage tank for bilge water. | 1970s |
| Use of OT-5 stopped and tank contents removed. | 1993 |
| Removal action and post-removal action sampling at OT-5. | 1994 |
| Post Removal Action Report for OT-5 completed. | 1994 |
| First Five-Year Review performed. | December 2001 |
| BGOURI completed. | January 2002 |
| SOPA (ADMIN) New London Instruction 5090.18C updated. | December 2006 |

## 7.2 BACKGROUND

Site 9, Waste OT-5, was an underground, concrete storage tank located between Sculpin Avenue and Tang Avenue in the southern portion of NSB-NLON. The investigations at Site 9 were conducted under the CTDEP RCRA UST Program. The site map is included as Figure 7-1. The site's location relative to other IR sites is shown on Figure 1-2. The tank had a diameter of approximately 112 feet and was 11 feet deep. The top of the tank was approximately 5 feet below the ground surface and the tank had a capacity of approximately 750,000 gallons.

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

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

In 1993, a majority of the contents of OT-5, including the floating product layer, water, and sludge were removed and disposed off site. Residual materials contained in OT-5 were later removed and stored on site as follows:

| Storage Vessel | Contents |
|---|---|
| Frac Trailer No. 1 | 6,000 gallons of waste decontamination fluid |
| Frac Trailer No. 2 | 19,000 gallons of OT-5 bottom sludge |
| Roll-Off Container No. 1 | 20,000 pounds of bottom sludge, waste wipe cloths, and discarded personal protective equipment (PPE) |
| Roll-Off Container No. 2 | 20,000 pounds of bottom sludge, waste wipe cloths, and discarded PPE |

The primary waste contaminants were PCBs at concentrations in excess of 500 mg/kg.

In April 1994, B&RE completed a removal action of these materials and then performed post-removal action sampling that confirmed that residual waste materials had been properly shipped and disposed and that the waste storage vessels had been properly decontaminated (HNUS, 1994b). After the contents of OT-5 were removed, the tank was cleaned, and the top of the tank was crushed. The tank was closed in place by filling it with inert material.

Site 9 is located within the Tank Farm (Site 23). Further discussion of the investigation of the groundwater OU at Site 23 (OU9) under the CERCLA IRP is provided in Section 20.

## 7.3 REMEDIAL ACTIONS

### 7.3.1 Remedy Selection

No RODs have been signed for OT-5. In April 1994, the Navy requested that HNUS complete the removal and disposal of the OT-5 waste still stored on site. The majority of the waste was an oily sludge removed from the bottom of OT-5. The main COCs in the OT-5 bottom sludge were PCBs with concentrations in excess of 500 mg/kg. Other wastes stored on site included spent decontamination fluids, waste diaper-like wipe cloths, and discarded PPE used during OT-5 closure activities. The objectives were to remove, ship, and dispose of all wastes, decontaminate the waste storage vessels, and conduct verification sampling and analysis.

### 7.3.2 Remedy Implementation

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

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

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

Each waste load was weighed on site prior to departure and again upon arrival at the Aptus facility. A Uniform Hazardous Waste Manifest and Notification of Waste Subject to Land Disposal Restriction were prepared for each waste shipment.

Following waste removal, the inside surfaces of the frac trailers and roll-off containers were decontaminated, and wipe samples were collected for verification purposes from inside surfaces. The trailers and containers were decontaminated repeatedly until PCB concentrations from the wipe samples were less than the required 10 µg/100 $cm^2$. The Post Removal Action Report (HNUS, 1994b) presents

the results of the verification sampling and analysis procedures performed by HNUS to verify that cleanup standards were met for the decontamination of the containers used for temporary on-site storage of the PCB-contaminated sludge removed from OT-5.

After the contents of OT-5 were removed, the tank was cleaned, and the top of the tank was crushed. The tank was closed in place by filling it with inert material. No further remedial action is necessary for soil to ensure protection of human health and the environment at Site 9. The removal action eliminated the need to conduct additional remedial action.

Groundwater associated with Site 9 is being addressed under Site 23. A ROD will be prepared to document the selected remedy for the groundwater OU (OU9).

## 7.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of Site 9. The recommendations from the First 5-Year Review report are provided below along with the actions that were taken to address the recommendations.

<u>It was recommended that an NFA PRAP and ROD be completed for Site 9.</u>

- A NFA Proposed Plan and ROD have not been prepared for the soil at Site 9.

<u>It was recommended that the decision for the groundwater OU be addressed under Site 23 (Tank Farm).</u>

- The Site 9 groundwater OU will be addressed under Site 23 (Tank Farm). A decision document for groundwater at Site 23 has not been prepared yet.

<u>Also, it was recommended that there be enforcement of the IR Site Use Restriction Instruction.</u>

- The instruction was updated to include the Goss Cove Landfill and re-issued in 2003. The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information for Site 2A - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON. The instruction has been enforced as appropriate at Site 9.

## 7.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 7.5.1 Document and Analytical Data Review

New London Instruction 5090.18C was the only document reviewed for the second five-year review of Site 9. The results of the BGOURI are discussed in Section 20. Within the past 5 years, no other documents have been completed regarding this site.

### 7.5.2 ARAR and Site-Specific Action Level Changes

There have been no changes in ARARs that call into question the protectiveness of the remedy for soil. Groundwater at Site 9 is still being evaluated, and no decisions regarding the remediation of groundwater at this site have been determined.

### 7.5.3 Site Inspection

A site inspection conducted on April 4, 2006 included visual observations of the Site 23/Site 9 area. Weather conditions during the inspection were cold (mid-40s) and overcast with light precipitation. Representatives from the Navy, USEPA, CTDEP, TtNUS, ECC, and Gannett Fleming participated in the inspection. Appendix A contains one photograph taken of the Site 23/Site 9 (OT-5) area. During the inspection, representatives discussed the information required to close the site.

Site 9 is contained within Site 23, which is within a partially fenced area that is currently used for recreation. Groundwater at the Tank Farm is not used for human consumption, and it is not likely to be used for human consumption in the foreseeable future because of its current classification (i.e., GB groundwater classification indicates that it is not suitable for direct human consumption without treatment). There are no short-term or long-term plans to convert this area to any other use.

### 7.5.4 Site Interviews

No formal interviews were conducted for this site as part of the second five-year review because there were no active site issues to discuss.

## 7.6 ASSESSMENT

The following conclusions support the determination that the remedy at Site 9 is protective of human health and the environment.

***Question 1. Is the remedy functioning as intended by the decision documents?***

- ***Remedial Action Performance:*** All contaminated wastes were removed from OT-5 (Site 9), and the tank has been properly closed in place. Groundwater at Site 9 is being evaluated under Site 23.

- ***System Operations/O&M:*** Not applicable.

- ***Opportunities for Optimization:*** Not applicable.

- ***Early Indicators of Potential Issues:*** No early indicators of potential remedy issues were noted during the review.

- ***Implementation of Institutional Controls and Other Measures:*** The Navy has an IR Site Use Restriction Instruction in place at NSB-NLON [SOPA (ADMIN) NLONINST 5090.18C]. The policy restricts ground surface disturbance of soils and any subsurface disturbance of soils and/or groundwater at IR sites.

***Question 2. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?***

- ***Changes in Standards and TBCs***: The removal action conducted at Site 9 was completed in accordance with RCRA UST regulations. Decontamination was completed to specifications included in 40 CFR 761.125.

- ***Changes in Exposure Pathways:*** There have been no changes in exposure pathways.

- ***Changes in Toxicity and Other Contaminant Characteristics:*** There have been no changes in toxicity and other factors for COCs that would call into question the protectiveness of the remedy.

- ***Changes in Risk Assessment Methods:*** A risk assessment was not conducted for Site 9.

- ***Expected Progress Towards Meeting RAOs:*** RAOs for the groundwater at Site 9, a portion of OU9, will be defined in the future.

***Question 3. Has any other information come to light that could call into question the protectiveness of the remedy?***

No additional information has been identified that would call into question the protectiveness of the remedy.

## 7.7 ISSUES

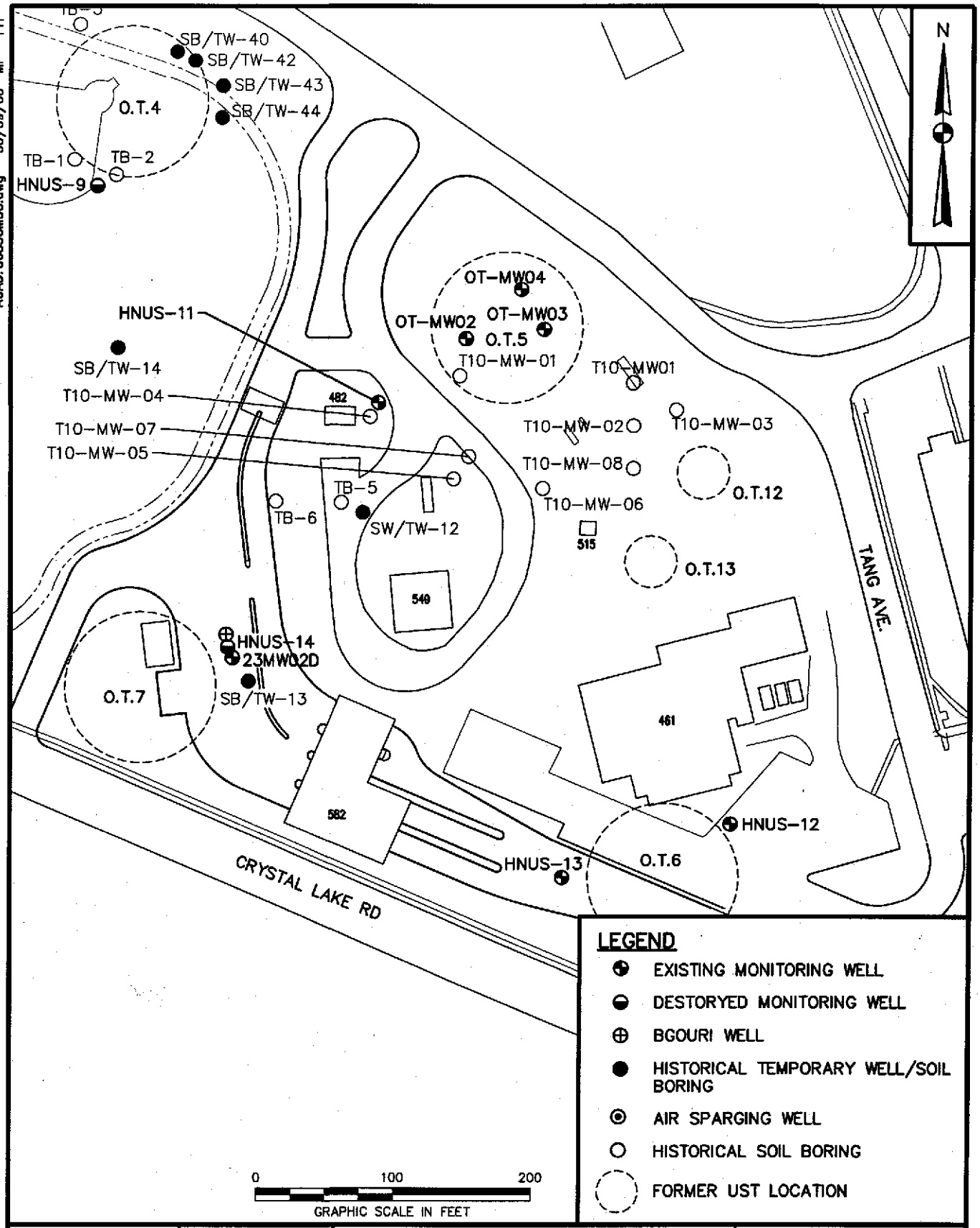
The only deficiency identified for Site 9 was that a ROD was not completed and signed for the soil OU.

## 7.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that an NFA Proposed Plan and ROD be completed for the Site 9 soil OU. It is recommended that the decision for the groundwater OU (OU9) be addressed under Site 23 (Tank Farm). Also, it is recommended that there be continued enforcement of the IR New London Instruction.

## 7.9 PROTECTIVENESS STATEMENT

The remedy for Site 9 is protective of human health and the environment. Current land use controls should minimize exposure to groundwater at the Tank Farm. In addition, the groundwater OU will be addressed in conjunction with Site 23.




## LEGEND

- EXISTING MONITORING WELL
- DESTORYED MONITORING WELL
- BGOURI WELL
- HISTORICAL TEMPORARY WELL/SOIL BORING
- AIR SPARGING WELL
- HISTORICAL SOIL BORING
- FORMER UST LOCATION

| | | | |
|---|---|---|---|
| DRAWN BY MF | DATE 6/9/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 9 - OT-5<br>NSB-NLON<br>GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

| | |
|---|---|
| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAR | DATE 6/9/06 |
| DRAWING NO. FIGURE 7-1 | REV. 0 |

FORM CADD NO. TTNUS-AV.DWG - REV 1 -9/10/98

ACAD: 0083CM30.dwg 06/09/06 MF PIT

# 8.0 SITE 10 – LOWER SUBASE - FUEL STORAGE TANKS AND TANK 54-H (OU 4)

This five-year review is being conducted for Site 10 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. Site 10 is currently being investigated under CERCLA. No decision documents have been prepared for this site.

## 8.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 10 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Five USTs put into service southwest of Building 107. | WW II |
| Tanks E, F, and G used to store diesel. | 1942 – 1987 |
| Tank K and L used to store lubrication and hydraulic oil. | 1954-1989 |
| Tank 54-H used as a reclamation tank for other five tanks. | NA |
| New steel tanks installed in locations of K and L. | After 1989 |
| Phase I RI report completed. | 1992 |
| Phase II RI report completed. | 1997 |
| Final Lower Subase RI Report completed. | 1999 |
| First Five-Year Review Report completed. | December 2001 |
| Draft Final FS for Soil and Groundwater at the Lower Subase completed. | July 2002 |
| SOPA (ADMIN) New London Instruction 5090.18B updated. | December 2006 |

## 8.2 BACKGROUND

Six former USTs, including Tank 54-H, were located at the Lower Subase at the corner of Corvina Road and Amber Jack Road. The site map is included as Figure 8-1. The location of Site 10 in relation to the other IR sites is shown on Figure 1-2.

Concrete USTs E, F, and G each had 125,000-gallon capacities and were used to store diesel fuel from 1942 to 1987. Concrete USTs K and L each had 25,000-gallon capacities and were used to store lubrication and hydraulic oil from 1954 to 1989. Tank 54-H had a 30,000-gallon capacity and was used as a reclamation tank for the other five tanks. Tanks E, F, and G have been decommissioned, and new

steel tanks have been installed within the concrete shells of Tanks K and L (USEPA, 1995a). Tank 54-H has also been decommissioned. The IAS concluded that there was some measurable leakage from the tanks at Site 10 and recommended monitoring of the tank levels to evaluate the leakage (Envirodyne, 1982).

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

No. 2 fuel oil was detected in monitoring wells at Tank 54-H at concentrations ranging from 21 to 1,100 mg/L. In addition, low concentrations (less than 15 µg/L) of benzene and xylenes were detected in FOMW13. Fuss & O'Neill concluded that petroleum contamination had impacted groundwater in the area (Fuss & O'Neill, 1989).

Site 10 was included in the Phase II RI (B&RE, 1997a) and Lower Subase RI (TtNUS, 1999b). Sites 10 and 11 were evaluated collectively as Zone 1 in the Phase II RI and Lower Subase RI. Because of this approach, the remainder of this section discusses information in terms of Zone 1.

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

- The nature and extent of organic and inorganic contamination in soil are well defined to the extent practical considering infrastructure limitations.

- The baseline HHRA indicates that noncarcinogenic risks for the construction worker under the RME scenario slightly exceed 1.0. The assessment also shows that carcinogenic risks for the construction worker, full-time employee, and the hypothetical future resident under the RME scenario and for the hypothetical future resident under the Central Tendency Exposure (CTE) scenario are in excess of the CTDEP cumulative target risk level. In addition, carcinogenic risks for the full-time employee and hypothetical future resident under the RME scenario exceed the USEPA target risk range.

- Based on a comparison of analytical results with conservative, generic mobility criteria, organic and inorganic contamination in soil has the potential to migrate and impact groundwater at this site. Groundwater analytical data confirm these screening results and indicate that limited migration is currently occurring.

- Monitored natural attenuation or bioremediation could be feasible alternatives for the petroleum contamination in soil.

- Significant amounts of petroleum contamination remain in the soils of Zone 1; however, the historical source(s) of petroleum contamination have been eliminated (i.e., the leaking Site 10 and 11 USTs, the Building 89 UST, and the fuel distribution line have been removed and/or repaired). The Navy has implemented leak detection systems for all USTs and conducts regular pressure testing and repairs on fuel distribution lines.

- The zone is generally covered with pavement or buildings, which minimizes direct exposure to contaminated soil by human receptors.

- The groundwater at Zone 1 is not currently or anticipated to be used in the future as a potable water source because it is brackish; therefore, there is no imminent threat to human health.

- The ERA for the Thames River adjacent to Zone 1 and the baseline HHRA for Zone 2 (both downgradient receptors of Zone 1) show that the risks to ecological and human receptors in these adjacent areas are currently minor. In addition, the Thames River provides significant dilution and mixing, which minimize the impact of any contaminant migration from Zone 1.

- Free-phase petroleum product was only detected in well 13MW18 during the latest round of sampling.

- Key parameters indicate that natural attenuation processes are at work in the groundwater of Zone 1, and these processes can reduce concentrations of petroleum contamination that reach the aquifer and convert the petroleum contamination to a less toxic form. Monitored natural attenuation should

be further evaluated as part of the remedial strategy for Zone 1 to confirm the effectiveness of these processes. The monitored natural attenuation program should include or be part of a tiered groundwater monitoring program, similar to those currently being implemented at other NSB-NLON IRP sites. Tiered programs confirm or disprove that contamination present in soil is mobile and impacting other media and allow for further actions to be completed if results show significant impacts.

- The storm sewer system in Zone 1 is a potential migration pathway for contaminants present in groundwater.

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

An FS is currently being prepared for Zone 1 soil and groundwater. The Navy is currently resolving ecological risk issues related to the adjacent Thames River. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy for Zone 1 will be selected after the FS is finalized.

## 8.3 REMEDIAL ACTIONS

### 8.3.1 Remedy Selection

A final remedy has not been selected or implemented for Zone 1, which includes Site 10. An FS is currently being prepared to evaluate remedial alternatives for the zone. The Lower Subase RI recommended that the FS for Zone 1 evaluate, to the extent possible, passive and/or in-situ remedial alternatives and the use of institutional controls. In addition, hot spot removal actions should also be considered in the FS for Zone 1. The RI also recommended that the FS evaluate limited action scenarios for groundwater and the storm sewer system of Zone 1 in conjunction with soil remedial alternatives.

### 8.3.2 Remedy Implementation

A final remedy has not yet been chosen for Zone 1. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy for Zone 1 will be selected after the FS is finalized.

## 8.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of Site 10. The recommendations from the First 5-Year Review Report are provided below along with the actions that were taken to address the recommendations.

It was recommended that the FS be completed to determine the appropriate remedial action for Zone 1 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative.

- The FS for the Lower Subase is in progress, and it is expected to be completed in 2007. Ecological issues related to the Thames River are currently being resolved. A decision document will be prepared upon completion of the FS.

It was also recommended that there be enforcement of the IR Site Use Restriction Instruction (Navy, 2000b).

- The instruction was updated to include the Goss Cove Landfill and was reissued in 2003. The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information for Site 2A - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON. The instruction has been enforced as appropriate at Site 10.

## 8.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 8.5.1 Document Review

New London Instruction 5090.18C was the only document reviewed for the second five-year review of Site 10. Within the past 5 years, no other documents have been completed regarding this site.

### 8.5.2 Data Review

No new data was collected from the site over the past 5 years. No monitoring or O&M activities have been initiated at the site because a final remedy has not been selected.

### 8.5.3 ARAR and Site-Specific Action Level Changes

A remedy has not been selected and a ROD has not been signed for Zone 1; therefore, ARARs and site-specific action levels have not been identified for Zone 1.

### 8.5.4 Site Inspection

The Lower Subase was visually inspected on April 4, 2006 as the inspection team drove through the area. Zone 1 is covered with pavement or buildings and is located near the Thames River and a set of railroad tracks. The Lower Subase is a high-security area at NSB-NLON and to avoid security issues the team conducted a drive through inspection lead by the Navy. Weather conditions during the inspection were cold (mid-40s), overcast, and windy. Representatives from the Navy, EPA, CTDEP, TtNUS, ECC, and Gannett Fleming participated in the inspection. No issues were identified and no photos of the zone were taken during the inspection. The Navy has no plans to change the current use of the site.

### 8.5.5 Site Interviews

No official interviews were conducted as part of the second five-year review.

## 8.6 ASSESSMENT

Because a final remedy has not been selected for Zone 1, conclusions cannot be made at this time to support the determination that the remedy for Zone 1 is protective of human health and the environment. The results of the Lower Subase RI do not indicate any imminent threats to human health or the environment.

The Navy has an IR Site Use Restriction instruction in place at NSB-NLON [SOPA (ADMIN) NLONINST 5090.18C]. The policy restricts ground surface disturbance of soils and any subsurface disturbance of soils and/or groundwater at IR sites.

## 8.7 ISSUES

A final remedy has not been selected for Zone 1; therefore, deficiencies cannot be determined at this time.

## 8.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that the FS be completed to determine an appropriate remedial action for Zone 1 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative. It is also recommended that there be continued enforcement of the IR New London Instruction.

## 8.9 PROTECTIVENESS STATEMENT

A protectiveness determination for Zone 1, which includes Site 10, cannot be made at this time because a remedy has not yet been selected for the zone. The results of the Lower Subase RI do not indicate any imminent threats to human health or the environment under current land use scenarios. The Navy has instituted an instruction that provides land use controls and restricts site activities. The instruction should minimize unauthorized and unplanned exposure to contaminated media at the zone until a remedy is selected and implemented. The Navy is currently addressing data gaps for the zone as part of development of the FS.

ACAD: 0083CM15.dwg 06/07/06 MF PIT

ZONE 1
ZONE 2
ZONE 3
TANK H-54 (REPLACED)
FOMW13
FOMW14
FOMW15
FOMW16
13MW1
13MW2
13MW3 (DESTROYED)
NES07
SITE 10
SITE 11
TB5-1RI
TB6-1RI
TB7-1RI
TB8-1RI
TB9-1RI
13TB13
13MW18
13MW5
GS-31L
BLDG 89
TB4-1RI
13TB17/13MW20
13MW4 (DESTROYED)
BUILDING 89 UST INVESTIGATION UST Z01 (REMOVED)
PC
TGN
TGS
13TB15/13MW21
GS-32L
13TB16/13MW19
TB3-1RI
13MW7 (DESTROYED)
NES03 (DESTROYED)
TB2-1RI
13MW8
TB1-1RI
GS-29L
GS-30L
NES04
GS-25L
SW/SD1-1RI
13MW9
GS-26L
GS-28L
NES01 (DESTROYED)
NES02 (DESTROYED)
SW/SD4-1RI
SW/SD3-1RI
SW/SD2-1RI
AMBERJACK RD.
ARGONAUT RD.
CISCO RD.
CAPELIN RD.
BULLHEAD RD.
ALBACORE RD.
PIER 8
PIER 10
PIER 12
13TB4A
13TB4
QW-6
13TB2A
13TB3A
13TB3
WE4A

**LEGEND:**

- LOWER SUBASE RI SURFACE WATER/ SEDIMENT LOCATION
- LOWER SUBASE RI TEST BORING LOCATION
- MANHOLES
- CATCH BASINS

**HISTORIC SAMPLING LOCATION IDENTIFIER:**

- MONITORING WELL LOCATION
- TEST BORING LOCATION
- DIRECT PUSH SAMPLE LOCATION
- ABANDONED OR DESTROYED MONITORING WELL
- SEDIMENT SAMPLE LOCATION
- STORM SEWER MONITORING LOCATION
- CAGGED RIBBED MUSSEL LOCATION
- SITE BOUNDARY
- ZONE BOUNDARY
- EXISTING FUEL PIPELINE
- SANITARY SEWER LINES
- STORM SEWER LINES
- STEAM/CONDENSATE LINES

0 100 200
GRAPHIC SCALE IN FEET

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

| | | | |
|---|---|---|---|
| DRAWN BY MF | DATE 5/19/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 10 - FUEL STORAGE TANKS AND TANK 54-H<br>NSB-NLON<br>GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

CONTRACT NO. 0083
OWNER NO. 038
APPROVED BY CAR DATE 6/7/06
DRAWING NO. FIGURE 8-1
REV. 0

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

# 9.0 SITE 11 – LOWER SUBASE – POWER PLANT OIL TANKS (OU4)

This five-year review is being conducted for Site 11 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. Site 11 is currently being investigation under CERCLA. No decision documents have been prepared for this site.

## 9.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 11 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Four USTs in place. | WW II |
| IAS detected leakage from tanks and recommended replacement of the tanks. | 1982 |
| Tanks A and B used to store No. 6 fuel oil. | WW II – 1980s |
| Tank C used to store diesel oil. | WW II – mid-1980s |
| Tank D used to store waste oil. | WW II – mid-1980s |
| Three new USTs installed. | mid-1980s |
| Final Site Investigation recommended further review of the operation and distribution of oil in Building 29. | 1987 |
| Phase I RI Report completed. | 1992 |
| Phase II RI Report completed. | 1997 |
| Final Lower Subase RI Report completed. | 1999 |
| First Five-Year Review performed | December 2001 |
| Draft Final FS for Soil and Groundwater at the Lower Subase completed. | July 2002 |
| SOPA (ADMIN) New London Instruction 5090.18C updated. | December 2006 |

## 9.2 BACKGROUND

Site 11 consists of four former USTs (A, B, C, and D) located immediately east of Building 29. The site map is included as Figure 9-1. The location of Site 11 in relation to the other IR sites is shown on Figure 1-2. Concrete tanks A and B each had a capacity of 170,000 gallons and were used to store No. 6 grade fuel oil that was pumped from the Tank Farm located at the southern end of NSB-NLON. Concrete tanks C and D each had a capacity of 170,000 gallons. Tank C was used to store diesel oil, and Tank D was

used to store waste oil generated by the bilge water oil recovery system at the power plant. The tanks were installed during World War II and were decommissioned in the mid-1980s. The old concrete tanks were repaired and are now used as containment structures for three new, 150,000-gallon steel tanks.

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

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

This site was included in the Phase II RI (B&RE, 1997a) and Lower Subase RI (TtNUS, 1999b). Sites 10 and 11 were evaluated collectively as Zone 1 in the Phase II RI and Lower Subase RI. Because of this approach, the remainder of this section discusses information in terms of Zone 1.

The Lower Subase RI recommended that Zone 1 proceed to an FS for evaluation of appropriate remedial alternatives for soil and limited actions for groundwater. Because of the extensive amount of underground utilities in Zone 1 and the nature of the activities conducted at this location (i.e., national security), the FS for this zone should evaluate, to the extent possible, passive and/or in-situ remedial alternatives and the use of institutional controls. In addition, “hot spot” removal actions, in lieu of full-scale excavation, should also be considered in the Zone 1 FS. It is also recommended that the FS evaluate limited action scenarios for groundwater and the storm sewer system of Zone 1, in conjunction with soil remedial alternatives. The scenarios evaluated for groundwater should include free-phase product removal from monitoring well 13MW18 and a monitored natural attenuation/tiered groundwater monitoring program. These recommendations are based on the following information:

- The nature and extent of organic and inorganic contamination in soil are well defined to the extent practical considering infrastructure limitations.

- The baseline HHRA indicates that noncarcinogenic risks for the construction worker under the RME scenario slightly exceed 1.0. The assessment also shows that carcinogenic risks for the construction worker, full-time employee, and the hypothetical future resident under the RME scenario and for the hypothetical future resident under the CTE scenario are in excess of the CTDEP cumulative target

risk level. In addition, carcinogenic risks for the full-time employee and hypothetical future resident under the RME scenario exceed the USEPA target risk range.

- Based on a comparison of analytical results with conservative, generic mobility criteria, organic and inorganic contamination in soil has the potential to migrate and impact groundwater at this site. Groundwater analytical data confirm these screening results and indicate that limited migration is currently occurring.

- Monitored natural attenuation or bioremediation could be feasible alternatives for the petroleum contamination in soil.

- Significant amounts of petroleum contamination remain in the soils of Zone 1; however, the historical source(s) of petroleum contamination have been eliminated (i.e., the leaking Site 10 and 11 USTs, the Building 89 UST, and the fuel distribution line have been removed and/or repaired). The Navy has implemented leak detection systems for all USTs and conducts regular pressure testing and repairs on fuel distribution lines.

- The zone is generally covered with pavement or buildings, which minimizes direct exposure to contaminated soil by human receptors.

- The groundwater at Zone 1 is not currently or anticipated to be used in the future as a potable water source because it is brackish; therefore, there is no imminent threat to human health.

- The ERA for the Thames River adjacent to Zone 1 and the baseline HHRA for Zone 2 (both downgradient receptors of Zone 1) show that the risks to ecological and human receptors in these adjacent areas are currently minor. In addition, the Thames River provides significant dilution and mixing, which minimize the impact of any contaminant migration from Zone 1.

- Free-phase petroleum product was only detected in well 13MW18 during the latest round of sampling.

- Key parameters indicate that natural attenuation processes are at work in the groundwater of Zone 1, and these processes can reduce concentrations of petroleum contamination that reach the aquifer and convert the petroleum contamination to a less toxic form. Monitored natural attenuation should be further evaluated as part of the remedial strategy for Zone 1 to confirm the effectiveness of these processes. The monitored natural attenuation program should include or be part of a tiered groundwater monitoring program, similar to those currently being implemented at other NSB-NLON IRP sites. Tiered programs confirm or disprove that contamination present in soil is mobile and

impacting other media and allow for further actions to be completed if results show significant impacts.

- The storm sewer system in Zone 1 is a potential migration pathway for contaminants present in groundwater.

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

An FS is currently being prepared for Zone 1 soil and groundwater. The Navy is currently resolving ecological risk issues related to the adjacent Thames River. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy for Zone 1 will be selected after the FS is finalized.

## 9.3 REMEDIAL ACTIONS

### 9.3.1 Remedy Selection

A final remedy has not been selected or implemented for Zone 1, which includes Site 11. An FS is currently being prepared to further evaluate remedial alternatives for the zone. The Lower Subase RI recommended that the FS for Zone 1 evaluate, to the extent possible, passive and/or in-situ remedial alternatives and the use of institutional controls. In addition, hot spot removal actions should also be considered in the FS for Zone 1. The RI also recommended that the FS evaluate limited action scenarios for groundwater and the storm sewer system of Zone 1, in conjunction with soil remedial alternatives.

### 9.3.2 Remedy Implementation

A final remedy has not yet been chosen for Zone 1. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy for Zone 1 will be selected after the FS is finalized.

## 9.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of the Site 11. The recommendations from the First Five-Year Review Report are provided below along with the actions that were taken to address the recommendations.

It was recommended that the FS be completed to determine the appropriate remedial action for Zone 1 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative.

- The FS for the Lower Subase is in progress, and it is expected to be completed in 2007. Ecological issues related to the Thames River are currently being resolved. A decision document will be prepared upon completion of the FS.

In addition, it was recommended that there be enforcement of the IR Site Use Restriction Instruction.

- The instruction was updated to include the Goss Cove Landfill and was reissued in 2003. The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information for Site 2A - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON. The instruction has been enforced as appropriate at Site 11.

## 9.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 9.5.1 Document Review

New London Instruction 5090.18C was the only document reviewed for the second five-year review of Site 11. Within the past 5 years, no other documents have been completed regarding this site.

### 9.5.2 Data Review

No new data were collected from the site over the past 5 years. No monitoring or O&M activities have been initiated at the site because a final remedy has not been selected.

### 9.5.3 ARAR and Site-Specific Action Level Changes

A remedy has not been selected and a ROD has not been signed for Zone 1; therefore, ARARs and site-specific actional levels have not been identified for Zone 1.

### 9.5.4 Site Inspection

The Lower Subase was visually inspected on April 4, 2006 as the inspection team drove through the area. Zone 1 is covered with pavement or buildings and is located near the Thames River and a set of railroad tracks. The Lower Subase is a high-security area at NSB-NLON, and to avoid security issues, the team conducted a drive-through inspection lead by the Navy. Weather conditions during the inspection were cold (mid-40s), overcast, and windy. Representatives from the Navy, USEPA, CTDEP, TtNUS, ECC, and Gannett Fleming participated in the inspection. No issues were identified and no photos of the zone were taken during the inspection. The Navy has no plans to change the current use of the site.

### 9.5.5 Site Interviews

No official interviews were conducted as part of the second five-year review.

## 9.6 ASSESSMENT

Because a final remedy has not been selected for Zone 1, conclusions cannot be made to support the determination that the remedy for Zone 1 is protective of human health and the environment. The results of the Lower Subase RI do not indicate any imminent threats to human health and the environment.

The Navy has an IR Site Use Restriction Instruction in place at NSB-NLON [SOPA (ADMIN) NLONINST 5090.18C]. The policy restricts ground surface disturbance of soils or any subsurface disturbance of soils and/or groundwater at IR sites.

## 9.7 ISSUES

A final remedy has not been selected for Zone 1; therefore, deficiencies cannot be determined at this time.

## 9.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that the FS be completed to determine the appropriate remedial action for Zone 1 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative. It is also recommended that there be enforcement of the IR New London Instruction.

## 9.9 PROTECTIVENESS STATEMENT

A protectiveness determination for Zone 1, which includes Site 11, cannot be made at this time because a remedy has not yet been selected for the zone. The results of the Lower Subase RI do not indicate any imminent threats to human health or the environment under current land use scenarios. The Navy has instituted an instruction that provides land use controls and restricts excavation activities. The instruction should minimize unauthorized and unplanned exposure to contaminated media at the zone until a remedy is selected and implemented. The Navy is currently addressing data gaps for the zone as part of the development of the FS.

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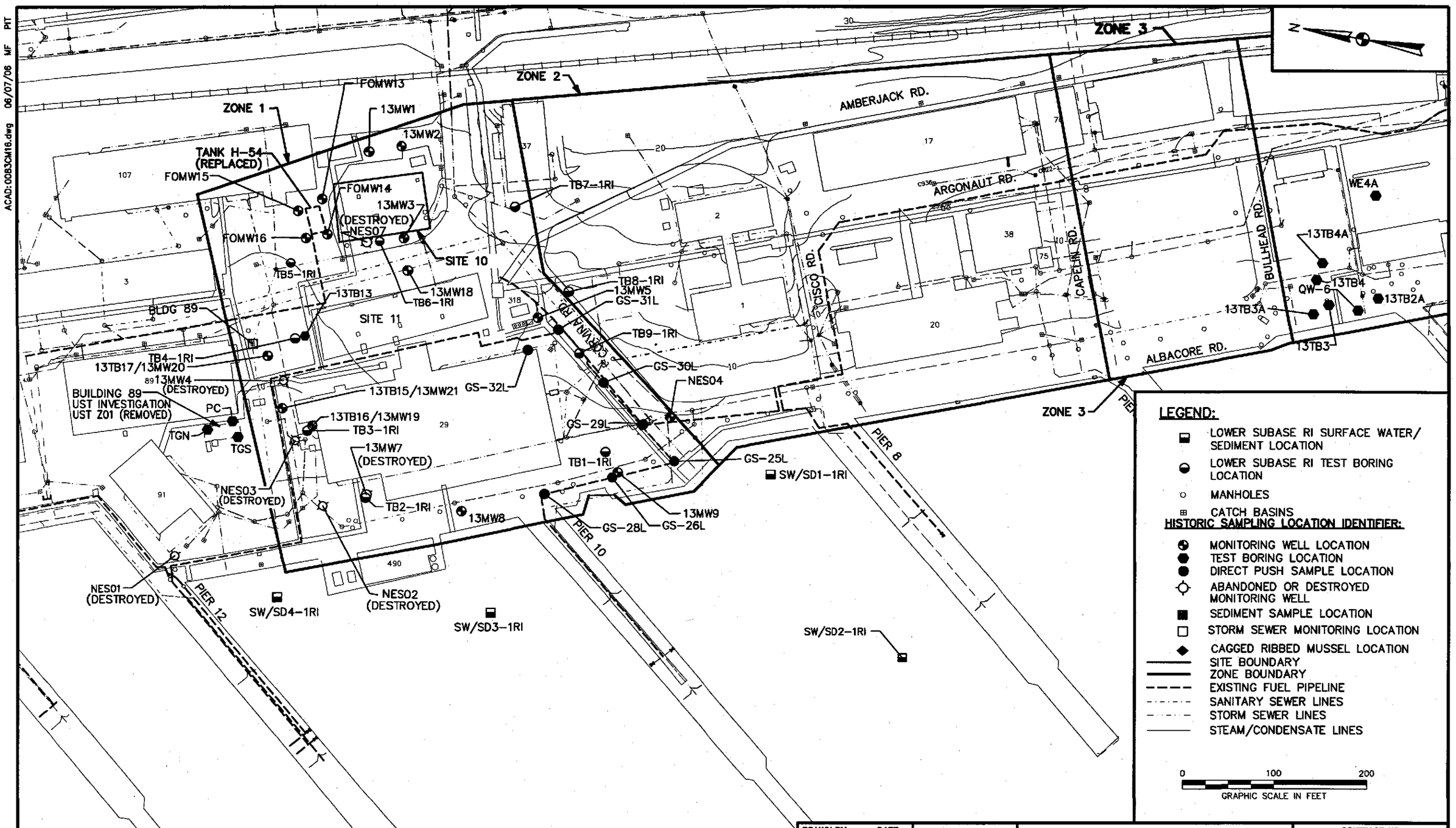


BASE MAP SOURCE: PREPARED BY THE NAVAL SUBMARINE BASE PUBLIC WORKS DEPT., ENGINEERING DIVISION, MARCH 2006, DRAWING NO. A-667.

| | | | |
|---|---|---|---|
| DRAWN BY MF | DATE 5/19/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 11 - POWER PLANT OIL TANKS<br>NSB-NLON<br>GROTON, CONNECTICUT |
| CHECKED BY | DATE | | CONTRACT NO. 0083 |
| REVISED BY | DATE | | OWNER NO. 038 |
| SCALE AS NOTED | | | APPROVED BY CAM DATE 6/7/06 |
| | | | DRAWING NO. FIGURE 9-1 REV. 0 |

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

# 10.0 SITE 13 – LOWER SUBASE – BUILDING 79 WASTE OIL PIT (OU4)

This five-year review is being conducted for Site 13 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. Site 13 is currently being investigated under CERCLA. No decision documents have been prepared for this site.

## 10.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 13 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Oil detected in soil samples from waste oil pit location. | 1979 |
| Waste oil pit filled and a recovery well system installed and operated for several months. | 1985 |
| Phase I RI completed. | 1992 |
| Quay Wall removal action completed. | 1994 |
| Phase II RI completed. | 1997 |
| Final Lower Subase RI completed. | 1999 |
| First Five-Year Review performed. | December 2001 |
| Draft Final FS for soil and groundwater at the Lower Subase completed. | July 2002 |
| SOPA (ADMIN) New London Instruction 5090.18C updated. | December 2006 |

## 10.2 BACKGROUND

Site 13 consists of the former waste oil pit located in the northwestern corner of Building 79 on the Lower Subase. The site map is included as Figure 10-1. Figure 1-2 shows the location of the site relevant to the other IR sites at NSB-NLON. The pit was formerly used as a collection area for waste oil and solvents generated during the cleaning and servicing of diesel train engines. The pit has been filled with concrete (Wehran, 1987), and a recovery well system was installed in approximately 1985. The system operated for a period of several months but was determined to be ineffective and was later abandoned.

Analytical results from soil samples collected from borings in the area of the waste oil pit indicate that subsurface contamination is primarily lubricating/motor oil (NESO, 1979). The oil was detected at a

sample interval of 6 to 9 feet below ground surface. It is estimated that the saturated volume of contamination is approximately 50 feet by 50 feet by 4 feet deep.

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

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

The Quay Wall Study Area runs from approximately Pier 2 to Pier 6 (see Figure 10-1). An investigation and removal action were completed in this area to address petroleum contamination. The area was man-made and consists of a wooden platform and quay wall that were constructed in 1940. The wooden platform is 4 inches thick and is supported by 10- to 12-inch-square wooden joists and 8-inch timber pilings. A steel bulkhead along the Thames River was erected in 1952; it was constructed of steel sheet piling and supports. During construction of the bulkhead, the quay wall and wooden platform were covered with approximately 6 to 7 feet of sand and gravel fill, and the area was paved for vehicular access along Albacore Road. The quay wall is located approximately 4 feet east of the steel bulkhead, immediately beneath the paved surface. Fill soil below the wooden platform and quay wall periodically wash out, leaving void spaces of 3 to 8 feet beneath the wooden platform. Sand and gravel fill separate the void spaces and the void spaces, are replaced with sand poured into a series of manholes along the length of Albacore Road. Natural river deposits of silt and sand underlie the void spaces and sand fill.

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

HNUS prepared a Removal Site Evaluation for the quay wall to summarize the removal actions performed in November and December 1994 to address petroleum product releases that occurred along the quay wall of the Lower Subase. A summary of the actions completed is as follows:

- From November 4 to 6, 1994, a spill response and cleanup contractor retained by the Navy completed cleanup activities.

- Approximately 2,300 gallons of oily waste water and thirty-nine 55-gallon drums, two 30-gallon drums, and one 18-gallon drum of absorbent pads contaminated with product were generated during cleanup activities.

- Five product recovery wells (QW-1 through QW-5) were subsequently installed. Oil/water was pumped from the recovery wells four times between December 5 and 21, 1994. A total of approximately 16,000 gallons of oil/water was pumped and containerized. A small percentage of the liquid pumped (less than 5 percent) was petroleum product.

One subsurface soil sample was collected from five of the six borings. Four of the soil samples (QW-2, QW-3, QW-4, and QW-5) were analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and TPH. The fifth soil sample (QW-1) was analyzed for TCL organics, TAL inorganics plus boron, TPH, and TCLP metals. Lead was identified as the only chemical of concern. Based on current and anticipated land use of the area, direct exposures to lead were not considered likely except during construction activities. Therefore, the Removal Site Evaluation recommended that no further removal action be performed at that time but that further site investigations focus on lead concentrations. It was estimated that no more than 800 gallons of petroleum were pumped from the void spaces.

A majority of the site is paved or covered with buildings. This site was included in Zone 4 of the Phase II RI and the Lower Subase RI. Because of this approach, the remainder of this section discusses information in terms of Zone 4.

The Lower Subase RI recommended that Zone 4, which includes Site 13 - Building 79 Waste Oil Pit, Site 19 - Solvent Storage Area (Building 316), the Quay Wall Study Area, and the fuel distribution pipeline, proceed to an FS to evaluate appropriate remedial alternatives. Because of the extensive amount of underground utilities in Zone 4 and the sensitive nature of the activities conducted at this location (i.e., national security), the FS for this zone should focus, to the extent possible, on evaluation of alternatives that rely on institutional controls to limit exposure to contaminated soil and passive and/or in-situ remedial alternatives. In addition, the Zone 4 FS should consider “hot spot” removal actions in lieu

of full-scale excavation. A tiered groundwater monitoring program and cleaning and repair of the Zone 4 storm sewer system should also be evaluated during the FS. These recommendations are based on the following information:

- The nature and extent of organic and inorganic contamination in the soil and groundwater are well defined to the extent practical considering infrastructure limitations.

- The baseline HHRA indicates that carcinogenic risks associated with Zone 4 exceed the USEPA acceptable risk range (i.e., the hypothetical future resident RME scenario) and CTDEP target risk level (i.e., the full-time employee and hypothetical future resident RME scenarios). In addition, modeling performed to evaluate exposures to lead showed that receptors sensitive to lead exposure (i.e., small children and fetuses of pregnant working women) are at risk in Zone 4. All the elevated risks (for lead and other chemicals) were calculated for a future exposure scenario where soils currently covered by pavement or buildings would be available for human contact. Institutional controls and/or hot spot removal actions could be used to eliminate this exposure route.

- Evidence suggests that limited organic and inorganic contamination is migrating from the site. Natural attenuation seems to be occurring in the groundwater of Zone 4 and is most likely reducing the concentrations of petroleum hydrocarbons migrating from the site. Groundwater monitoring will confirm natural attenuation and potential inorganic migration.

- Natural attenuation or bioremediation could be feasible alternatives to address petroleum contamination in soil.

- A tiered groundwater monitoring program would allow for further actions to be implemented if results show significant impacts.

- The ERA for the Thames River adjacent to Zone 4 showed that the risks to ecological receptors in this area are relatively low to moderate. Maximum concentrations of several non-AVS inorganics in Zone 4 sediments near the Lower Subase exceeded conservative guidelines (e.g., ER-Ls) indicating that potential risks may be present. The AVS/SEM analysis suggested that cadmium, copper, nickel, lead, and zinc are not bioavailable. Beryllium, boron, cobalt, thallium, and vanadium were retained as COCs because conservative sediment guidelines were unavailable. No alternate guideline was available for barium, the maximum concentration of which exceeded the conservative guideline. The COCs were concluded to not be of ecological significance in the NSB-NLON Phase II RI ERA for the Thames River. Benzo(a)pyrene was the only organic in Zone 4 sediments that had maximum concentrations in excess of guidelines. The average concentration of benzo(a)pyrene also exceeded

the guideline. The maximum concentration slightly exceeded its ER-M. Despite exceedances of guideline values by several COCs, no significant toxicity was observed in Zone 4 sediment toxicity tests from the NSB-NLON Phase II RI. Low concentrations of some PAHs were detected in a native blue mussel sample collected in Zone 4 as part of the NSB-NLON Phase II RI ERA. Chromium, mercury, and benzo(a)pyrene were not detected in that sample, indicating that they were probably not bioavailable. Boron was detected in the blue mussel sample from Zone 4 and in the blue mussel sample collected south of Zone 4 at concentrations greatly exceeding background and control concentrations. The toxicological significant is unclear due a lack to toxicity data for that metal. The NSB-NLON Phase II RI concluded that boron was not of ecological significance in the Thames River. The weight of evidence appears to indicate that potential risks to sediment-dwelling organisms from contaminants in Zone 4 sediment are present and that these potential risks are low to moderate.

- The Thames River provides significant dilution and mixing, which minimize the impact of contaminant migration from Zone 4.

- The Navy removed the waste oil pit at Building 79 and filled the area with concrete. A recovery well system was installed and operated for a short time in this area. In addition, approximately 800 gallons of petroleum product were removed via pumping from the quay wall area during a removal action in 1994.

- The Navy currently conducts regular pressure testing and repairs on the fuel distribution lines; therefore, the historical source of petroleum contamination has most likely been minimized.

- Zone 4 is covered with pavement or buildings, which minimizes the potential for direct exposure to contaminated soil by human receptors.

- The groundwater at Zone 4 is not currently or anticipated to be used in the future as a potable water source because it is brackish and classified as GB; therefore, there is no imminent threat to human health.

- The storm sewer system in Zone 4 is a potential migration pathway for contaminants present in groundwater.

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

An FS is currently being prepared for Zone 4 soil and groundwater. The Navy is currently resolving ecological risk issues related to the adjacent Thames River. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy for Zone 4 will be selected after the FS is finalized.

## 10.3 REMEDIAL ACTIONS

### 10.3.1 Remedy Selection

A final remedy has not been selected or implemented for Zone 4, which includes Site 13. An FS is currently being prepared to evaluate alternatives for the zone. The Lower Subase RI recommended that the FS for Zone 4 evaluate a range of remedial alternatives that include institutional controls to limit exposure to contaminated soil and passive and/or in-situ remedial alternatives.

### 10.3.2 Remedy Implementation

A final remedy has not yet been chosen for Zone 4. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy will be selected after the FS is finalized.

## 10.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of Site 13. The recommendations from the First Five-Year Review Report are provided below along with the actions that were taken to address the recommendations.

It was recommended that the FS be completed to determine the appropriate remedial action for Zone 4 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative.

- The FS for the Lower Subase is in progress, and it is expected to be completed in 2007. Ecological issues related to the Thames River are currently being resolved. A decision document will be prepared upon completion of the FS.

In addition, it was recommended that there be enforcement of the IR Site Use Restriction Instruction.

- The instruction was updated to include the Goss Cove Landfill and was reissued in 2003. The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information for Site 2A - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON. The instruction has been enforced as appropriate at Site 13.

## 10.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 10.5.1 Document Review

New London Instruction 5090.18C was the only document reviewed for the second five-year review of Site 13. Within the past 5 years, no other documents have been completed regarding this site.

### 10.5.2 Data Review

No new data were collected from the site over the past 5 years. No monitoring or O&M activities have been initiated at the site because a final remedy has not been selected.

### 10.5.3 ARAR and Site-Specific Action Level Changes

A remedy has not been selected and a ROD has not been signed for Zone 4; therefore, ARARs and site-specific action levels have not been identified for Zone 4.

### 10.5.4 Site Inspection

The Lower Subase was visually inspected on April 4, 2006 as the inspection team drove through the area. Zone 4 is covered with pavement or buildings and is located near the Thames River and a set of railroad tracks. The Lower Subase is a high-security area at NSB-NLON, and to avoid security issues, the team conducted a drive-through inspection lead by the Navy. Weather conditions during the inspection were cold (mid-40s), overcast, and windy. Representatives from the Navy, USEPA, CTDEP, TtNUS, ECC, and Gannett Fleming participated in the inspection. No issues were identified and no photos of the zone were taken during the inspection. The Navy has no plans to change the current use of the site.

### 10.5.5 Site Interviews

No official interviews were conducted as part of the second five-year review.

## 10.6 ASSESSMENT

Because a final remedy has not been selected for Zone 4, conclusions cannot be made to support the determination that the remedy for Zone 4 is protective of human health and the environment. The results of the Lower Subase RI do not indicate any imminent threats to human health or the environment.

The Navy has an IR Site Use Restriction Instruction in place at NSB-NLON [SOPA (ADMIN) NLONINST 5090.18C]. The policy restricts ground surface disturbance of soils or any subsurface disturbance of soils and/or groundwater at IR sites.

## 10.7 ISSUES

A final remedy has not yet been implemented for Zone 4, therefore deficiencies cannot be determined at this time.

## 10.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that the FS be completed to determine the appropriate remedial action for Zone 4 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative. It is also recommended that there be enforcement of the IR Site Use Restriction Instruction.

## 10.9 PROTECTIVENESS STATEMENT

A protectiveness determination for Zone 4, which includes Site 13, cannot be made at this time because a remedy has not yet been selected for the zone. The results of the Lower Subase RI do not indicate any imminent threats to human health or the environment under current land use scenarios. The Navy has instituted an instruction that provides land use controls and restricts excavation activities. The instruction should minimize unauthorized and unplanned exposure to contaminated media at the zone until a remedy is selected and implemented. The Navy is currently addressing data gaps for the zone as part of development of the FS.

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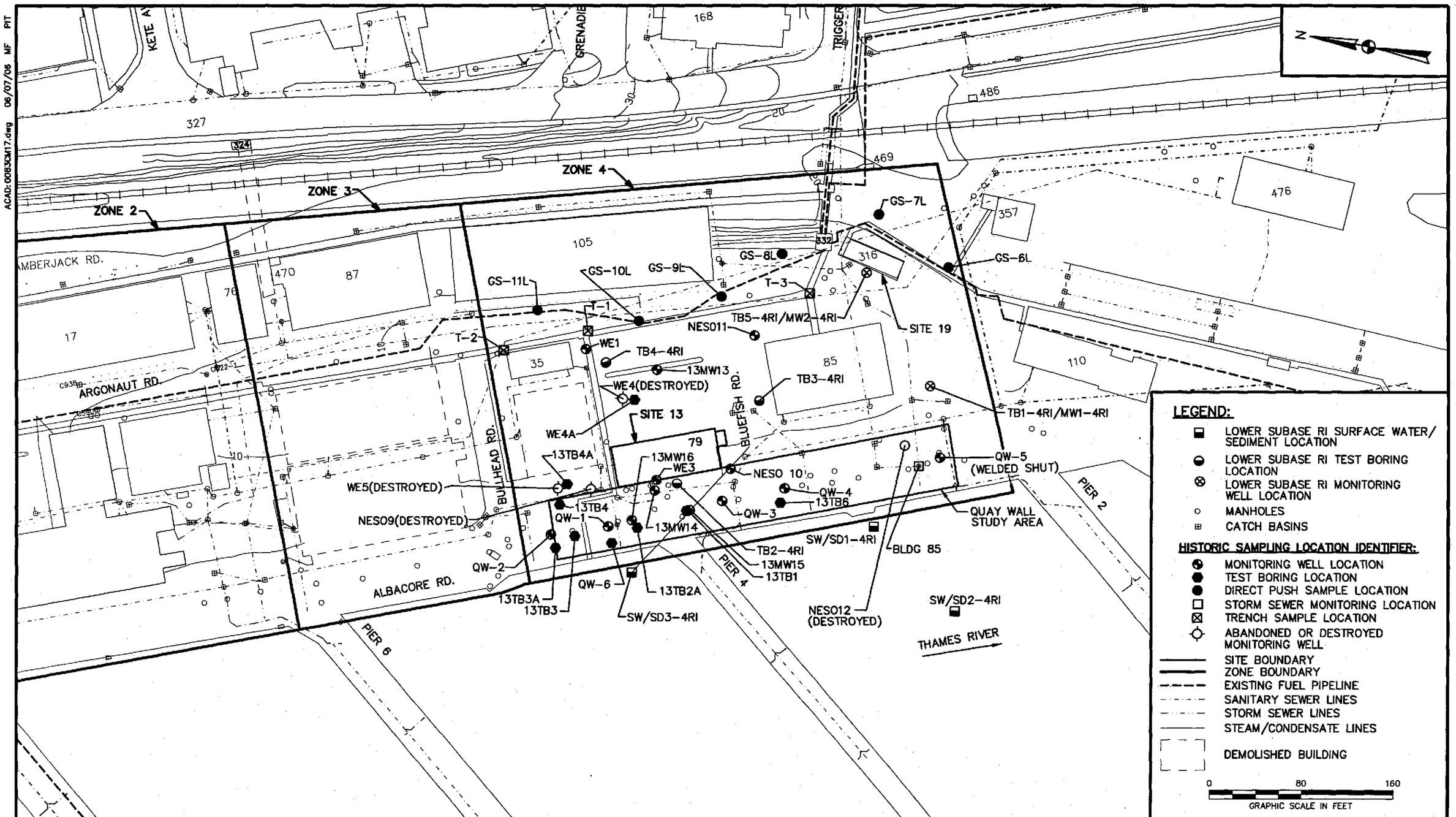


BASE MAP SOURCE: PREPARED BY THE NAVAL SUBMARINE BASE PUBLIC WORKS DEPT., ENGINEERING DIVISION. MARCH 2006, DRAWING NO. A-667.

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| DRAWN BY MF | DATE 5/22/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 13 - BUILDING 79 WASTE OIL PIT<br>NSB-NLON<br>GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
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| SCALE AS NOTED | | | |

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| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAR | DATE 6/7/06 |
| DRAWING NO. FIGURE 10-1 | REV. 0 |

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# 11.0 SITE 14 – OVERBANK DISPOSAL AREA NORTHEAST (OBDANE) (OU8 AND OU9)

This five-year review is being conducted for Site 14 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. An Action Memorandum and NTCRA for soil and waste were completed. The removal action resulted in no hazardous substances remaining in soil at the site that would limit use or restrict exposure. A NFA ROD was subsequently signed for the soil OU (OU8) in 2004 (Navy, 2004f). Evaluations showed that exposure to Site 14 groundwater would not result in any unacceptable risks to human health or the environment, and an NFA remedy was selected for the groundwater OU, a portion of OU9, in an Interim ROD (Navy, 2004b). It is expected that NFA will be the final remedy for Site 14 groundwater after remedial actions are selected for all portions of OU9.

## 11.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 14 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Miscellaneous wastes dumped over the bedrock edge. | Prior to 1972 |
| Final IAS completed. | 1983 |
| Phase I RI completed. | 1992 |
| Phase II RI completed. | 1997 |
| OBDANE EE/CA and Action Memorandum completed. | 1999 |
| NTCRA completed. | May 2001 |
| First Five-Year Review completed. | December 2001 |
| BGOURI completed. | January 2002 |
| Final Removal Action Report completed. | February 2002 |
| BGOURI Update/FS completed. | July 2004 |
| Proposed Plan for Site 7 Torpedo Shops and Site 14 OBDANE Soil (OU8) completed. | July 2004 |
| ROD for Site 7 - Torpedo Shops and Site 14 - OBDANE Soil (OU8) completed. | September 2004 |
| Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 Groundwater (OU9) completed. | September 2004 |
| Interim ROD for Sites 3, 7, 14, 15, 18, and 20 Groundwater completed. | December 2004 |

## 11.2 BACKGROUND

The OBDANE site is located in a heavily wooded area on the edge of a ravine north of Stream 3 of the Area A Downstream Watercourses, west of the Area A Weapons Center, and south of the Torpedo Shops. Prior to 1972, miscellaneous wastes were apparently dumped over the bedrock edge in circular area approximately 80 feet in diameter. A dirt road provided limited access to the wooded site. Figure 11-1 shows the general site arrangement. The location of Site 14 in relation to the other IR sites is shown on Figure 1-2. A nearly vertical 20-foot-high bedrock face is located at the eastern edge of the site. The rest of the site slopes to the southwest.

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

During the Phase I RI, surface soil samples were collected from within the limits of the identified disposal area. Based on the sample results, the RI concluded that there was negligible risk associated with Site 14 and recommended that a supplemental Step I Investigation be performed. During the Phase II RI investigation, a single shallow monitoring well was installed downgradient of the site and two rounds of groundwater samples were collected. Six additional soil samples were also collected within the limits of the disposal area and downgradient of the area. The Phase II RI concluded that all human health risks were found to be within or less than USEPA's target range; however, arsenic was found in surface soil samples at concentrations slightly exceeding State standards, and lead contamination was found in surface soil samples approximately 80 feet south of the site. The RI Report recommended that further characterization of surface soil with respect to arsenic and lead be completed.

An EE/CA and Action Memorandum for an NTCRA were prepared for Site 14 by the Navy in 1999. Removal and off-site disposal of contaminated soil and debris at the site was the recommended alternative in the Action Memorandum. A work plan for the removal action was prepared, and the removal action was completed in May 2001. Approximately 270 tons of debris and contaminated soil were removed and disposed off site. A post-removal action report was prepared to document the actions taken during the removal action. The actual cost of the NTCRA was not provided in the report, but the cost were estimated at $200,000 in the Action Memorandum. A ROD (Navy, 2004b) signed for soil at the site (OU8) in September 2004 called for NFA. This remedy was selected because the NTCRA addressed all significant risks to human health and the environment associated with the soil and debris at the site.

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

Site 14 groundwater was further evaluated in the BGOURI Update/FS Report (TtNUS, 2004). A supplemental HHRA evaluation was performed with the Site 14 groundwater data collected during the BGOURI, separate from the Site 3 groundwater data. The evaluation indicated no significant risks to potential receptors from exposure to Site 14 groundwater. Based on these results, NFA was recommended for Site 14 groundwater in the BGOURI Update/FS. An interim ROD (Navy, 2004h) signed for groundwater at the site (OU9) in December 2004 called for NFA.

## 11.3 REMEDIAL ACTIONS

### 11.3.1 Remedy Selection

The investigation of Site 14 soil identified minimal organic contamination, including low concentrations of VOCs, PAHs, and pesticides, and slightly more significant inorganic contamination (e.g., arsenic and lead). The HHRA indicated that risks to potential receptors associated with Site 14 soil were minimal; however, the results of the ERA indicated that the chemicals detected in Site 14 soil could adversely impact ecological receptors. An NTCRA was conducted at Site 14 in 2001. By removing all debris and contaminated soil with concentrations greater than the remedial goals that were protective of human health and ecological receptors [i.e., combination of ecological-based goals selected for the Site 3 (OU3) remedial action and Connecticut GB Pollutant Mobility Criteria], all site-related risks were addressed, and

no future adverse health affects are anticipated from exposure to Site 14 soil. The remedy selected for Site 14 soil in the ROD was NFA under CERCLA.

No significant contamination was discovered in groundwater at Site 14 during the BGOURI; therefore, the selected remedy was NFA. The NFA remedy for groundwater at Site 14 is an interim remedy, but it is expected that it will be the final remedy after remedial actions are selected for all portions of OU9.

### 11.3.2 Remedy Implementation

The selected remedies for Site 14 soil and groundwater were NFA; therefore, remedy implementation is not a concern for Site 14.

### 11.3.3 System Operations/Operation and Maintenance

O&M is not required at Site 14 because the selected remedies for Site 14 soil and groundwater were NFA.

## 11.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of the Site 14. The recommendations from the First Five-Year Review Report are provided below along with the actions that were taken to address the recommendations.

The post-removal action report should be completed to document the NTCRA. The results of the confirmatory sampling and post-removal action risk analysis should be documented in the report.

- A Final Removal Action Report was completed in 2002.

A NFA decision document should be prepared for the soil OU.

- An NFA ROD for Site 14 soil (OU8) was signed in 2004.

The FS for the groundwater OU at the site should be completed to determine the appropriate remedial alternatives for groundwater.

- Site 14 groundwater was evaluated in the BGOURI Update/FS that was completed in 2004. An Interim ROD for Site 14 groundwater, which is a part of OU9, was signed in 2004. The selected remedy for groundwater was NFA.

It is recommended that there be enforcement of the IR Site Use Restriction Instruction.

- The instruction was enforced at Site 14 until the RODs were signed in 2004. Because there are no remaining unacceptable risks related to Site 14 soil and groundwater, enforcement of the instruction at Site 14 is not necessary in the future.

## 11.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 11.5.1 Document Review

The documents reviewed for the second five-year review are listed below, and key information obtained from the documents is summarized in the following sections.

| | |
|---|---|
| BGOURI | January 2002 |
| Final Removal Action Report | February 2002 |
| BGOURI Update/FS | July 2004 |
| Proposed Plan for Site 7 Torpedo Shops and Site 14 OBDANE Soil (OU8) | July 2004 |
| ROD for Site 7 - Torpedo Shops and Site 14 – OBDANE Soil (OU8) | September 2004 |
| Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 Groundwater (OU9) | September 2004 |
| Interim ROD for Sites 3, 7, 14, 15, 18, and 20 Groundwater | December 2004 |

### 11.5.2 Data Review

Monitoring and O&M were not necessary for this site; therefore, there were no data available for review.

### 11.5.2 ARAR and Site-Specific Action Level Changes

No changes have occurred in ARARs or site-specific action levels that would affect the remedial goals selected in the Action Memorandum and used to complete the NTCRA. The selected remedies for Site 14 soil and groundwater in the RODs were NFA.

### 11.5.3 Site Inspection and Site Interviews

Because the selected remedies for soil and groundwater were NFA, no site inspection or site interviews were performed.

## 11.6 ASSESSMENT

The following conclusions support the determination that the remedy for the Site 14 is currently protective of human health and the environment.

***Question 1. Is the remedy functioning as intended by the decision documents?***

The remedies for both soil and groundwater are NFA.

***Question 2. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?***

- ***Changes in Standards and TBCs***: ARARs and TBCs considered during preparation of the Action Memorandum and ROD for Site 14 soil and the ROD for Site 14 groundwater were reviewed, and no changes have occurred that would change the selected remedies of NFA.

- ***Changes in Exposure Pathways:*** There have been no changes at the site that would have resulted in new exposure pathways to human or ecological receptors.

- ***Changes in Toxicity and Other Contaminant Characteristics:*** There have been no changes in human health toxicity criteria that would impact the selected remedy of NFA for Site 14 soil and groundwater.

- ***Changes in Risk Assessment Methods:*** As discussed in Section 1.4, there have been no major changes in HHRA methodology since the signing of the RODs for Site 14 soil and groundwater that would impact the protectiveness of the remedies.

- ***Expected Progress Towards Meeting RAOs:*** The RAOs for Site 14 soil (OU8) were met by excavating and disposing of contaminated soil with concentrations in excess of the remedial goals at an approved disposal facility. The remedy selected for Site 14 groundwater was NFA; therefore, RAOs were not required.

***Question 3. Has any other information come to light that could call into question the protectiveness of the remedy?***

No additional information has been identified that would call into question the protectiveness of the remedy.

## 11.7 ISSUES

Monitoring well 14MW1S has not been abandoned. Because no additional sampling is required from the well, the well should be properly abandoned.

## 11.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that no additional five-year reviews of Site 14 be completed because the remedies implemented at the site did not result in hazardous substances, pollutants, or contaminants remaining on site in excess of levels that allow for unlimited use and unrestricted exposure. It is also recommended that a well abandonment program be developed and implemented to properly abandon monitoring well 14MW1S.

## 11.9 PROTECTIVENESS STATEMENT

The remedy is protective of human health and the environment because all debris and contaminated soil with concentrations greater than the remedial goals was removed, and there are no unacceptable risks to human health or the environment from current or potential future exposure to soil or groundwater at Site 14.

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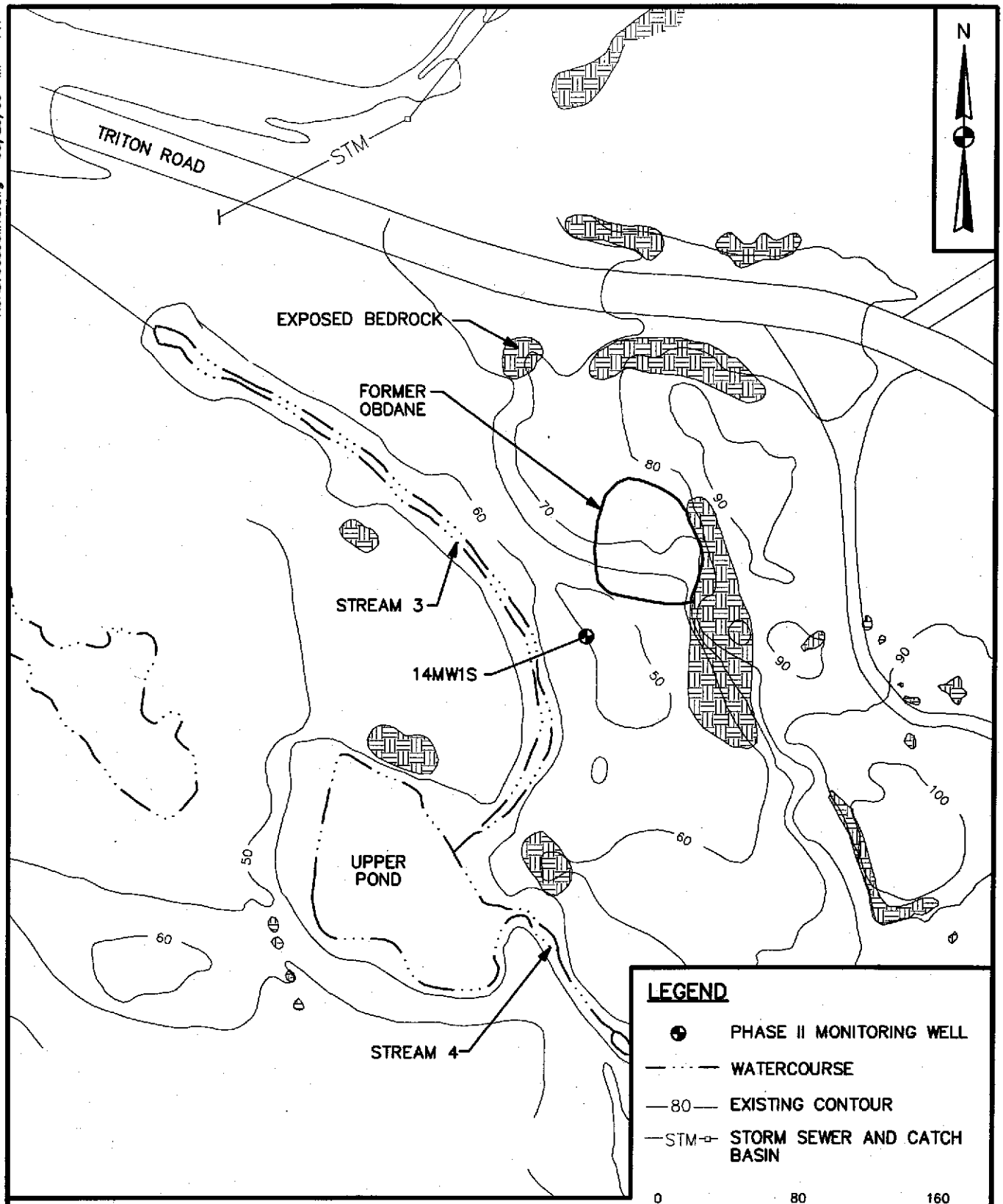


BASE MAP SOURCE: PREPARED BY THE NAVAL SUBMARINE BASE PUBLIC WORKS DEPT., ENGINEERING DIVISION. MARCH 2006, DRAWING NO. A-667.

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| DRAWN BY MF | DATE 5/22/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 14, OBDANE<br>NSB-NLON<br>GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
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| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAR | DATE 6/7/06 |
| DRAWING NO. FIGURE 11-1 | REV. 0 |

FORM CADD NO. TTNUS-AV.DWG – REV 1 –9/10/98

# 12.0 SITE 15 – SPENT ACID STORAGE AND DISPOSAL AREA (OU6 AND OU9)

This five-year review is being conducted for Site 15 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. An Action Memorandum and TCRA were completed at the site in 1995. The TCRA resulted in no hazardous substances remaining in soil at the site that would limit use or restrict exposure. An NFA remedy was selected in the ROD for Site 15 soil (OU6) in 1997 (Navy, 1997b). Further evaluation of Site 15 groundwater, a portion of OU9, indicated no contaminants in groundwater that would limit use or restrict exposure. An Interim ROD for Site 15 groundwater (Navy, 2004h) was signed, and the selected remedy was NFA. It is expected that NFA will be the final remedy for Site 15 groundwater after remedial actions are selected for all portions of OU9.

## 12.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 15 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Temporary storage of waste battery acid. | World War II period |
| Final IAS completed. | 1983 |
| Phase I RI completed. | 1992 |
| Draft FFS completed. | 1994 |
| Action Memorandum completed. | 1995 |
| TCRA completed. | 1995 |
| Final Report for Soil Remediation at Site 15 completed. | 1995 |
| Phase II RI completed. | March 1997 |
| ROD for Site 15 soil signed. | September 1997 |
| First Five-Year Review completed. | December 2001 |
| BGOURI completed. | January 2002 |
| BGOURI Update/FS completed. | July 2004 |
| Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 Groundwater (OU9) completed. | September 2004 |
| Interim ROD for Sites 3, 7, 14, 15, 18, and 20 Groundwater signed. | December 2004 |

## 12.2 BACKGROUND

The SASDA was located in the southeastern section of NSB-NLON, between the southern sides of Buildings 409 and 410. Figure 12-1 displays the general site arrangement. Figure 1-2 shows the location

of the site relative to the other IR sites at NSB-NLON. The site consisted of a concrete storage pad and an underground storage tank.

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

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

Site 15 was investigated during the Phase I RI (Atlantic, 1992) and an FFS (Atlantic, 1994b). Soil and groundwater samples were collected and analyzed during the investigations to characterize the site and to determine appropriate remedial alternatives. The results of the RI and FFS suggested that a removal action should be completed to address the tank and associated contamination. An Action Memorandum was prepared and a TCRA was completed by OHM in January 1995. The tank, 318 tons (200 cubic yards) of lead-contaminated soil, contaminated pavement, and the tank contents were removed and disposed off site. The September 1995 Final Report for Soil Remediation (OHM, 1995b) indicated that all soil around and beneath the spent acid tank to a depth of 4 feet below ground surface, or with a total lead concentration of 500 mg/kg or more, or a TCLP extract lead concentration of 5.0 mg/L or more, was excavated and properly disposed. The excavated area was filled with clean borrow material and covered with bituminous pavement.

The site was further evaluated during the Phase II RI (B&RE, 1997a). The soil OU at Site 15 was designated as OU6, and Site 15 groundwater is part of OU9. The Phase II RI included the collection and analysis of soil and groundwater samples from the site. The field investigation was conducted prior to the TCRA, but the only data evaluated during the RI were associated with sample locations that were not excavated during the TCRA. This approach provided an assessment of post-TCRA conditions at the site. The RI recommended that limited additional sampling be completed to verify that the remaining soil did not contain significant contaminant concentrations that would impact the groundwater beneath the site. The RI also recommended that if the sampling results confirmed that the soil would not impact groundwater, an NFA decision document should be prepared for soil.

Based on the recommendations of the Phase II RI, the CTDEP completed additional sampling and analysis at the site in 1997. The results of this sampling indicated that remaining concentrations of

inorganics in soil did not present a contaminant migration concern between soil and groundwater. Using these results, the Navy subsequently prepared an NFA Source Control ROD for the site. The ROD was signed in September 1997 (Navy, 1997b).

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

A DGI was conducted in the fall of 2002 and presented in the BGOURI Update/FS (TtNUS, 2004). The data collected during the DGI were used to confirm the nature and extent of contamination associated with Site 15 soil and groundwater and to determine the risks to human receptors from exposure to Site 15 media. The sampling program was focused on the groundwater contaminants (e.g., TCE, chromium, and silver) identified during the BGOURI. The DGI results indicated that no contamination remaining in soil is acting as a source of contamination to the groundwater and that there is no significant groundwater contamination at the site. The HHRA and data screening results indicated that there are no groundwater or soil COCs for the site. Comparison of the Phase II RI and DGI analytical results to the BGOURI results indicated that the BGOURI results were anomalies and were not representative of site conditions. The cause(s) of the BGOURI anomalies may have been the field sampling methodology and/or laboratory issues. Based on the results of the DGI, it was recommended that the existing NFA ROD for Site 15 soil did not need to be amended and that an NFA decision document should be prepared for Site 15 groundwater.

A Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 Groundwater at NSB-NLON was released for public comment on September 24, 2004. The Interim ROD for groundwater was subsequently signed in December 2004.

## 12.3 REMEDIAL ACTIONS

### 12.3.1 Remedy Selection

A TCRA was completed at this Site 15 in January 1995. The results of the Phase I RI and the FFS were used to determine that a removal action was necessary. An Action Memorandum was prepared to document the decision process used to select the removal action. The remedial goals for the removal action were 500 mg/kg for total lead in soil and 5.0 mg/L for TCLP lead extract. After the TCRA and subsequent investigations were completed, it was determined that the soil OU at the site did not pose unacceptable risks to human health or the environment. Subsequently, a NFA Source Control ROD was signed for the site in September 1997. Based on the results of the DGI, it was determined that there was no need to amend the existing NFA ROD for OU6.

The BGOURI DGI analytical results indicated that the groundwater at Site 15 did not pose any significant risks to human health or the environment. Because there were no unacceptable risks and no COCs associated with the site's groundwater, a NFA remedy was selected in an Interim ROD (Navy, 2004h). The NFA remedy is an interim remedy, but it is expected to be the final remedy once remedial actions are selected for all portions of OU9.

### 12.3.2 Remedy Implementation

The selected remedies for Site 15 soil and groundwater were NFA; therefore, remedy implementation is not a concern at Site 15.

### 12.3.3 System Operations/O&M

O&M is not required at Site 15 because the selected remedies for Site 15 soil and groundwater were NFA.

## 12.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of Site 15. The recommendations from the First Five-Year Review Report are provided below along with the actions that were taken to address the recommendations.

The BGOURI should be finalized and an FS should be completed for the groundwater OU. Additional investigations should be completed as necessary to develop appropriate remedial alternatives during the FS. The results of the RI and FS should be used to select an appropriate remedial action for the groundwater OU as well as determine whether the NFA ROD for soil should be revisited and revised.

A DGI was performed and the BGOURI was updated. Based on the results of the DGI, it was determined that there was no need to amend the existing NFA ROD for OU6. The RI Update also recommended that there was no need to prepare an FS for the groundwater OU at Site 15 and an NFA decision document should be prepared for the groundwater OU. A ROD for Site 15 groundwater was signed in 2004 and the selected remedy was NFA.

It is also recommended that there be continued enforcement of the IR Site Use Restriction Instruction, especially if the car wash is constructed at the site.

- The instruction was enforced at Site 15 until the RODs were signed for the soil and groundwater. Because there are no hazardous substances, pollutants, or contaminants remaining on site in excess of levels that allow for unlimited use and unrestricted exposure, enforcement of the instruction at Site 15 is not necessary in the future.

## 12.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 12.5.1 Document Review

The following documents were reviewed for the second five-year review, and key information obtained from the documents is summarized in the following sections.

| | |
|---|---|
| BGOURI | January 2002 |
| BGOURI Update/FS | July 2004 |
| Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 Groundwater (OU9) | September 2004 |
| Interim ROD for Sites 3, 7, 14, 15, 18, and 20 Groundwater | December 2004 |

### 12.5.2 Data Review

Monitoring or O&M were not necessary for this site; therefore, there were no data available for review.

### 12.5.3 ARAR and Site-Specific Action Level Changes

No changes have occurred in ARARs or site-specific action levels that would affect the remedial goals selected in the Action Memorandum and used to complete the TCRA. The selected remedies for Site 15 soil and groundwater were NFA.

### 12.5.4 Site Inspection

Because the selected remedies for soil and groundwater were NFA, no site inspection was performed.

### 2.5.5 Site Interviews

No formal interviews were conducted for this site as part of the second five-year review because there were not active site issues to discuss.

## 12.6 ASSESSMENT

The following questions were answered to determine if the remedy at Site 15 is protective of human health and the environment.

***Question 1. Is the remedy functioning as intended by the decision documents?***

The remedies for both soil and groundwater are NFA.

***Question 2. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?***

- ***Changes in Standards and TBCs*:** ARARs and TBCs considered during preparation of the Action Memorandum and ROD for Site 15 soil and the ROD for Site 15 groundwater were reviewed and no changes have occurred that would change the selected remedies of NFA.

- ***Changes in Exposure Pathways:*** Potential changes in site conditions that could affect exposure pathways were identified during the first five-year review. A change in land use at the site from a parking lot to a car wash was planned. Short-term exposure to site soil and groundwater could have occurred during construction of the car wash. However, the plans were never implemented, and the site remains a parking lot. No changes in site conditions are expected in the near future.

- ***Changes in Toxicity and Other Contaminant Characteristics:*** There have been no changes in the human health toxicity criteria that would impact the selected remedy of NFA for Site 15 soil and groundwater.

- ***Changes in Risk Assessment Methods:*** As discussed in Section 1.4, there have been no major changes in HHRA methodology since the signing of the RODs for Site 15 soil and groundwater that would impact the protectiveness of the remedies.

- ***Expected Progress Towards Meeting RAOs:*** The RAOs for Site 15 soil (OU6) were met by completing the TCRA which involved removing the tanks, excavating contaminated soil, and disposing the contaminated soil at an approved off site disposal facility. The remedy selected for Site 15 groundwater was NFA; therefore, RAOs were not required.

***Question 3. Has any other information come to light that could call into question the protectiveness of the remedy?***

No additional information has been identified that would call into question the protectiveness of the remedy.

## 12.7 ISSUES

The monitoring wells at Site 15 have not been properly abandoned. Because no additional sampling is required from the wells, they should be properly abandoned.

## 12.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that no additional five-year reviews of Site 15 be conducted because the remedies implemented at the site did not result in hazardous substances, pollutants, or contaminants remaining on site in excess of action levels that allow for unlimited use and unrestricted exposure. It is also recommended that a well abandonment program be developed and implemented to properly abandon monitoring wells at Site 15.

## 12.9 PROTECTIVENESS STATEMENT

The remedy is protective of human health and the environment because the TCRA removed all soil with concentrations of COCs greater than the remedial goals, and there are no unacceptable risks to human health or the environment from current or potential future exposure to groundwater at Site 15.

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PAVEMENT

410

30

APPROXIMATE LOCATION OF CONCRETE APRON

15TW01

15MW2S

15SB03

15TW02

15TW03

15MW1S

15MW1D

FORMER SPENT ACID STORAGE TANK

APPROXIMATE LIMIT OF EXCAVATION

15SB01

15SB02

15MW3S

FUEL FARM

PAVEMENT

409

N

**LEGEND:**

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

**NOTE:**

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

0 30 60

GRAPHIC SCALE IN FEET

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

| | | | |
|---|---|---|---|
| DRAWN BY MF | DATE 5/22/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 15 - SPENT ACID STORAGE AND DISPOSAL AREA<br>NSB-NLON<br>GROTON, CONNECTICUT |
| CHECKED BY | DATE | | CONTRACT NO. 0083 |
| REVISED BY | DATE | | OWNER NO. 038 |
| SCALE AS NOTED | | | APPROVED BY CAL DATE 6/7/06 |
| | | | DRAWING NO. FIGURE 12-1 REV. 0 |

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

# 13.0 SITE 16 – HOSPITAL INCINERATORS (OU11)

This five-year review is being conducted for Site 16 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. Investigation of Site 16 did not identify any hazardous substances that would limit use or restrict exposure. A ROD for Site 16 soil OU (OU11) was signed in 2004 (Navy, 2004g), and the selected remedy was NFA. No groundwater was encountered at Site 16.

## 13.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 16 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Naval Hospital Groton operated skid-mounted waste incinerator. | 1980s |
| IAS completed. | 1983 |
| FFA signed. | 1995 |
| First Five-Year Review performed. | December 2001 |
| BGOURI completed. | January 2002 |
| Proposed Plan for Sites 16 and 18 Soil (OU11) issued. | July 2004 |
| ROD for Sites 16 and 18 Soil (OU11) signed. | September 2004 |

## 13.2 BACKGROUND

Site 16 consists of the two former locations where the skid-mounted hospital incinerator was reportedly located. In the 1980s, the Naval Hospital Groton operated the skid-mounted waste incinerator at two sites adjacent to the base hospital. The two sites (16-A and 16-B) are located west of Tautog Road, adjacent to Building 449 and Building 452. The site map is included as Figure 13-1. The location of the site relative to other IR sites is shown on Figure 1-2.

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

Site 16 was evaluated during the IAS (Envirodyne, 1983) for NSB-NLON that was conducted in March 1983. No sampling activities were conducted as part of the study. The study's recommendation for this

site was that no further investigation was necessary because, at the time of the IAS study, the site was still operational. As a result of this, no investigation of Site 16 was conducted during either the Phase I or the Phase II RIs. The Navy subsequently ceased operations of the incinerator at the hospital.

The site was investigated during the BGOURI (TtNUS, 2002a) to determine the impact of the operation of the incinerator. The objectives of the BGOURI at Site 16 were to perform an initial characterization of the nature and extent of contamination at the site and to quantify the risks to human receptors associated with the site. Risks to ecological receptors were not evaluated during the RI, in accordance with the final work plan, because the site is paved.

The BGOURI focused on soil at Site 16. Surface and subsurface soil samples were collected for analysis during test boring activities. Temporary groundwater monitoring wells were not installed at Site 16 because shallow bedrock was encountered (at 3 feet below ground surface), the depth to groundwater was estimated at 70 feet below ground surface, and the potential site contaminants (dioxins/furans, PCBs, and metals) and release mechanism (skid-mounted incinerator) would typically not impact groundwater.

In addition to the sampling and analytical program, interviews were conducted during the BGOURI to obtain historical information about the incinerator. Personnel at the Naval Groton Hospital (i.e., the director of records and the regional coordinator) and the NSB-NLON Public Works Department were contacted regarding this issue. None of the personnel knew any historical information about the incinerator or could provide any insight into its operation.

The nature and extent of contamination and HHRA results from the BGOURI indicated that past operation of the skid-mounted incinerator at Site 16 did not significantly impact the surrounding soil and the site soils do not pose significant risks to any potential human receptors. All ILCRs for exposure to soil at Site 16 were less than or within USEPA's target risk range and CTDEP's acceptable risk level for cumulative exposures. All HIs for exposure to soil at Site 16 were less than USEPA's and CTDEP's acceptable level of 1.0. Several chemicals were detected at concentrations that exceeded screening criteria for contaminant migration from soil to groundwater; however, upon further screening they were determined not to pose significant contaminant migration concerns.

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

## 13.3 REMEDIAL ACTIONS

### 13.3.1 Remedy Selection

Based on the results of the BGOURI, NFA was recommended for the site. A Proposed Plan was prepared in July 2004, and the NFA ROD was signed in September 2004.

### 13.3.2 Remedy Implementation

Remedy implementation is not a concern for Site 16 because the selected remedy is NFA.

### 13.3.3 System Operations/O&M

O&M is not required at Site 16 because the selected remedy is NFA.

## 13.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of Site 16. The recommendations from the First Five-Year Review Report are provided below along with the actions that were taken to address the recommendations.

It is recommended that a NFA PRAP and ROD be prepared for this site.

- The Proposed Plan was issued for public comment in July 2004, and the NFA ROD was signed in September 2004.

In addition, it is recommended that there be enforcement of the IR Site Use Restriction instruction.

- The instruction was enforced at Site 16 until the ROD was signed for OU11. Because there are no hazardous substances, pollutants, or contaminants remaining on site in excess of levels that allow for unlimited use and unrestricted exposure, enforcement of the instruction at Site 16 is no longer necessary.

## 13.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 13.5.1 Document Review

The following documents were reviewed for the second five-year review:

| | |
|---|---|
| BGOURI | January 2002 |
| Proposed Plan for Sites 16 and 18 Soil (OU 11) | July 2004 |
| ROD for Sites 16 and 18 Soil (OU 11) | September 2004 |

### 13.5.2 Data Review

Monitoring and O&M were not necessary for this site because of the NFA remedy; therefore, there was no data available for review.

### 13.5.3 ARAR and Site-Specific Action Level Changes

No new human health or ecological ARARs have been promulgated that would call into question the protectiveness of the NFA remedy.

### 13.5.4 Site Inspection

Because the selected remedy for the site was NFA, no site inspection was performed.

### 13.5.5 Site Interviews

No formal interviews were conducted for this site as part of the second five-year review because there were not active site issues to discuss.

## 13.6 ASSESSMENT

The following questions were answered to determine if the remedy for the Site 16 is protective of human health and the environment.

***Question 1. Is the remedy functioning as intended by the decision documents?***

The remedy for Site 16 OU11 was NFA.

***Question 2. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?***

- ***Changes in Standards and TBCs***: ARARs and TBCs considered during preparation of the ROD were reviewed, and no changes have occurred that would change the selected remedy of NFA.

- ***Changes in Exposure Pathways:*** There have been no changes at the site that would have resulted in new exposure pathways to human or ecological receptors.

- ***Changes in Toxicity and Other Contaminant Characteristics:*** There have been no changes in human health toxicity criteria that would impact the selected remedy of NFA for Site 16 soil (OU11).

- ***Changes in Risk Assessment Methods:*** As discussed in Section 1.4, there have been no major changes in HHRA methodology since the signing of the ROD that will impact the protectiveness of the remedy.

- ***Expected Progress Towards Meeting RAOs:*** The remedy selected for Site 16 soil was NFA; therefore, RAOs were not required.

***Question 3. Has any other information come to light that could call into question the protectiveness of the remedy?***

No additional information has been identified that would call into question the protectiveness of the remedy.

## 13.7 ISSUES

No deficiencies were identified for Site 16.

## 13.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that no additional five-year reviews of Site 16 be conducted because the remedy implemented at the site did not result in hazardous substances, pollutants, or contaminants remaining on site in excess of action levels that allow for unlimited use and unrestricted exposure. An NFA Proposed Plan and ROD were prepared for Site 16 soil (OU11).

## 13.9 PROTECTIVENESS STATEMENT

Because the remedy did not result in hazardous substances, pollutants, or contaminants remaining on site in excess of levels that allow for unlimited use and unrestricted exposure, the NFA remedy for Site 16 is protective of human health and the environment.

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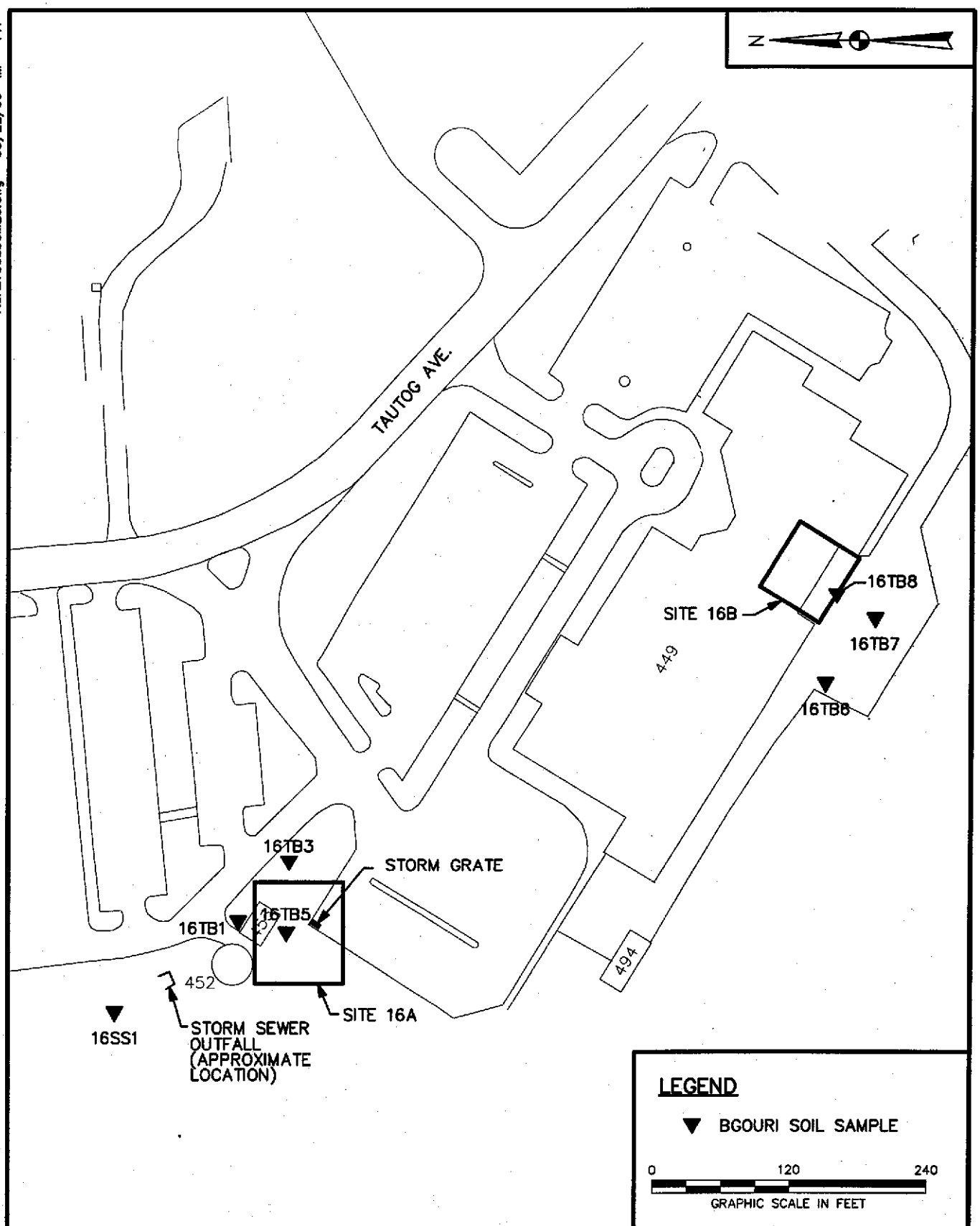


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|---|---|---|---|
| DRAWN BY MF | DATE 5/22/06 | Tetra Tech NUS, Inc. | CONTRACT NO. 0083 |
| CHECKED BY | DATE | SITE MAP<br>SITE 16 - HOSPITAL INCINERATORS<br>NSB-NLON<br>GROTON, CONNECTICUT | OWNER NO. 038 |
| REVISED BY | DATE | | APPROVED BY CAL DATE 6/7/06 |
| SCALE AS NOTED | | | DRAWING NO. FIGURE 13-1 REV. 0 |

FORM CADD NO. TTNUS-AV.DWG - REV 1 -9/10/98

# 14.0 SITE 17 – LOWER SUBASE - HAZARDOUS MATERIALS/SOLVENT STORAGE AREA – BUILDING 31 (OU4)

This five-year review is being conducted for Site 17 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. A TCRA was completed at Site 17 in 1995, but not all contamination was removed during the TCRA that would allow for unlimited use and unrestricted exposure. This site is still being investigated under CERCLA, and no decision documents have been prepared for the site.

## 14.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 17 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Building 31 constructed near Pier 6 on Albacore Road. | 1917 |
| Building 31 used as a battery shop. | 1950s |
| Building 31 used as the main hazardous/flammable materials warehouse. | 1970s |
| Final Site Investigation Subsurface Soil Contamination report completed. | 1987 |
| Yellow discoloration discovered in soil beneath the floor slab, and elevated levels of lead detected. Phase I RI completed. | 1992 |
| Action Memorandum for Building 31 completed. | 1993 |
| TCRA for lead-contaminated soil at Building 31 completed. | 1995 |
| Post-Removal Action Report completed. | 1995 |
| Leak testing investigation for fuel oil distribution system completed. | 1996 |
| Existing Data Summary Report for Lower Subase RI completed. | 1997 |
| Phase II RI Report completed. | 1997 |
| Final Lower Subase RI Report completed. | 1999 |
| First Five-Year Review performed. | December 2001 |
| Above-ground portion of Building 31 demolished. | 2001-2002 |
| Draft Final FS for Soil and Groundwater at the Lower Subase completed. | July 2002 |
| SOPA (ADMIN) New London Instruction 5090.18C updated. | December 2006 |

## 14.2 BACKGROUND

Building 31 was constructed in 1917 and was originally used as a battery shop until the mid-1950s. Battery overhaul was one of the largest operations conducted at the Subase prior to nuclear power. Old

diesel submarines, containing approximately 100 batteries, were routinely serviced in the Battery Overhaul Shop at Building 31. Services ranged from charging batteries to complete battery overhaul. Spent acid from the overhauled batteries was disposed in a spent acid tank located at the SASDA - Site 15 (Envirodyne, 1983).

Building 31 was used as the main hazardous/flammable materials warehouse starting in the 1970s. Items such as sulfuric acid, methyl isobutyl ketone, potassium hydroxide, potassium tetraborate, hydrofluoric acid, and nitric acid were stored in containers of up to 55-gallon capacity. In 1992, while the concrete floor of the building was being replaced to comply with RCRA regulations, a yellow discoloration was discovered in soil beneath the floor slab. Analysis of soil samples revealed elevated levels of lead. As a result, an Action Memorandum was prepared (HNUS, 1993a) to document the need to remediate lead-contaminated soil to a depth of 1 foot below the water table. The TCRA was completed in 1995 (HNUS, 1995). Lead-contaminated soil to 1 foot below the water table was remediated to concentrations less than 500 mg/kg and TCLP lead results less than 5.0 mg/L during the TCRA. Some contaminated soil was left in place in the areas between Building 31 and the Thames River front because its removal would have interfered with Subase traffic. The location of Site 17 relative to other IR sites is shown on Figure 1-2.

During subsequent investigations, Site 17 – Hazardous Materials/Solvent Storage Area (Building 31) has been included in Zone 3 of the Lower Subase, which extends from Capelin Road along the southern end of Zone 2 to the southern side of Bullhead Road. Zone 3 includes Site 17, fuel oil distribution lines, and steam, condensate, and electrical ducts. The Providence and Worcester Railroad borders the eastern edge of Zone 3, and the Thames River lies to the west of it. Figure 14-1 illustrates the Zone 3 and Site 17 boundaries, fuel oil distribution lines, steam and condensate lines, and sewer lines within this zone. Because of this approach, the remainder of this section discusses information in terms of Zone 3.

Fuel oil distribution lines and utility ducts and trenches run through Zone 3. The locations of the distribution lines and utility ducts are shown in Figure 14-1. In 1996, pressure leak testing was performed on the lines and valves in the fuel distribution system within Zone 3. All sections of the line and various valves tested in the portion of the distribution system within Zone 3 passed the pressure testing procedures.

The Lower Subase RI (TtNUS, 1999b) recommended that Zone 3 proceed to an FS. Because of the extensive amount of underground utilities in Zone 3 and the sensitive nature of the activities conducted at this location (i.e., national security), the FS for this zone should focus on the evaluation of alternatives that rely on institutional controls to limit exposure to contaminated soil and a tiered groundwater monitoring program to verify that significant contaminant migration is not occurring. Hot spot removal

actions for lead contamination and cleaning and repair of the Zone 3 storm sewer system should also be evaluated during the FS. These recommendations are based on the following information:

- The nature and extent of organic and inorganic contamination in soil and groundwater are well defined to the extent practical considering infrastructure limitations.

- The baseline HHRA indicated that risks associated with Zone 3 are within the USEPA acceptable risk range. There are carcinogenic risks in excess of the CTDEP target risk level to human receptors, but only under the hypothetical future resident scenario. In addition, modeling performed to evaluate exposure to lead showed that sensitive receptors to lead exposure (i.e., children and fetuses of pregnant women) are only at risk in Zone 3 under a future hypothetical scenario, which assumes that soils currently covered by pavement or buildings are available for exposure. Institutional controls and/or hot spot removal actions could be used to eliminate this exposure route.

- Although reported concentrations of TPH in site soil samples exceeded the State RSRs for direct exposure and pollutant mobility, the chemical-specific risk assessment for those compounds assumed to be major constituents of the observed TPH contamination indicated minimal risks to potential receptors.

- The groundwater at Zone 3 is not currently or anticipated to be used in the future as a potable water source because it is brackish (CTDEP-classified as GB); therefore, there is no imminent threat to human health.

- The data do not suggest that petroleum contamination in soil is significantly migrating to groundwater. In addition, natural attenuation processes seem to be at work in the groundwater. These processes can reduce concentrations of petroleum contamination that reach the aquifer and convert the petroleum contamination to a less toxic form. Groundwater monitoring will confirm this information.

- Inorganics are potentially migrating from Zone 3 to the Thames River. However, the ERA for the Thames River adjacent to Zone 3 shows that the risks to ecological receptors in the sediment adjacent to Zone 3 are relatively low and that lead is not a significant threat to ecological receptors. Groundwater monitoring will confirm the contaminant migration.

- A tiered groundwater monitoring program will allow for further actions to be completed if results show significant impacts.

- The Thames River provides significant dilution and mixing, which minimize the impact of any contaminant migration from Zone 3.

- The Navy completed a TCRA on soil contaminated with lead underneath and adjacent to Building 31; therefore, a majority of the lead-contaminated soil that historically acted as a source of contamination to other media has been remediated.

- The Navy conducts regular pressure testing and repairs on the fuel distribution lines; therefore, the historical source of petroleum contamination has most likely been eliminated.

- The zone is covered with pavement or buildings, which minimizes direct exposure to the contaminated soil by human receptors.

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

Building 31 was demolished in 2001. The building's foundation and floor slab were not disturbed during the demolition. Building 78, which was located adjacent to Building 31, was demolished in 2005, and a parking lot was constructed in the area formerly occupied by Buildings 31 and 78. Three inches of asphalt were placed over Building 31's floor slab, which covered the solidified waste material and contaminated soil remaining at Site 17, to make the parking lot. An FS is currently being prepared for Zone 3 soil and groundwater. The Navy is currently resolving ecological risk issues related to the adjacent Thames River. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy for Zone 3 will be selected after the FS is finalized.

## 14.3 REMEDIAL ACTIONS

### 14.3.1 Remedy Selection

A final remedy has not been selected or implemented for Zone 3, which includes Site 17. A TCRA was completed to address lead-contaminated soil underneath and adjacent to the building. Based on the Action Memorandum, the TCRA included excavation and on-site solidification of soil with total lead concentrations greater than 500 mg/kg or TCLP leachate lead concentrations greater than 5 mg/L, on-site backfilling, and off-site disposal of contaminated debris. Design documents were prepared for the TCRA, and the TCRA was completed in 1995 (HNUS, 1993b and 1995).

An FS is currently being prepared to evaluate further remedial actions for the site. The Lower Subase RI recommended that the FS for Zone 3, which includes Site 17, evaluate, to the extent possible, alternatives that include institutional controls to limit exposure to contaminated soil and a tiered groundwater monitoring program. Hot spot removal actions for lead contamination should also be evaluated.

### 14.3.2 Remedy Implementation

A final remedy has not yet been chosen for Zone 3. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy will be selected after the FS is finalized.

## 14.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of Site 17. The recommendations from the First Five-Year Review Report are provided below along with the actions taken to address the recommendations.

It was recommended that the FS be completed to determine the appropriate remedial action for Zone 3 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative.

- The FS for the Lower Subase is in progress, and it is expected to be completed in 2007. Ecological issues related to the Thames River are currently being resolved. A decision document will be prepared upon completion of the Feasibility Study.

It was also recommended that during the demolition of Building 31, the foundation and floor slab not be disturbed.

- Building 31 has been demolished. The location of former Building 31 is now a parking lot. Three inches of asphalt were placed over Building 31's floor slab, which covered the solidified waste material and contaminated soil remaining at Site 17, to make the parking lot.

In addition, it was recommended that there be enforcement of the IR Site Use Restriction Instruction.

- The instruction was updated to include the Goss Cove Landfill and was reissued in 2003. The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information for Site 2A - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON. The instruction has been enforced as appropriate at Site 17.

## 14.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the 5-year review process and the actions taken to complete this review.

### 14.5.1 Document Review

New London Instruction 5090.18C was the only document reviewed for the second 5-year review of Site 17. Within the past 5 years, no other documents have been completed regarding this site.

### 14.5.2 Data Review

No new data were collected from the site over the past five years. No monitoring or O&M activities have been initiated at the site because a final remedy has not been selected.

### 14.5.3 ARAR and Site-Specific Action Level Changes

A remedy has not been selected and a ROD has not been signed for Zone 3; therefore, ARARs and site-specific action levels have not been identified for Zone 3.

### 14.5.4 Site Inspection

The Lower Subase was visually inspected on April 4, 2006 as the inspection team drove through the area. Zone 3 is covered with pavement or buildings and is located near the Thames River and a set of railroad tracks. The Lower Subase is a high-security area at NSB-NLON, and to avoid security issues, the team conducted a drive-through inspection lead by the Navy. Weather conditions during the inspection were cold (mid-40s), overcast, and windy. Representatives from the Navy, USEPA, CTDEP, TtNUS, ECC, and Gannett Fleming participated in the inspection. It was noted during the site inspection that Buildings 31 and 78 in Zone 3 were demolished and that the area was now a parking lot. No issues were identified, and no photos of the zone were taken during the inspection. The Navy has no other plans to change the use of the site.

### 14.5.5 Site Interviews

No official interviews were conducted as part of the second five-year review.

## 14.6 ASSESSMENT

Because a final remedy has not been selected for Zone 3, conclusions cannot be made to support the determination that the remedy for Zone 3 is protective of human health and the environment. The results of the Lower Subase RI do not indicate any imminent threats to human health or the environment under the current land use scenario.

The Navy has an IR Site Use Restriction Instruction in place at NSB-NLON [SOPA (ADMIN) NLONINST 5090.18C]. The policy restricts ground surface disturbance of soils and any subsurface disturbance of soils and/or groundwater at IR sites.

## 14.7 ISSUES

A final remedy has not been selected for Zone 3; therefore, deficiencies cannot be determined at this time.

## 14.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that the FS be completed to determine the appropriate remedial action for Zone 3 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative. It is also recommended that there be enforcement of the IR Site Use Restriction Instruction.

## 14.9 PROTECTIVENESS STATEMENT

A protectiveness determination for Zone 3, which includes Site 17, cannot be made at this time because a remedy has not yet been selected for the zone. The results of the Lower Subase RI do not indicate any imminent threats to human health or the environment under current land use scenarios. The Navy has instituted instruction that provides land use controls and restricts excavation activities. The instruction should minimize unauthorized and unplanned exposure to contaminated media at the zone until a remedy is selected and implemented. The Navy is currently addressing data gaps for the zone as part of the development of the FS.

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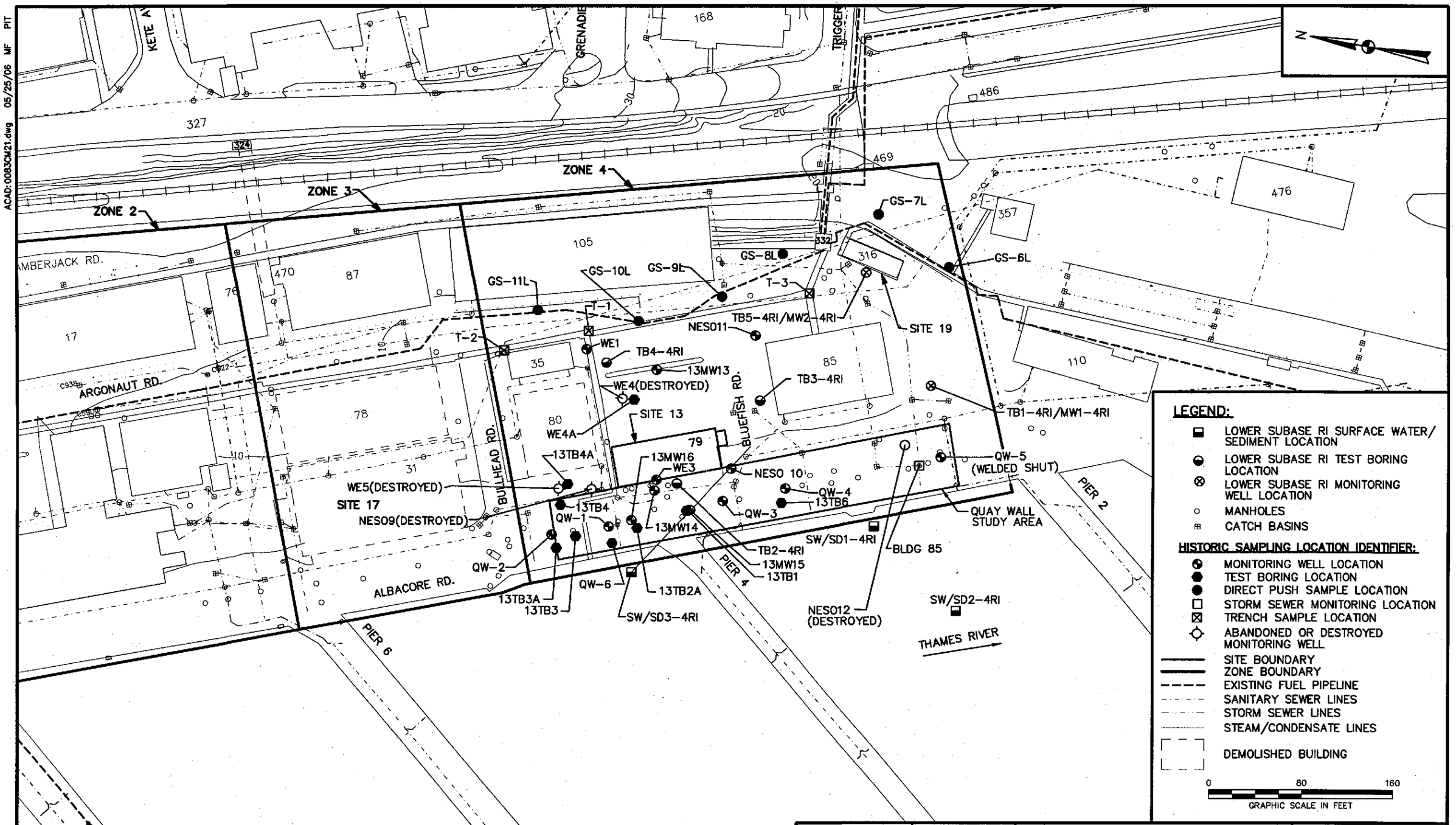


BASE MAP SOURCE: PREPARED BY THE NAVAL SUBMARINE BASE PUBLIC WORKS DEPT., ENGINEERING DIVISION. MARCH 2006, DRAWING NO. A-667.

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| DRAWN BY MF | DATE 5/22/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 17 - HAZARDOUS MATERIALS.SOLVENT STORAGE AREA (BUILDING 31)<br>NSB-NLON<br>GROTON, CONNECTICUT |
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| DRAWING NO. FIGURE 14-1 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

# 15.0 SITE 18 – SOLVENT STORAGE AREA – BUILDING 33 (OU11 AND OU9)

This five-year review is being conducted for Site 18 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. An investigation of Site 18 found no hazardous substances in the soil or groundwater at the site that would limit use or restrict exposure. An NFA remedy was selected for Site 18 soil OU (OU11) in a ROD signed in 2004 (Navy, 2004g). An Interim ROD for Site 18 groundwater, a portion of OU9, was signed in 2004 (Navy, 2004h), and the selected remedy was NFA. It is expected that the NFA remedy will be the final remedy for Site 18 groundwater after remedial actions are selected for all portions of OU9.

## 15.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 18 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Storage of 55-gallon drums of solvents and gas cylinders. | 1980s |
| IAS identified solvent storage at Building 33. | 1983 |
| FFA identified site as Study Area F. | 1995 |
| First Five-Year Review performed. | December 2001 |
| BGOURI completed. | January 2002 |
| Proposed Plan for Sites 16 and 18 Soil (OU11) issued. | July 2004 |
| ROD for Sites 16 and 18 Soil (OU11) signed. | September 2004 |
| Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 Groundwater (OU9) completed. | September 2004 |
| Interim ROD for Sites 3, 7, 14, 15, 18, and 20 Groundwater signed. | December 2004 |

## 15.2 BACKGROUND

Site 18 consists of Building 33, which is located east of Grayback Avenue. The site map is included as Figure 15-1. Several 55-gallon drums containing solvents, such as TCE and DCE, and some gas cylinders were stored in Building 33 (USEPA, 1995a). The solvent storage area was identified during the IAS (Envirodyne, 1983) for NSB-NLON that was conducted in March 1983. The site was identified as Study Area F in the FFA and is now identified as IRP Site 18.

No sampling activities were conducted at the site prior to the BGOURI. During the BGOURI (TtNUS, 2001e), soil and groundwater samples were collected to characterize Site 18. One objective of the RI at Site 18 was to perform an initial characterization of the nature and extent of contamination at the site because no sampling or analytical programs had been completed at the site in the past. Another objective of the RI was to quantify the risks to human receptors associated with the site.

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

The results of the BGOURI did not indicate that subsequent rounds of investigation were necessary to further characterize the site. In addition, the results did not suggest that an FS was necessary for the site. Therefore, the RI recommended that an NFA decision document be prepared for this site. Separate RODs for Site 18 soil and groundwater (Navy, 2004g and 2004h, respectively) were prepared to document the NFA decisions. The selected NFA remedy for groundwater at Site 18 is an interim remedy, but it is expected that it will be the final remedy after remedial actions are selected for all portions of OU9.

## 15.3 REMEDIAL ACTIONS

### 15.3.1 Remedy Selection

An investigation of Site 18 found no hazardous substances in soil or groundwater at the site that would limit use or restrict exposure. An NFA remedy was selected for Site 18 soil OU (OU11) in a ROD signed in 2004 (Navy, 2004g). An Interim ROD for Site 18 groundwater, a portion of OU9, was signed in 2004 (Navy, 2004h), and the selected remedy was NFA.

### 15.3.2 Remedy Implementation

The selected remedies for both soil and groundwater at Site 18 were NFA; therefore, remedy implementation is not a concern for Site 18.

### 15.3.3 System Operations/O&M

Monitoring and O&M are not required at Site 18 because the selected remedies for Site 18 soil and groundwater were NFA.

## 15.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of the Site 18. The recommendations from the First Five-Year Review Report are provided below along with the actions that were taken to address the recommendations.

It is recommended that a NFA PRAP and ROD be prepared for this site.

- The Proposed Plan for Site 18 soil (OU11) was issued in July 2004, and the NFA ROD was signed in September 2004. The Proposed Plan for Site 18 groundwater (a portion of OU9) was issued in September 2004, and the NFA Interim ROD was signed in December 2004.

Also, it is recommended that there be enforcement of the IR Site Use Restriction instruction.

- The instruction was enforced at Site 18 until the RODs were signed for soil and groundwater. Because there are no hazardous substances, pollutants, or contaminants remaining on site in excess of levels that allow for unlimited use and unrestricted exposure, enforcement of the instruction at Site 18 is not necessary in the future.

## 15.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 15.5.1 Document Review

The following documents were reviewed for the second five-year review, and key information obtained from the documents is summarized in the following sections:

| | |
|---|---|
| BGOURI | January 2002 |
| Proposed Plan for Sites 16 and 18 Soil (OU11) | July 2004 |
| ROD for Sites 16 and 18 Soil (OU11) | September 2004 |
| Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 Groundwater (OU9) | September 2004 |
| Interim ROD for Sites 3, 7, 14, 15, 18, and 20 Groundwater | December 2004 |

### 15.5.2 Data Review

Monitoring and O&M are not necessary for this site because of the NFA remedies; therefore, there were no additional data available for review.

### 15.5.3 ARAR and Site-Specific Action Level Changes

No new ARARs or site-specific action levels have been promulgated that would call into question the protectiveness of the remedy.

### 15.5.4 Site Inspection

Because the selected remedy for the site was NFA, no site inspection was performed for Site 18.

### 15.5.5 Site Interviews

No formal interviews were conducted for this site as part of the second five-year review because there were no active site issues to discuss.

## 15.6 ASSESSMENT

The following conclusions support the determination that the NFA remedies for Site 18 are currently protective of human health and the environment.

***Question 1. Is the remedy functioning as intended by the decision documents?***

The remedies for both soil and groundwater are NFA.

***Question 2. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?***

- ***Changes in Standards and TBCs***: ARARs and TBCs considered during preparation of the RODs were reviewed, and no changes have occurred that would change the selected remedies of NFA.

- ***Changes in Exposure Pathways:*** There have been no changes at the site that would have resulted in new exposure pathways to human or ecological receptors.

- ***Changes in Toxicity and Other Contaminant Characteristics:*** There have been no changes in human health toxicity criteria that would impact the primary or secondary monitoring criteria

- ***Changes in Risk Assessment Methods:*** There have been no changes in the HHRA methodology that would impact the protectiveness of the NFA remedies selected for Site 18 soil and groundwater.

- ***Expected Progress Towards Meeting RAOs:*** The remedies selected for Site 18 soil and groundwater were NFA; therefore, RAOs were not required.

***Question 3. Has any other information come to light that could call into question the protectiveness of the remedy?***

No additional information has been identified that would call into question the protectiveness of the remedy.

## 15.7 ISSUES

No deficiencies were identified for Site 18.

## 15.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that no additional five-year reviews of Site 18 be conducted because the remedies implemented at the site did not result in hazardous substances, pollutants, or contaminants remaining on site in excess of action levels that allow for unlimited use and unrestricted exposure. NFA Proposed Plans and RODs were prepared for Site 18 soil and groundwater.

## 15.9 PROTECTIVENESS STATEMENT

Because the remedies do not result in hazardous substances, pollutants, or contaminants remaining on site in excess of levels that allow for unlimited use and unrestricted exposure, the NFA remedies for Site 18 soil and groundwater are protective of human health and the environment.

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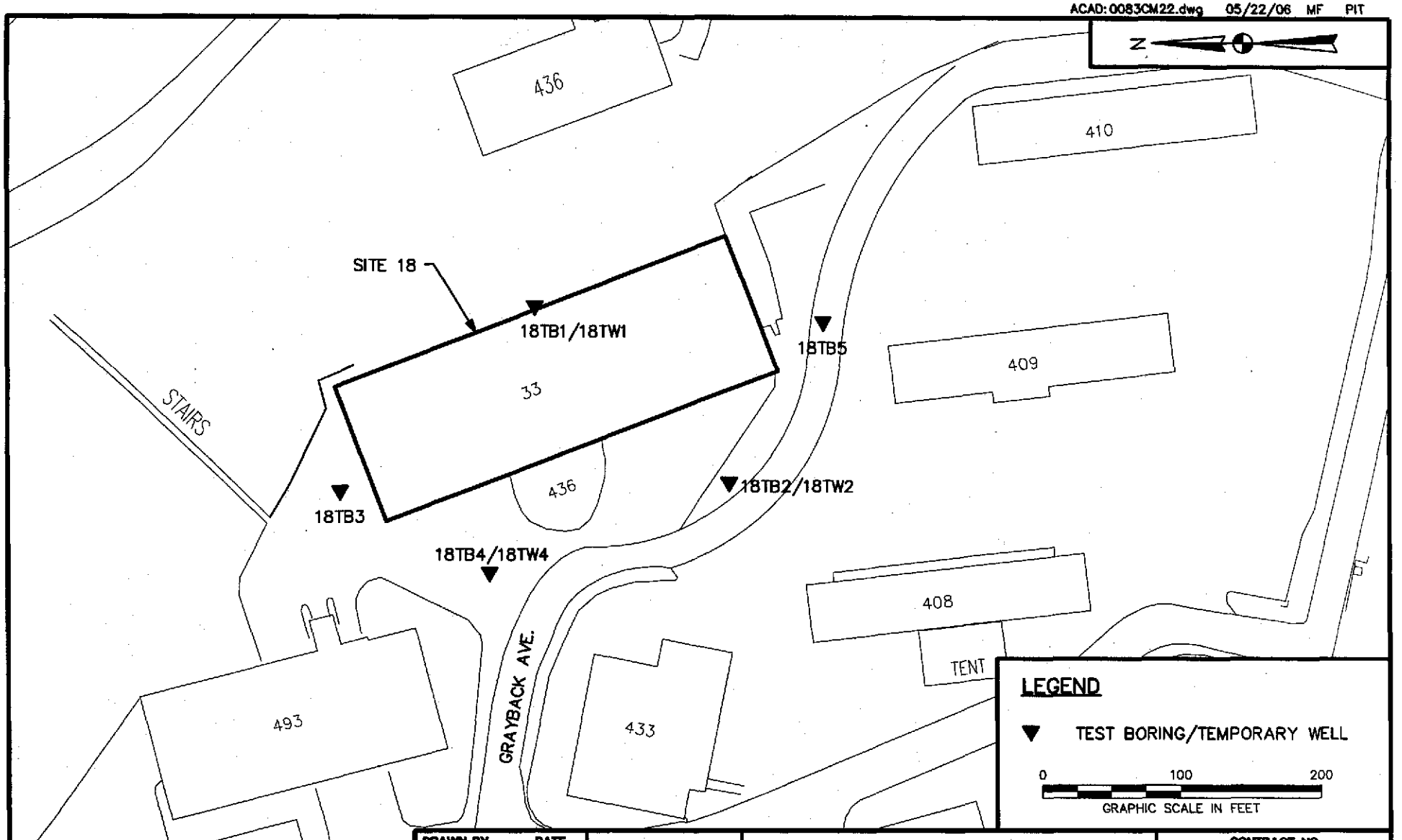


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| DRAWN BY MF | DATE 5/22/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 18<br>SOLVENT STORAGE AREA (BUILDING 33)<br>NSB-NLON<br>GROTON, CONNECTICUT |
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| DRAWING NO. FIGURE 15-1 | REV. 0 |

FORM CADD NO. TTNUS-AH.DWG – REV 1 –9/10/98

# 16.0 SITE 19 – LOWER SUBASE – SOLVENT STORAGE AREA – BUILDING 316 (OU4)

This five-year review is being conducted for Site 19 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. Site 19 is currently being investigated under CERCLA. No decision documents have been prepared for this site.

## 16.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 19 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Solvents stored in Building 316. | NA |
| Existing Data Summary Report for Lower Subase RI completed. | 1997 |
| Final Lower Subase RI completed. | 1999 |
| First Five-Year Review performed. | December 2001 |
| Draft Final FS for soil and groundwater at the Lower Subase completed. | July 2002 |
| SOPA (ADMIN) New London Instruction 5090.18C updated. | December 2006 |

## 16.2 BACKGROUND

Site 19 – Solvent Storage Area, Building 316, is located in the Lower Subase, west of Pier 2. The site map is included as Figure 16-1. Several 5-gallon cans containing methyl ethyl ketone were stored in Building 316 (USEPA, 1995a). Solvents are no longer stored in this facility.

Soil and groundwater sampling and analysis were conducted at this site, included as part of Zone 4, during the Lower Subase RI (TtNUS, 1999b). Because of this approach, the remainder of this section discusses information in terms of Zone 4.

The Lower Subase RI (TtNUS, 1999b) recommended that Zone 4 proceed to an FS to evaluate appropriate remedial alternatives. Because of the extensive amount of underground utilities in Zone 4 and the sensitive nature of the activities conducted at this location (i.e., national security), the FS for this zone should focus, to the extent possible, on evaluation of alternatives that rely on institutional controls to limit exposure to contaminated soil and passive and/or in-situ remedial alternatives. In addition, the

Zone 4 FS should consider hot spot removal actions in lieu of full-scale excavation. A tiered groundwater monitoring program and cleaning and repair of the Zone 4 storm sewer system should also be evaluated during the FS. These recommendations are based on the following information:

- The nature and extent of organic and inorganic contamination in soil and groundwater are well defined to the extent practical considering infrastructure limitations.

- The baseline HHRA indicates that carcinogenic risks associated with Zone 4 exceed the USEPA acceptable risk range (i.e., the hypothetical future resident RME scenario) and CTDEP target risk level (i.e., the full-time employee and hypothetical future resident RME scenarios). In addition, modeling performed to evaluate exposures to lead showed that receptors sensitive to lead exposure (i.e., small children and fetuses of pregnant working women) are at risk in Zone 4. All the elevated risks (for lead and other chemicals) were calculated for a future exposure scenario where soils currently covered by pavement or buildings would be available for human contact. Institutional controls and/or hot spot removal actions could be used to eliminate this exposure route.

- Evidence suggests that limited organic and inorganic contamination is migrating from the site. Natural attenuation seems to be occurring in the groundwater of Zone 4 and is most likely reducing the concentrations of petroleum hydrocarbons migrating from the site. Groundwater monitoring will confirm natural attenuation and potential inorganic migration.

- Natural attenuation or bioremediation could be feasible alternatives to address petroleum contamination in soil.

- A tiered groundwater monitoring program would allow for further actions to be implemented if results show significant impacts.

- The ERA for the Thames River adjacent to Zone 4 shows that the risks to ecological receptors in this area are relatively low to moderate. Maximum concentrations of several non-AVS inorganics in Zone 4 sediments near the Lower Subase exceeded conservative guidelines (e.g., ER-Ls), indicating that potential risks may be present. Beryllium, boron, cobalt, thallium, and vanadium were retained as COCs because conservative sediment guidelines were unavailable. No alternate guideline was available for barium, the maximum concentration of which exceeded the conservative guideline. The COCs were concluded to not be of ecological significance in the NSB-NLON Phase II RI ERA for the Thames River. Benzo(a)pyrene was the only organic in Zone 4 sediments that had maximum concentrations in excess of guidelines. The average concentration of benzo(a)pyrene also exceeded the guideline. The maximum concentration slightly exceeded its ER-M. Despite exceedances of

guideline values by several COCs, no significant toxicity was observed in Zone 4 sediment toxicity tests from the NSB-NLON Phase II RI. Low concentrations of some PAHs were detected in a native blue mussel sample collected in Zone 4 as part of the NSB-NLON Phase II RI ERA. Chromium, mercury, and benzo(a)pyrene was not detected in that sample, indicating that they were probably not bioavailable. Boron was detected in the blue mussel sample from Zone 4 and in the blue mussel sample collected south of Zone 4 at concentrations greatly exceeding background and control concentrations. The toxicological significance is unclear due a lack to toxicity data for that metal. The NSB-NLON Phase II RI concluded that boron was not of ecological significance in the Thames River. The weight of evidence appears to indicate that potential risks to sediment-dwelling organisms from contaminants in Zone 4 sediment are present and that these potential risks are low to moderate.

- The Thames River provides significant dilution and mixing, which minimize the impact of contaminant migration from Zone 4.

- The Navy removed the waste oil pit at Building 79 and filled the area with concrete. A recovery well system was installed and operated for a short time in this area. In addition, approximately 800 gallons of petroleum product were removed via pumping from the quay wall area during a removal action in 1994.

- The Navy currently conducts regular pressure testing and repairs on the fuel distribution lines; therefore, the historical source of petroleum contamination has most likely been minimized.

- Zone 4 is covered with pavement or buildings, which minimizes the potential for direct exposure to contaminated soil by human receptors.

- The groundwater at Zone 4 is not currently or anticipated to be used in the future as a potable water source because it is brackish (classified as GB); therefore, there is no imminent threat to human health.

- The storm sewer system in Zone 4 is a potential a migration pathway for contaminants present in groundwater.

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

Zone 4 proceeded to an FS to evaluate appropriate remedial alternatives for the soil and groundwater. The FS is currently being prepared and the Navy is resolving ecological risk issues related to the adjacent Thames River. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy for Zone 4 will be selected after the FS is finalized.

## 16.3 REMEDIAL ACTIONS

### 16.3.1 Remedy Selection

A final remedy has not been selected or implemented at Zone 4, which includes Site 19. An FS is currently being prepared to evaluate alternatives for the zone. The Lower Subase RI recommended that the FS for Zone 4 evaluate a range of remedial alternatives that include institutional controls to limit exposure to contaminated soil and passive and/or in-situ remedial alternatives.

### 16.3.2 Remedy Implementation

A final remedy has not yet been chosen for Zone 4. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy will be selected after the FS is finalized.

## 16.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of Site 19. The recommendations from the First Five-Year Review Report are provided below along with the actions taken to address the recommendations.

It was recommended that the FS be completed to determine the appropriate remedial action for Zone 4 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative.

- The FS for the Lower Subase is in progress, and it is expected to be completed in 2007. Ecological issues related to the Thames River are currently being resolved. A decision document will be prepared upon completion of the FS.

In addition, it is recommended that there be enforcement of the IR Site Use Restriction instruction.

- The instruction was updated to include the Goss Cove Landfill and was reissued in 2003. The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information from Site 2A - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON. The instruction has been enforced as appropriate at Site 19.

## 16.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 16.5.1 Document Review

New London Instruction 5090.18C was the only document reviewed for the second five-year review of Site 19. Within the past 5 years, no other documents have been completed regarding this site.

### 16.5.2 Data Review

No new data were collected from the site over the past 5 years. No monitoring or O&M activities have been initiated at the site because a final remedy has not been selected.

### 16.5.3 ARAR and Site-Specific Action Level Changes

A remedy has not been selected and a ROD has not been signed for Zone 4; therefore, ARARs and site-specific action levels have not been identified for Zone 4.

### 16.5.4 Site Inspection

The Lower Subase was visually inspected on April 4, 2006 as the inspection team drove through the area. Zone 4 is covered with pavement or buildings and is located near the Thames River and a set of railroad tracks. The Lower Subase is a high-security area at NSB-NLON, and to avoid security issues, the team conducted a drive-through inspection lead by the Navy. Weather conditions during the inspection were cold (mid-40s), overcast, and windy. Representatives from the Navy, USEPA, CTDEP, TtNUS, ECC, and Gannett Fleming participated in the inspection. It was noted during the site inspection that Building 80 in Zone 4 was demolished within the past 5 years. No other issues were identified and no photos of the zone were taken during the inspection. The Navy has no plans to change the current use of the site.

### 16.5.5 Site Interviews

No official interviews were conducted as part of the second five-year review.

## 16.6 ASSESSMENT

Because a final remedy has not been selected for Zone 4, conclusions cannot be made to support the determination that the remedy at Zone 4 is protective of human health and the environment. The results of the Lower Subase RI do not indicate any imminent threats to human health or the environment under the current land use scenario.

The Navy has an IR Site Use Restriction Instruction in place at NSB-NLON [SOPA (ADMIN) NLONINST 5090.18C]. The policy restricts ground surface disturbance of soils and any subsurface disturbance of soils and/or groundwater at IR Sites.

## 16.7 ISSUES

A final remedy has not been implemented at Zone 4; therefore, deficiencies cannot be determined at this time.

## 16.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that the FS be completed to determine the recommended remedial action for Zone 4 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative. It is also recommended that there be enforcement of the IR Site Use Restriction Instruction.

## 16.9 PROTECTIVENESS STATEMENT

A protectiveness determination for Zone 4, which includes Site 19, cannot be made at this time because a remedy has not yet been selected for the zone. The results of the Lower Subase RI do not indicate any imminent threats to human health or the environment under current land use scenarios. The Navy has instituted instruction that provides land use controls and restricts excavation activities. The instruction should minimize unauthorized and unplanned exposure to contaminated media at the zone until a remedy is selected and implemented. The Navy is currently addressing data gaps for the zone as part of development of the FS.

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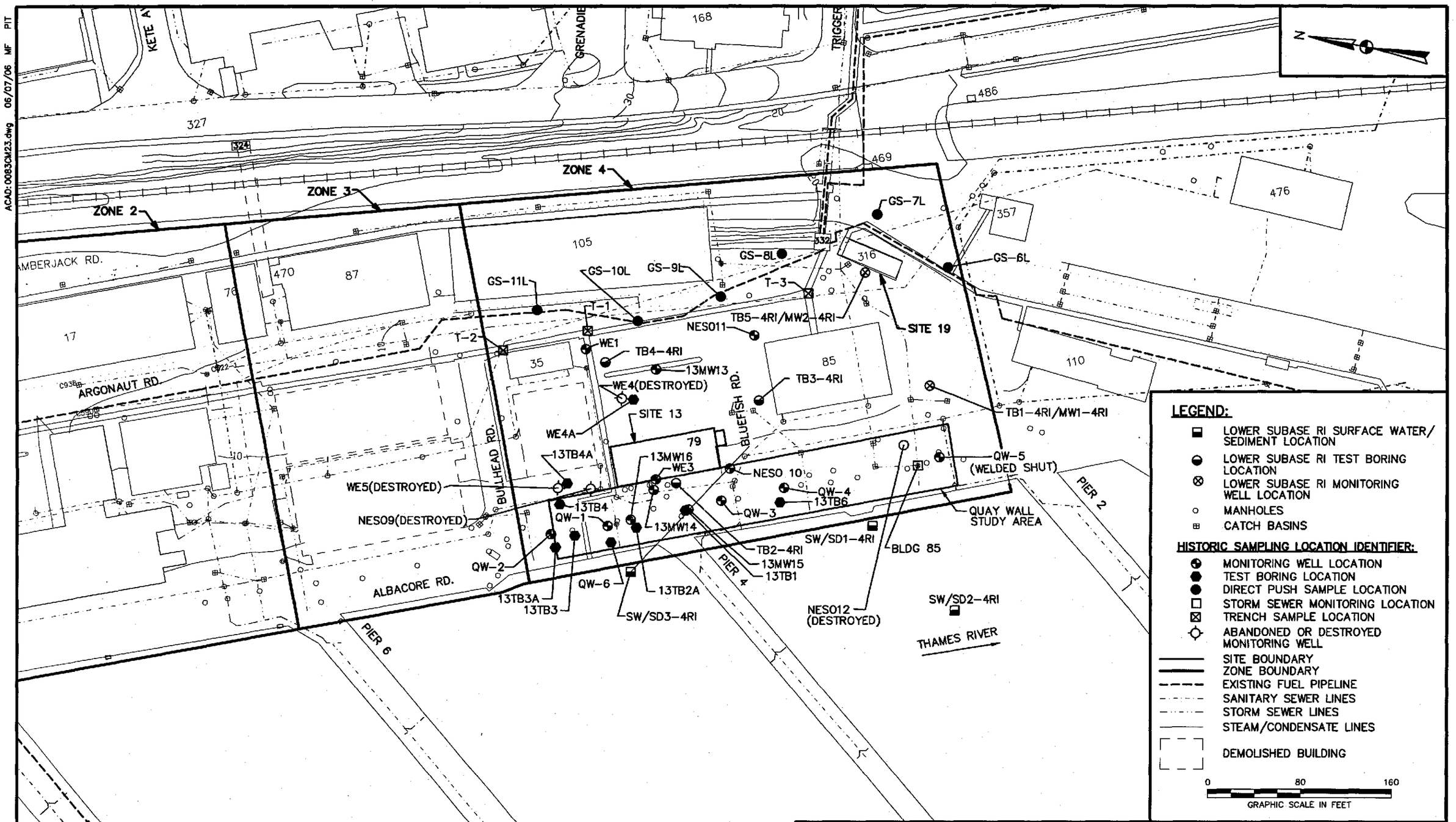


BASE MAP SOURCE: PREPARED BY THE NAVAL SUBMARINE BASE PUBLIC WORKS DEPT., ENGINEERING DIVISION. MARCH 2006, DRAWING NO. A-667.

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| DRAWN BY MF | DATE 5/22/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 19 - SOLVENT STORAGE AREA<br>(BUILDING 316)<br>NSB-NLON<br>GROTON, CONNECTICUT |
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# 17.0 SITE 20 – AREA A WEAPONS CENTER (OU7 AND OU9)

This five-year review is being conducted for Site 13 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. Site 20 was investigated during the Phase I RI (Atlantic, 1992), Phase II RI (B&RE, 1997a), BGOURI (TtNUS, 2002a), and BGOURI DGI (TtNUS, 2002e). The results of the investigations showed minimal contamination of groundwater and surface water at the site, but the soil at the site may be a contaminant source to the Area A Wetlands. A remedial alternative of excavation and off-site disposal was subsequently selected in the ROD for the soil and sediment OU (OU7) at Site 20 (Navy, 2000a). The remedial action consisted of the removal of a small amount of PAH- and arsenic-contaminated soil and sediment (less than 200 cubic yards) and was completed in 2001. An NFA remedy was selected for Site 20 groundwater, a portion of OU9, in an Interim ROD (Navy, 2000h). It is expected that NFA will be the final remedy for Site 20 groundwater after remedial actions are selected for all portions of OU9.

## 17.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 20 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Storage of chemicals and chemical wastes generated by Building 524. Weapons storage in bunkers. | Current |
| Phase II RI Report recommended an FS for Site 20. | 1997 |
| Proposed Plan for Soil and Sediment published. | May 2000 |
| Final FS for Site 20 Soil and Sediment completed. | June 2000 |
| ROD for Soil and Sediment signed. | June 2000 |
| Remedial Action for Soil and Sediment completed. | 2001 |
| First Five-Year Review performed. | December 2001 |
| BGOURI completed. | January 2002 |
| BGOURI Update/FS completed. | July 2004 |
| Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 Groundwater (OU9) completed. | September 2004 |
| Interim ROD for Sites 3, 7, 14, 15, 18, and 20 Groundwater signed. | December 2004 |

## 17.2 BACKGROUND

Site 20 is the Area A Weapons Center, which is located north of the terminus of Triton Avenue, adjacent to the Area A Wetland. The site map is included as Figure 17-1. The site's location relative to other IR sites is shown on Figure 1-2. The site includes Building 524 and the north and south weapons storage areas. Building 524 is used for administration, minor torpedo assembly, and storage of simulator torpedoes (B&RE, 1997a). No weapons production takes place in this building. Chemicals and chemical wastes, including cleaning and lubricating compounds, paints, adhesives, and liquid fuels, were stored in 1-gallon to 5-gallon containers in seven metal storage cabinets located on a paved area south of the building (B&RE, 1997a). Many of these materials are classified as corrosive or flammable. Building 524 was constructed in 1990/1991. Prior to construction, the area was primarily woodlands. Portions of the site were blasted to remove bedrock during construction.

The north and south weapons storage bunkers are located southeast of Building 524. The southern bunkers are first evident in photographs from 1969, and the northern area bunker is evident in photographs from 1974. Weapons containing liquid fuels such as Otto fuel, JP-10, and TH Dimer (jet rocket fuel) are stored in these bunkers (B&RE, 1997a). Routine maintenance and security improvements were planned for the Area A Weapons Center include grouting and waterproofing of bunkers, repaving of roads, regrading, and culvert installation and it is assumed that they were completed.

Site 20 was investigated during the Phase II RI (B&RE, 1997a). Minimal contamination of surface water and groundwater was detected, and the potential for substantial contaminant transport was determined to be low. Therefore, limited action was recommended for the site in the Phase II RI. No impacted soil or sediment was identified at Building 524 at Site 20, and a remedial action in the area was not recommended.

A ROD was signed for the soil and sediment OU associated with Site 20 (OU7) in June 2000 (Navy, 2000a). A small (less than 200 cubic yards) remedial action was conducted at the site in 2001 to address PAH and arsenic contamination in soil and sediment. The action was intended to mitigate direct exposures to soil and sediment and involved the excavation of soil and sediment with contaminant concentrations exceeding cleanup levels. Confirmatory soil and sediment samples were collected from the bottom and sidewalls of the excavation. Following verification of contaminated soil removal, the excavations were backfilled with clean soil, the drainage swales were regraded, and the disturbed asphalt was replaced.

The groundwater at Site 20 was further characterized during the BGOURI (TtNUS, 2002a). The objectives of the investigation were to further characterize the nature and extent of groundwater

contamination and to quantify the risks to human receptors from the groundwater. In general, organic and inorganic contaminants were detected infrequently and at low concentrations in groundwater at Site 20. TCE and benzo(a)pyrene were the only organic contaminants identified as significant contaminants in groundwater. Metals detected at significant concentrations in groundwater included antimony, arsenic, nickel, silver, thallium, and zinc. High levels of TSS and TDS in one sample may have caused the elevated concentrations of two of the metals. All organic and inorganic contaminants were identified in samples from overburden monitoring wells.

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

Prior to proceeding to an FS for groundwater, a DGI was conducted at Site 20 to confirm the groundwater results of the BGOURI. The results of the DGI were presented in the BGOURI Update/FS (TtNUS, 2004). During the DGI, groundwater samples were collected from the two monitoring wells in which elevated silver concentrations were detected during the BGOURI. The groundwater samples were analyzed for total and dissolved TAL inorganics. Silver was not detected at concentrations greater than the detection limit (4.8 µg/L) in either well during the DGI. These results, in conjunction with similar nondetect results during the Phase II RI, indicated that the silver concentrations detected during the BGOURI were anomalies. Further data and risk evaluations were also conducted during the BGOURI Update. The results of the evaluations indicated no significant contamination in Site 20 groundwater and no significant risks to human health associated with exposure to Site 20 groundwater. The BGOURI Update recommended that an FS not be prepared for Site 20 groundwater and that an NFA decision document be prepared for the groundwater. The Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 groundwater (OU9) at NSB-NLON was released for public comment on September 24, 2004 (Navy, 2004d). The Interim ROD for OU9 was signed in December 2004, which called for NFA for Site 20 groundwater (Navy, 2004h).

## 17.3 REMEDIAL ACTIONS

### 17.3.1 Remedy Selection

The ROD for Site 20 soil and sediment was signed in June 2000. The RAOs developed to aid in the development of alternatives were as follows:

- Minimize potential human exposure to COCs above cleanup levels that will ensure that carcinogenic risk levels do not exceed $1x10^{-5}$ and noncarcinogenic risks do not exceed an HI of 1.0.

- Minimize the potential migration of COCs from soil into groundwater.

- Minimize potential transport of COCs from Site 20 into the Area A Wetlands or the Area A Downstream Watercourses.

The selected remedy for soil and sediment at Site 20 was excavation with asphalt batching or off-site disposal (residential scenario). The selected remedy addresses principal and low-level wastes in soil and sediment, including PAHs and inorganic constituents. The major components of the selected remedy were as follows:

- Excavation of all soil and sediment containing PAHs and metals in excess of medium-specific residential cleanup goals.

- Off-site asphalt batching (treatment using thermoplastic stabilization/solidification) of excavated media or disposal at an off-site, licensed disposal facility if asphalt batching is not available in the State of Connecticut at the time of excavation.

- Collection of confirmatory samples from the bottom and sidewalls of the excavation to confirm that material exceeding the medium-specific cleanup levels has been removed.

The remedial goals for the remedial action are summarized below.

| Constituent of Concern | Cleanup Level | Basis of Cleanup Level |
|---|---|---|
| **SOIL** | | |
| Arsenic | 9.62 mg/kg | Risk Assessment |
| Benzo(a)anthracene | 1.0 mg/kg | CTDEP RSR |
| Benzo(a)pyrene | 1.0 mg/kg | CTDEP RSR |
| Benzo(b)fluoranthene | 1.0 mg/kg | CTDEP RSR |
| Chrysene | 1.0 mg/kg | CTDEP RSR |
| Dibenzo(a,h)anthracene | 1.0 mg/kg | CTDEP RSR |
| **SEDIMENT** | | |
| Arsenic | 19.27 mg/kg | Risk Assessment |
| Benzo(a)pyrene | 4.08 mg/kg | Risk Assessment |
| Dibenzo(a,h)anthracene | 4.08 mg/kg | Risk Assessment |

Groundwater at Site 20 was addressed as part of the BGOURI and BGOURI Update/FS. The overburden and bedrock groundwater at Site 20 was characterized during three separate investigations. VOCs and SVOCs were detected sporadically at low concentrations in overburden and bedrock groundwater during the investigations. Naturally occurring metals were detected consistently in the groundwater. The Interim ROD for OU9 (Navy, 2004h) recommended NFA for Site 20 groundwater.

### 17.3.2 Remedy Implementation

**Soil and Sediment**

A Remedial Design Work Plan for soil and sediment at Site 20 was completed by Foster Wheeler for the Navy. The sequence of actions regarding Site 20 soil and sediment contamination was as follows:

- Excavated soil and sediment that contained COCs at concentrations exceeding the clean-up levels.

- Soil and sediment was removed from Drainage Area 1. Soil and sediments in Drainage Areas 2 and 3 were less than cleanup levels and did not require remediation. These areas were sampled to ensure that all soil and sediment concentrations at the Area A Weapons Center were less than remedial goals.

- The affected soil and sediment was temporarily stockpiled on site.

- Confirmatory soil and sediment samples were collected from the bottom and sidewalls of the excavation and sent to a laboratory for PAHs and inorganic analyses to confirm that material exceeding the medium-specific cleanup levels was removed. At least 5 samples were collected at each excavation location (one from the bottom and each sidewall of the excavation) and one sample was taken every 10 feet along the drainage swale. In addition, one sample per 100 cubic yards of excavated material was collected for waste characterization.

- The excavated area was backfilled with clean soil, the drainage swales were regraded, and disturbed asphalt was replaced.

- Asphalt batching was the preferred disposal option and the excavated soil was to be treated using thermoplastic stabilization/solidification (e.g., asphalt batching). However, asphalt batching was not available and the excavated soil was disposed at an off-site, licensed disposal facility.

- Safety precautions were taken during excavation, loading, and transporting activities to minimize fugitive dust emissions.

The remedial action involved excavation and disposal of less than 200 cubic yards of soil and sediment and it was conducted in 2001 (FWEC, 2002b). The contaminated soil and sediment was disposed in the BFI Landfill in Fall River, Massachusetts. Asphalt removed during the remedial action was shipped to Aggregate Industries in Stoughton, Massachusetts for recycling. The total cost for the remedial action was $149,250.

**Groundwater**

The selected remedy for Site 20 groundwater was NFA; therefore, remedy implementation is not a concern.

### 17.3.3 System Operations/O&M

O&M is not required for Site 20 because contaminated soil and sediment with contaminant concentrations greater than the remedial goals were removed from the site, and the selected remedy for groundwater was NFA.

## 17.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of the Site 20. The recommendations from the First Five-Year Review Report are provided below along with the actions that were taken to address the recommendations.

It is recommended that the remedial action for the soil and sediment be completed at Site 20 and that an FS be completed to determine the necessary actions for groundwater at Site 20. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative.

- The remedial action for soil and sediment was completed in October 2001. Approximately 200 cubic yards of contaminated soil and sediment were excavated and disposed off site.

- Site 20 groundwater was evaluated in the BGOURI Update/FS (TtNUS, 2004). The BGOURI Update recommended an FS not be prepared for Site 20 groundwater and that an NFA decision document be prepared for groundwater. The Interim ROD was signed in December 2004, and the selected remedy for Site 20 groundwater was NFA.

Also, it is recommended that there be enforcement of the IR Site Use Restriction Instruction.

- The instruction was enforced at Site 20 until the remedial action for soil and sediment was completed and the groundwater ROD was signed in 2004. Because there are no hazardous substances,

pollutants, or contaminants remaining on site in excess of levels that allow for unlimited use and unrestricted exposure, enforcement of the instruction is no longer necessary at Site 20.

## 17.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 17.5.1 Document Review

The following documents were reviewed for the second five-year review:

| | |
|---|---|
| BGOURI | January 2002 |
| Final Remedial Action Report | June 2002 |
| BGOURI Update/FS | July 2004 |
| Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 Groundwater (OU9) | September 2004 |
| Interim ROD for Sites 3, 7, 14, 15, 18, and 20 Groundwater | December 2004 |

### 17.5.2 Data Review

No monitoring or O&M is necessary at this site; therefore, there were no data available for review.

### 17.5.3 ARAR and Site-Specific Action Level Changes

No new human health or ecological ARARs have been promulgated that would call into question the protectiveness of the remedies selected for the soil, sediment, and groundwater.

### 17.5.4 Site Inspection and Site Interviews

Because soil and sediment with contaminant concentrations exceeding cleanup levels were removed and the selected remedy for groundwater is NFA, no site inspection or site interviews were performed. Future land use at Site 20 is likely to remain the same. The site is located in a high-security area at NSB-NLON.

## 17.6 ASSESSMENT

The following conclusions support the determination that the remedies selected for Site 20 are currently protective of human health and the environment.

***Question 1. Is the remedy functioning as intended by the decision documents?***

Soil and sediment with contaminant concentrations exceeding cleanup levels were removed during the remedial action. The selected remedy for groundwater was NFA.

***Question 2. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?***

- ***Changes in Standards and TBCs***: ARARs and TBCs considered during preparation of the RODs were reviewed, and there have been no changes that would impact the selected remedies.

- ***Changes in Exposure Pathways:*** There have been no changes at the site that would have resulted in new exposure pathways to human or ecological receptors.

- ***Changes in Toxicity and Other Contaminant Characteristics:*** There have been no changes in human health toxicity criteria that would impact the selected remedies.

- ***Changes in Risk Assessment Methods:*** As discussed in Section 1.4, there have been no major changes in HHRA methodology since the signing of the RODs that would impact the protectiveness of the remedies.

- ***Expected Progress Towards Meeting RAOs:*** The RAOs for Site 20 soil (OU7) were met by excavating and disposing of contaminated soil and sediment with concentrations in excess of the remedial goals at an approved disposal facility. The remedy selected for Site 20 groundwater, a portion of OU9, was NFA; therefore, RAOs were not required.

***Question 3. Has any other information come to light that could call into question the protectiveness of the remedy?***

No additional information has been identified that would call into question the protectiveness of the remedies.

## 17.7 ISSUES

The Site 20 monitoring wells have not been properly abandoned. Because no additional sampling is required from the wells, the wells should be properly abandoned.

## 17.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that no additional five-year reviews of Site 20 be completed because the remedies implemented at the site did not result in hazardous substances, pollutants, or contaminants remaining on site in excess of levels that allow for unlimited use and unrestricted exposure. It is also recommended that a well abandonment program be developed and implemented to properly abandon Site 20 monitoring wells.

## 17.9 PROTECTIVENESS STATEMENT

The remedies for Site 20 are protective of human health and the environment because all contaminated soil and sediment with concentrations greater than the remedial goals were removed from the site, and there are no unacceptable risks from exposure to groundwater.

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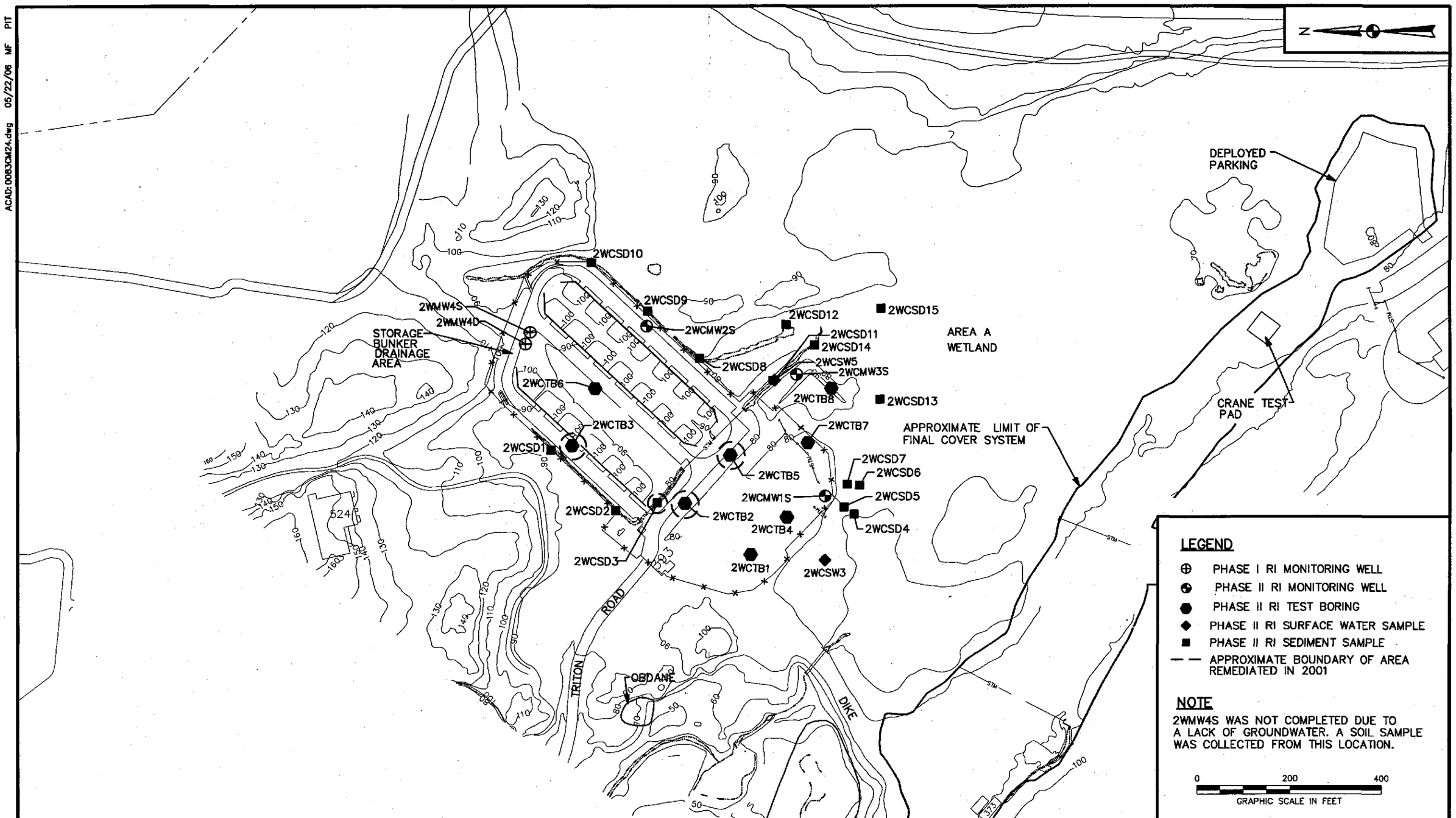


## LEGEND

- ⊕ PHASE I RI MONITORING WELL
- ⊕ PHASE II RI MONITORING WELL
- ⬢ PHASE II RI TEST BORING
- ◆ PHASE II RI SURFACE WATER SAMPLE
- ■ PHASE II RI SEDIMENT SAMPLE
- — — APPROXIMATE BOUNDARY OF AREA REMEDIATED IN 2001

## NOTE

2WMW4S WAS NOT COMPLETED DUE TO A LACK OF GROUNDWATER. A SOIL SAMPLE WAS COLLECTED FROM THIS LOCATION.

0 200 400
GRAPHIC SCALE IN FEET

| | | | |
|---|---|---|---|
| DRAWN BY MF | DATE 5/22/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 20 - AREA A WEAPONS CENTER<br>NSB-NLON<br>GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

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| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAR | DATE 6/7/06 |
| DRAWING NO. FIGURE 17-1 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

# 18.0 SITE 21 – LOWER SUBASE – BERTH 16 (OU4)

This five-year review is being conducted for Site 21 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. Site 21 is currently being investigated under CERCLA. No decision documents have been prepared for this site.

## 18.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 21 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Construction of Buildings 103, 173, 106, and 156. | 1918 – 1944 |
| Construction of Buildings 456 and 478. | After 1979 |
| Final Site Inspection Report for Berth 16 completed. | 1995 |
| Final Lower Subase RI completed. | 1999 |
| First Five-Year Review completed. | December 2001 |
| Draft Final FS for soil and groundwater at the Lower Subase completed. | July 2002 |
| SOPA (ADMIN) New London Instruction 5090.18C updated. | December 2006 |

## 18.2 BACKGROUND

Site 21 is Berth 16, which is located at the Lower Subase along the Thames River at the intersection of Amberjack Road and Albacore Road. The site map is included as Figure 18-1. Figure 1-2 shows the location of the site relative to the other IR sites at NSB-NLON. The following structures are currently included in Berth 16 (Atlantic, 1995a).

| Building | Original Use | Current Use |
|---|---|---|
| 103 | Instruction | Instruction |
| 173 | Substation | Electrical distribution |
| 106 | Photolab and electronics | Storage |
| 157 | Periscope Shop | Optical Shop |
| 456,478 | Maintenance Shop | Maintenance Shop |

Berth 16 formerly included a refuse/classified materials incinerator; an underground, 250-gallon, diesel fuel storage tank; and an underground, diesel-fuel transfer line (Atlantic, 1995a). The incinerator, which

was located at the current site of Building 478, has been separated from Site 21 and is now Site 25. The UST was located adjacent to the northern wall of Building 157, and the underground fuel line extended along Pier 51, east of Building 173. All these items have been decommissioned (Atlantic, 1995a). Sites 21 and 25 were evaluated collectively as Zone 7 during the Lower Subase RI. Because of this approach, the remainder of this section discusses information in terms of Zone 7.

Soil, groundwater, and sediment sampling (in the adjacent Thames River) and analysis were conducted at the site in conjunction with the Lower Subase RI (TtNUS, 1999b). The Lower Subase RI (TtNUS, 1999b) recommended that Zone 7 proceed to an FS to evaluate appropriate remedial alternatives for the soil and groundwater OU. These recommendations were based on the following information:

- The nature and extent of organic and inorganic contamination in soil are well defined to the extent practical considering the limitations presented by existing infrastructure.

- The baseline HHRA indicated that ILCRs for full-time employees and hypothetical future residents under the RME scenario are in excess of the USEPA acceptable risk range and the CTDEP cumulative target cancer risk level. Noncarcinogenic risks for all receptor groups were less than the USEPA and CTDEP acceptable limit of 1.0, except for the construction worker under the RME scenario. Although the RME HI for the construction worker slightly exceeded unity, adverse impacts are not anticipated because the major contributors (antimony and manganese) to the cumulative risk do not affect the same target organs. Cumulative risks to each individual target organ are expected to be less than unity. In addition, modeling performed to evaluate exposure to lead showed that all receptors (i.e., small children, fetuses of pregnant women, future employees, and construction workers) are at risk in Zone 7. These elevated risks (for lead and other chemicals) assume that, sometime in the future, soils currently covered by pavement or buildings would be exposed and available for human contact.

- Evidence suggests that inorganic contamination (mainly lead) is migrating from soil to groundwater.

- Natural attenuation or bioremediation could be feasible alternatives for petroleum contamination in soil.

- The Navy decommissioned the fuel lines within Zone 7; therefore, the historic source of petroleum contamination has been eliminated.

- The zone is covered with pavement or buildings, which minimizes direct exposure of human receptors to contaminated soil.

- The data do not suggest that petroleum contamination in soil is significantly migrating to groundwater. In addition, natural attenuation processes seem to be at work in the groundwater. These processes can reduce concentrations of petroleum contamination that reach the aquifer and convert the petroleum contamination to a less toxic form. Groundwater monitoring will confirm this information.

- A tiered groundwater monitoring program will allow for further actions to be completed if results show significant adverse impacts.

- The source of lead contamination in the groundwater is the unsaturated soil of Zone 7. Appropriate remedial alternatives for Zone 7 soil will be evaluated in the FS. When the appropriate actions are taken, concentrations of lead in groundwater will decrease.

- The ERA for the Thames River adjacent to Zone 7 shows that maximum concentrations of several non-AVS inorganics in Zone 7 sediments near the Lower Subase exceeded conservative guidelines (e.g., ER-Ls), indicating that potential risks may be present. The AVS/SEM analysis suggests that cadmium, copper, nickel, lead, and zinc are not bioavailable. Beryllium, cobalt, and vanadium were retained as COCs because no conservative sediment guidelines were available. No alternate guideline was available for barium, for which the maximum detected concentration exceeded the conservative guideline. The COCs were concluded to not be of ecological significance in the NSB-NLON Phase II RI ERA for the Thames River. Benzo(a)pyrene was the only organic in Zone 7 sediments that had maximum and average concentrations in excess of guidelines. HQ values were low, 1.39 for the maximum concentration and 1.11 for the average concentration. The maximum concentration of benzo(a)pyrene was much less than its ER-M. Significant toxicity was not observed in Zone 7 sediment toxicity tests from the NSB-NLON Phase II RI using *Leptocheirus*. Survival of *Ampelisca* was significantly lower than survival in reference sediments. Significant mortality was not observed in Pier 17 EA toxicity tests with *Ampelisca*. The Pier 17 EA benthic community analyses concluded that the Pier 15 benthic community was relatively healthy, and the Pier 17 benthic community appeared to be disturbed. Significant bioaccumulation of some PAHs was observed in Pier 17 EA bioaccumulation studies with *Macoma* and *Nereis*. Some bioaccumulation of PCBs was noted in *Nereis* but not in *Macoma*. Significant bioaccumulation of inorganics was not observed in either species. Low concentrations of some inorganics and pesticides were detected in a blue mussel sample collected in Zone 7. The weight of evidence appears to be equivocal, suggesting significant potential risks to sediment-dwelling organisms from contaminants in Zone 7 near Pier 17 but not near Pier 15. However, most of the Pier 15 and Pier 17 sediments have been subsequently dredged, making interpretation of biological analyses from historical studies difficult. Sediments were

replaced with "clean" fill after dredging, which may have ameliorated some of the potential risks. The NSB-NLON Phase II RI suggested that potential risk in the Lower Subase was confined to the Piers 15 and 17 area.

- The groundwater at Zone 7 is not currently or anticipated to be used in the future as a potable water source because it is brackish (classified GB); therefore, there is no imminent threat to human health.

- The Thames River provides significant dilution and mixing, which minimize the impact of any contaminant migration from Zone 7.

- The storm sewer system in Zone 7 is a potential migration pathway for contaminants present in groundwater.

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

An FS is currently being prepared for Zone 7 soil and groundwater. The Navy is currently resolving ecological risk issues related to the adjacent Thames River. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy for Zone 7 will be selected after the FS is finalized.

## 18.3 REMEDIAL ACTIONS

### 18.3.1 Remedy Selection

A final remedy has not been selected or implemented for Zone 7. An FS is currently being prepared to evaluate alternatives for the zone. The Lower Subase RI recommended that the FS for Zone 7 evaluate appropriate remedial alternatives for the soil including institutional controls, passive and/or in-situ technologies, and hot spot removal actions for the lead contamination. In addition, it was recommended that the FS evaluate limited action scenarios for the groundwater of Zone 7.

### 18.3.2 Remedy Implementation

A final remedy has not yet been chosen for Zone 7. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy will be selected after the FS is finalized.

## 18.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of Site 21. The recommendations from the First Five-Year Review Report are provided below along with the actions that were taken to address the recommendations.

It was recommended that the FS be completed to determine the appropriate remedial action for Zone 7 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative.

- The FS for the Lower Subase is in progress, and it is expected to be completed in 2007. Ecological issues related to the Thames River are currently being resolved. A decision document will be prepared upon completion of the FS.

Also, it was recommended that rehabilitation or abandonment of site groundwater monitoring wells be conducted.

- No rehabilitation or abandonment activities have been performed on Site 21 groundwater monitoring wells since the first five-year review. Monitoring wells are still present at the site with missing covers, providing an open conduit from the ground surface to the groundwater aquifer.

In addition, it was recommended that there be enforcement of the IR Site Use Restriction instruction.

- The instruction was updated to include the Goss Cove Landfill and was reissued in 2003. The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information for Site 2A - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON. The instruction has been enforced as appropriate at Site 21.

## 18.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the 5-year review process and the actions taken to complete this review.

### 18.5.1 Document Review

New London Instruction 5090.18C was the only document reviewed for the second five-year review of Site 21. Within the past 5 years, no other documents have been completed regarding this site.

### 18.5.2 Data Review

No new data were collected from the site over the past 5 years. No monitoring or O&M activities have been initiated at the site because a final remedy has not been selected.

### 18.5.3 ARAR and Site-Specific Action Level Changes

A remedy has not been selected and a ROD has not been signed for Zone 7; therefore, ARARs and site-specific action levels have not been identified for Zone 7.

### 18.5.4 Site Inspection

The Lower Subase was visually inspected on April 4, 2006 as the inspection team drove through the area. Zone 7 is covered with pavement or buildings and is located near the Thames River and a set of railroad tracks. The Lower Subase is a high-security area at NSB-NLON, and to avoid security issues, the team conducted a drive-through inspection lead by the Navy. Weather conditions during the inspection were cold (mid-40s), overcast, and windy. Representatives from the Navy, USEPA, CTDEP, TtNUS, ECC, and Gannett Fleming participated in the inspection. It was noted during the site inspection that an extension to Building 157 (Zone 7) was being built. Excavated soil from near Building 157 had been stockpiled, and samples from the stockpile had been tested for TCLP lead and had failed. The soil was to be disposed at an approved off-site disposal facility. No photos of the zone were taken during the inspection. The Navy has no additional plans to change the current use of the site.

### 18.5.5 Site Interviews

No official interviews were conducted as part of the second five-year review.

## 18.6 ASSESSMENT

Because a final remedy has not been selected for Zone 7, conclusions cannot be made to support the determination that the remedy at Zone 7 is protective of human health and the environment. The results of the Lower Subase RI do no indicate any imminent threats to human health or the environment as long as site conditions remain the same.

The Navy has an IR Site Use Restriction Instruction in place at NSB-NLON [SOPA (ADMIN) NLONINST 5090.18C]. The policy restricts ground surface disturbance of soils and subsurface disturbance of soils and/or groundwater at IR sites.

## 18.7 ISSUES

A final remedy has not been implemented at Zone 7; therefore, deficiencies in the remedial action cannot be determined at this time. However, during the first five-year review site inspection, it was noted that several site monitoring wells were missing covers, providing an open conduit from the ground surface to groundwater. It was recommended that these wells be rehabilitated or abandoned; however, no action has been taken to correct the problem.

## 18.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that the FS be completed to determine the appropriate remedial action for Zone 7 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative. In addition, it is recommended that rehabilitation or abandonment of site groundwater monitoring wells be conducted. Also, it is recommended that there be enforcement of the IR Site Use Restriction Instruction.

## 18.9 PROTECTIVENESS STATEMENT

A protectiveness determination for Zone 7, which includes Site 21, cannot be made at this time because a remedy has not yet been selected for the zone. The results of the Lower Subase RI do not indicate any imminent threats to human health or the environment under current land use scenarios. The Navy has instituted an instruction that provides land use controls and restricts excavation activities. The instruction should minimize unauthorized and unplanned exposure to contaminated media at the zone until a remedy is selected and implemented. The Navy is currently addressing data gaps for the zone as part of development of the FS.

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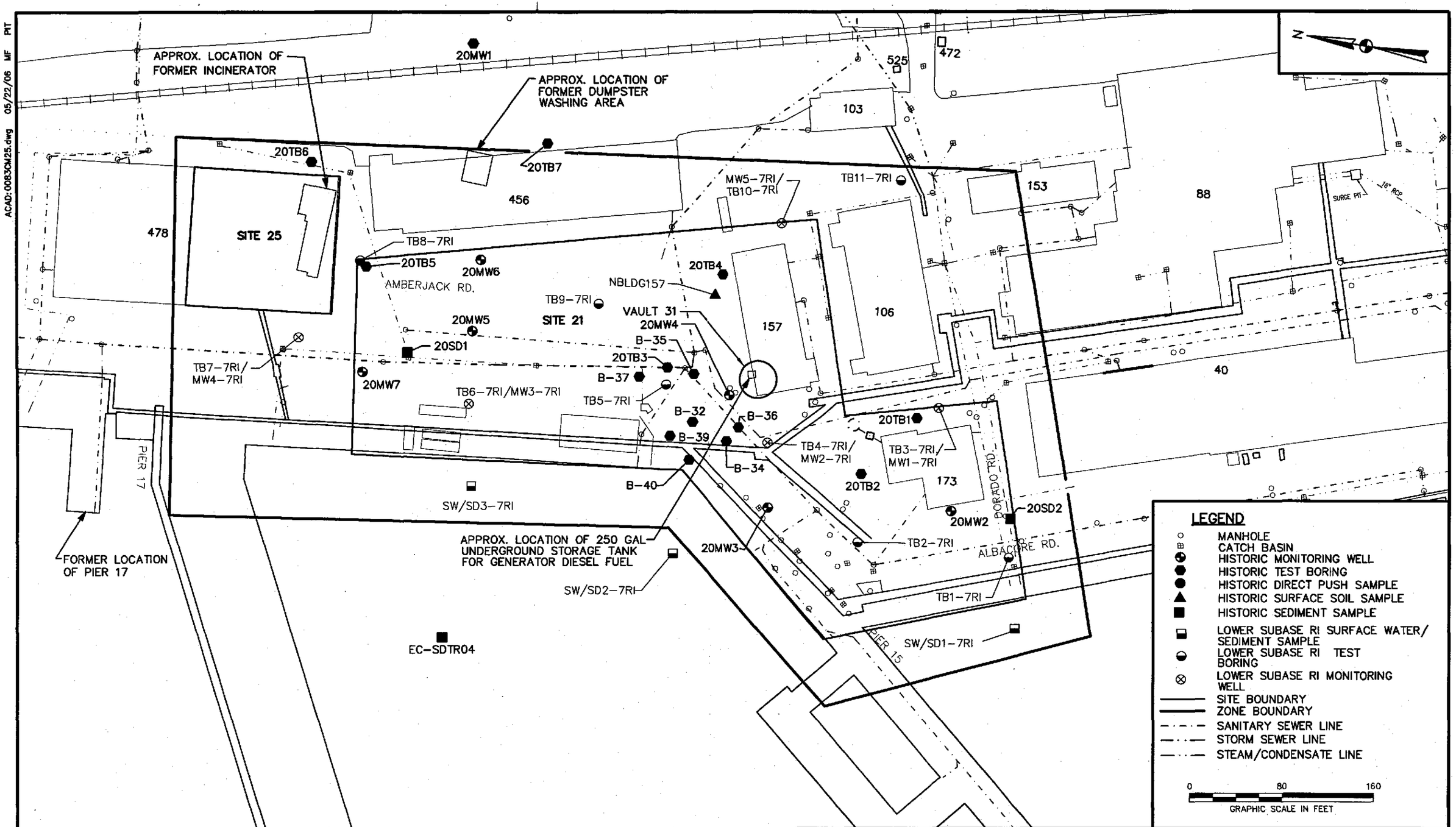


| | | | |
|---|---|---|---|
| DRAWN BY MF | DATE 5/22/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 21 - BERTH 16, AND<br>SITE 25 - CLASSIFIED MATERIAL INCINERATOR<br>NSB-NLON<br>GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

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| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAR | DATE 6/1/06 |
| DRAWING NO. FIGURE 18-1 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

# 19.0 SITE 22 – LOWER SUBASE – PIER 33 (OU4)

This five-year review is being conducted for Site 22 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. Site 22 is currently being investigated under CERCLA. No decision documents have been prepared for this site.

## 19.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 22 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Final Site Inspection Report, Pier 33 and Berth 16 completed. | 1995 |
| Final Lower Subase RI Report completed. | 1999 |
| First Five-Year Review completed. | December 2001 |
| Draft Final FS for soil and groundwater at the Lower Subase completed. | July 2002 |
| SOPA (ADMIN) New London Instruction 5090.18C updated. | December 2006 |

## 19.2 BACKGROUND

Site 22 is located at the Lower Subase along the Thames River and includes Pier 33, Building 175, and approximately 800 feet of property in the area of Pier 33, Building 175, and Amberjack Road. The site map is included as Figure 19-1. The site's location relative to other IR sites is shown on Figure 1-2.

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

A 1,000-gallon, underground fuel storage tank was located adjacent to the southern side of Building 175. The age and type of the tank are unknown. Based on a tank test performed on May 22, 1990, no leakage was identified. Stained soil was observed around the fill pipe of the UST, and concentrations of TPH detected in shallow and deep soil samples collected in the vicinity of the UST exceeded State and federal

criteria (Atlantic, 1995a). This information indicated that the UST was the source of the TPH contamination. The tank has since been excavated, removed, and replaced by a new 1,000-gallon UST. A 250-gallon, underground diesel fuel storage tank is located adjacent to the northern side of Building 175 and this tank services an emergency generator for the sewage lift station. The age and type of the tank are unknown.

Zone 5 consists of Site 22 and was investigated during the Pier 33 and Berth 16/Former Incinerator Site Investigation (Atlantic, 1995a) and the Lower Subase RI (TtNUS, 1999b). No. 2 fuel oil was detected in subsurface soils in front of Building 175 during the 1995 Site Investigation. Additional investigation of site operations and sediment analysis of the storm sewer system were recommended to determine the extent and source of sediment contamination. Removal and disposal of contaminated sediment and modification of any site operations identified as a contributor to the contaminated sediment were also recommended.

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

- The nature and extent of organic and inorganic contamination in the soil and groundwater are well defined to the extent practical considering limitations presented by existing infrastructure.

- The contamination detected at Zone 5 is related to the former UST used to store heating oil and not to the battery acid above-ground storage tanks (ASTs) that were in Building 175. The UST has been replaced; therefore, the main source of the contamination has been eliminated.

- Monitored natural attenuation or bioremediation could be feasible alternatives for petroleum contamination in soil.

- Evidence suggests that limited organic contamination may be migrating from the site. Natural attenuation processes seem to be at work in the groundwater. These processes can reduce concentrations of petroleum contamination that reach the aquifer and convert the petroleum contamination to a less toxic form. Monitored natural attenuation should be further evaluated as part of the remedial strategy for Zone 5 to confirm the effectiveness of these processes. The monitored natural attenuation program should include or be part of a tiered groundwater monitoring program, similar to those currently being implemented at other NSB-NLON IRP sites. These programs confirm or disprove that contamination present in the soil is mobile and impacting other media and allow for further actions to be completed if the results show significant impacts.

- The baseline HHRA indicates that there are minimal risks to human receptors. None of the risks were in excess of the USEPA acceptable risk range, but the risk to the hypothetical future resident under the RME scenario slightly exceeded the CTDEP risk level. Lead was not a COC for this zone; therefore, modeling was not necessary to evaluate exposure to lead.

- Although reported concentrations of TPH in site soil samples exceeded the State RSRs for direct exposure and pollutant mobility, the chemical-specific risk assessment for the compounds assumed to be the major constituents of the observed TPH contamination indicated minimal risks to potential human receptors.

- The zone is generally covered with pavement and a building, which minimizes direct exposure to the contaminated soil by human receptors.

- Elevated levels of inorganics, particularly lead, were detected in sediment collected from a catch basin between Zones 5 and 6. Both zones contribute surface water to this catch basin. Slightly elevated levels of inorganics were also detected in surface water samples collected from the storm sewer system for the National Pollution Discharge Elimination System (NPDES) permit. Therefore, the storm sewer system in Zone 5 may be acting as a migration pathway for inorganic contaminants. The lead contamination is believed to be the result of storage of lead ballast in this area and surface water runoff. The Navy has eliminated the storage of ballast in this area.

- The storm sewer system in Zone 5 is a potential migration pathway for contaminants present in groundwater.

- The ERA for the Thames River adjacent to Zone 5 shows that risks to ecological receptors in this area are relatively low.

- The groundwater at Zone 5 is not currently or anticipated to be used in the future as a potable water source because it is brackish; therefore, there is no imminent threat to human health.

- The Thames River provides significant dilution and mixing, which minimize the impact of contaminant migration from Zone 5.

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

A FS is currently being prepared for Zone 5 soil and groundwater. The Navy is currently resolving ecological risk issues related to the adjacent Thames River. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy for Zone 5 will be selected after the FS is finalized.

## 19.3 REMEDIAL ACTIONS

### 19.3.1 Remedy Selection

A final remedy has not been selected or implemented for Zone 5. An FS is currently being prepared to evaluate alternatives for the zone. The Lower Subase RI (TtNUS, 1999b) recommended that the FS for Zone 5, which includes Site 22, focus, to the extent possible, on alternatives that rely on institutional controls to limit exposure to contaminated soil and passive and/or in-situ remedial alternatives.

### 19.3.2 Remedy Implementation

A final remedy has not yet been chosen for Zone 5. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy will be selected after the FS is finalized.

## 19.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of the Site 22. The recommendations from the First Five-Year Review Report are provided below along with the actions that were taken to address the recommendations.

It was recommended that the FS be completed to determine the appropriate remedial action for Zone 5 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative.

- The FS for the Lower Subase is in progress, and it is expected to be completed in 2007. Ecological issues related to the Thames River are currently being resolved. A decision document will be prepared upon completion of the FS.

In addition, it was recommended that there be enforcement of the IR Site Use Restriction Instruction.

- The instruction was updated to include the Goss Cove Landfill and was reissued in 2003 (Navy, 2003). The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information for Site 2A - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON. The instruction has been enforced as appropriate at Site 22.

## 19.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 19.5.1 Document Review

New London Instruction 5090.18C was the only document reviewed for the second five-year review of Site 22. Within the past 5 years, no other documents have been completed regarding this site.

### 19.5.2 Data Review

No new data was collected from the site over the past 5 years. No monitoring or O&M activities have been initiated at the site because a final remedy has not been selected.

### 19.5.3 ARAR and Site-Specific Action Level Changes

A remedy has not been selected and a ROD has not been signed for Zone 5; therefore, ARARs and site-specific action levels have not been identified for Zone 5.

### 19.5.4 Site Inspection

The Lower Subase was visually inspected on April 4, 2006 as the inspection team drove through the area. Zone 5 consists of Pier 33, Building 175, and approximately 400 linear feet of additional river front property adjacent to these two structures. The area is covered with pavement or buildings and is adjacent to the Thames River and railroad. The Lower Subase is a high-security area at NSB-NLON and to avoid security issues, the team conducted a drive-through inspection lead by the Navy. Weather conditions during the inspection were cold (mid-40s), overcast, and windy. Representatives from the Navy, USEPA, CTDEP, TtNUS, ECC, and Gannett Fleming participated in the inspection. No issues were identified during the inspection, and no photos of the zone were taken during the inspection. The Navy has no additional plans to change the current use of the site.

### 19.5.5 Site Interviews

No official interviews were conducted as part of the second five-year review.

## 19.6 ASSESSMENT

Because a final remedy has not been implemented at Zone 5, conclusions cannot be made to support the determination that the remedy at Zone 5 is protective of human health and the environment. The results of the Lower Subase RI do not indicate any imminent threats to human health or the environment under the current land use scenario.

The Navy has an IR Site Use Restriction Instruction in place at NSB-NLON [SOPA (ADMIN) NLONINST 5090.18C]. This policy restricts ground surface disturbance of soils and any subsurface disturbance of soils and/or groundwater at IR sites.

## 19.7 ISSUES

A final remedy has not been selected for Zone 5; therefore, deficiencies cannot be determined at this time.

## 19.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that the FS be completed to determine the appropriate remedial action for Zone 5 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative. It is also recommended that there be continued enforcement of the IR Site Use Restriction Instruction.

## 19.9 PROTECTIVENESS STATEMENT

A protectiveness determination for Zone 5, which includes Site 22, cannot be made at this time because a remedy has not yet been selected for the zone. The results of the Lower Subase RI (TtNUS, 1999b) do not indicate any imminent threats to human health or the environment under current land use scenarios. The Navy has instituted an instruction that provides land use controls and restricts excavation activities. The instruction should minimize unauthorized and unplanned exposure to contaminated media at the zone until a remedy is selected and implemented. The Navy is currently addressing data gaps for the zone as part of development of the FS.

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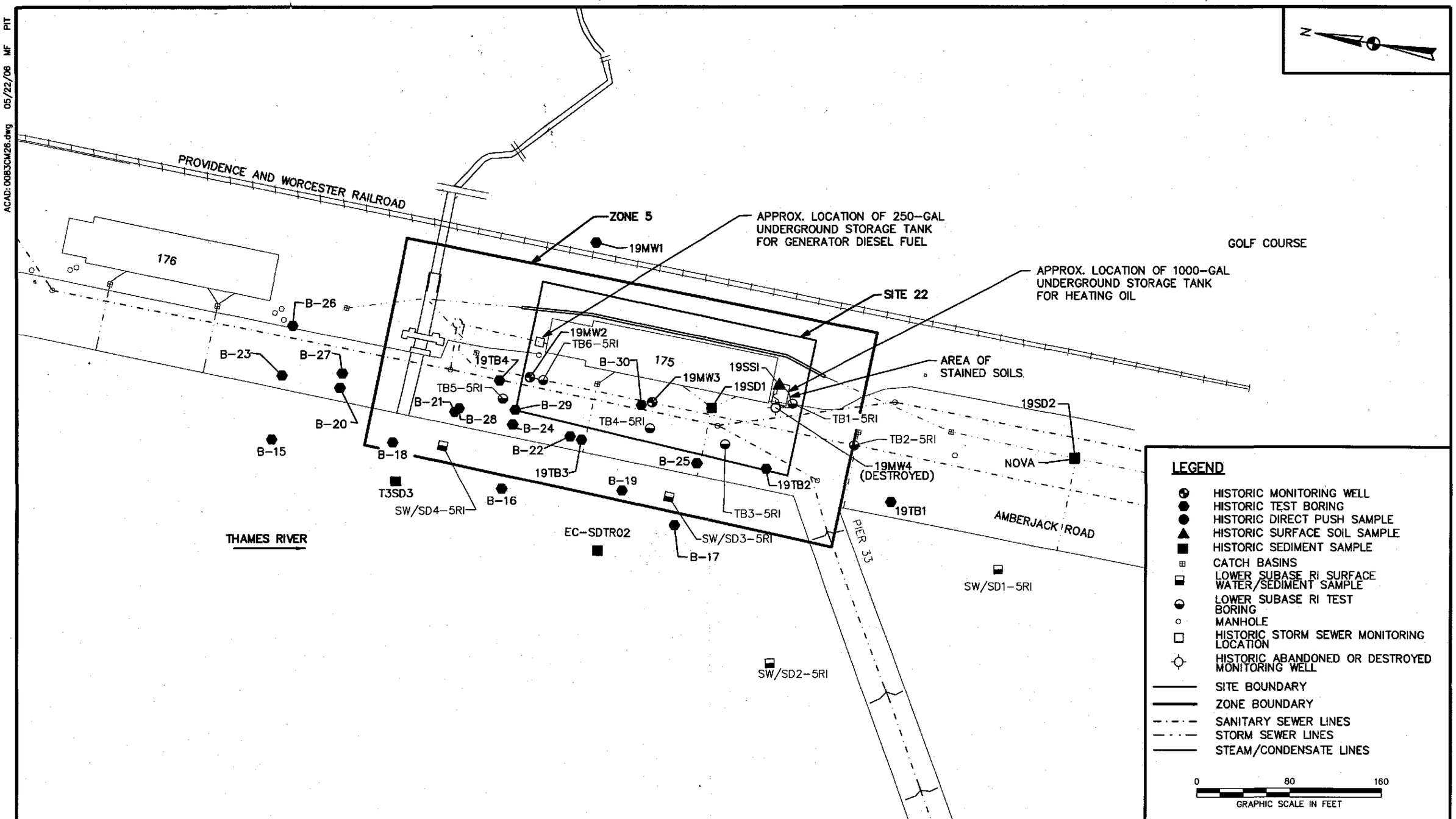


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| DRAWN BY MF | DATE 5/22/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 22 - PIER 33<br>NSB-NLON<br>GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

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| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAM | DATE 6/7/06 |
| DRAWING NO. FIGURE 19-1 | REV. 0 |

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# 20.0 SITE 23 – TANK FARM (OU9)

This five-year review is being conducted for Site 23 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. The soil at Site 23 was investigated and remediated under the CTDEP RCRA UST Program. As such, no decision documents were prepared for the soil OU. Groundwater associated with the site is being investigated under CERCLA, but no decision documents have been prepared for the groundwater OU (OU9).

## 20.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 23 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Crystal Lake drained and dredged to allow for construction of nine concrete USTs. | 1940s |
| Decommissioning and demolition of Tank OT-6. | 1970s |
| Tanks OT-7 through OT-9 decommissioned. | 1990 |
| New Tank OT-10 installed and Tanks OT-4 and OT-5 decommissioned. | 1990 |
| Tanks OT-1 through OT-3 removed from service. | 1991 |
| Waste Oil Tank OT-5 investigated for demolition and closure. | 1994 |
| Site Investigation of Tank Farm completed to define extent of soil and groundwater contamination in the UST farm. | 1997 |
| Free-product removal and soil excavation completed at OT-8. | February 1998 |
| Hydrogeologic study at the Tank Farm conducted to provide information to complete the design of a replacement storm sewer system. | 1998 |
| Tank Farm in the vicinity of OT-2 and OT-3 further investigated because weathered diesel fuel was detected in the storm sewers. | 1999 |
| Contaminated soil and free product remediated during storm drainage system rehabilitation by the Navy's RAC. | 2000 |
| First Five-Year Review completed. | December 2001 |
| BGOURI completed. | January 2002 |
| SOPA (ADMIN) New London Instruction 5090.18C updated. | December 2006 |

## 20.2 BACKGROUND

In the early 1940s, Crystal Lake was drained and dredged to allow for construction of nine concrete USTs (see Figure 20-1). When construction was complete, the former lake bed was reportedly filled with soils excavated from a small hill west of the Tank Farm (Site 23) and graded to create a level surface for development at NSB-NLON. The location of Site 23 relative to the other IR sites is shown on Figure 1-2.

Each of the nine USTs had a holding capacity of 750,000 gallons. No. 6 fuel oil was stored in tanks OT-1 through OT-3 from the date of construction until they were removed from service in the summer of 1991. Tanks OT-7 through OT-9 were decommissioned in the summer of 1990 and were used exclusively for storage of diesel during all 48 years of service.

A reduced demand for diesel fuel at NSB-NLON in the mid-1970s led to the decommissioning and demolition of tank OT-6. The reduced demand for diesel also led to the modification of tank OT-5 for waste oil storage purposes. Tank OT-4 was used to store tank bottom wastes from OT-1. Tank OT-5 was used as part of an oil/water separator system. Tanks OT-4 and OT-5 were reportedly decommissioned after installation of a new 30,000-gallon waste oil underground tank (OT-10) in 1990. For further information regarding OT-5, see Section 9.0. Tanks OT-1 through OT-9 have been demolished and closed in place. Tank closure was accomplished following RCRA closure requirements by cleaning the tanks, demolishing the tank roof supports, and allowing the roof to collapse into the tank. The void was then filled with gravel, and the site was restored using soil and topsoil.

Evidence of releases of petroleum products from these tanks, their associated piping, and possibly from other nearby sources was detected during previous investigations. Historical sampling locations are shown on Figure 20-1. Both soil and groundwater contamination have been identified. Petroleum hydrocarbons have been detected periodically at the outfall of the Tank Farm storm sewer system. A number of petroleum releases were documented by the Navy in the vicinity of the Tank Farm at NSB-NLON from 1989 through 1999.

The Tank Farm features are shown on Figure 20-1 and include the following:

- Nine former 110-foot-diameter, 11-foot-high USTs (OT-1 to OT-9)
- A 30,000-gallon, double-walled UST (OT-10)
- An oil/water separator (at OT-10)
- A 10,000-gallon waste oil tank (at OT-10)
- A fuel oil loading area adjacent to Building 482
- Tanker truck dumping pad and trough (at OT-10)
- Associated UST piping systems

- The Morale, Welfare, and Recreation (MWR) Recreation Center (Building 461)
- Baseball/softball fields
- A restroom facility (Building 445)
- Buildings that housed the former air sparging/soil vapor extraction (AS/SVE) facility for the Naval Exchange (NEX) service station
- Two 150,000-gallon diesel ASTs (OT-12 and OT-13)
- Miscellaneous buildings

**Product Transfer Lines**

Product (No. 6 fuel oil or diesel fuel) was historically delivered via barge to a pier, where it was pumped via pipelines to the Tank Farm USTs through the Building 332 valve house. Product was transferred via pipeline from the USTs to the power plant or the submarines at the Lower Subase on an as-needed basis.

The No. 6 fuel oil transfer lines were situated within concrete-lined trenches but were removed because No. 6 fuel oil is no longer used at NSB-NLON. The diesel transfer lines have no trenches. Portions of the diesel fuel lines on the Lower Base were recently replaced. The lines located on the Upper Base are cathodically protected.

Petroleum contamination related to the former USTs and their associated piping was identified during previous investigations at Site 23. The Navy conducted three removal actions to address the identified contamination. Soil and free product were removed in the vicinity of OT-8 and OT-3 during the removal actions. Contaminated soil was also removed along Tang Avenue. In addition, BTEX compounds were historically detected in groundwater at the Tank Farm, and it was determined that the contamination was related to leaking USTs from an adjacent site (i.e., NEX Gas Station). The leaking USTs have been repaired, and an AS/SVE system was installed to address the associated BTEX plumes.

**Storm Drainage System**

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

The drainage system was rehabilitated in 2000. The original combined groundwater and stormwater system was separated into a deep groundwater and a new shallow stormwater system. The old deteriorated pipes in the groundwater collection system were slip-lined to improve their integrity and conductance. The old tank ring-drains (french drains) were not rehabilitated, but their connection with the groundwater collection system was maintained. Groundwater sampling and analysis from the groundwater collection system is currently ongoing, and the results will be used to determine if some form of further action is required for groundwater.

As part of the drainage system rehabilitation project, contaminated soil and free product were also remediated. Contaminated soil and free product, which were previously identified during the Tank Farm Site Investigation Addendum in the vicinity of the former UST OT-3, were removed and disposed off site. The Navy initiated a sampling program for the deep groundwater collection system after construction activities were completed. It was anticipated that the results would be used to determine whether further action is required for groundwater; however, a final decision has not been made yet.

**Tank Underdrain System**

The nine former USTs (OT-1 to OT-9) at the Tank Farm were each rated for a nominal capacity of 750,000 gallons or approximately 100,000 cubic feet. Each tank was approximately 110 feet in diameter and 11 feet in depth. Depending on the season, the depth to groundwater in some areas of the site may be as little as 2 feet below grade. Groundwater at a depth of 2 feet would convert to a hydraulic pressure of 2.6 pounds per square inch exerted over the entire floor of one empty tank or an upward force of approximately 1,400 tons. The floor of the tank would rise, with or without its walls.

Tank stability was obtained using a combination of a site-wide drainage system, a series of columns inside the tanks, and an underdrain system. A site-wide stormwater drainage/dewatering system was installed, and french drains were installed around OT-1, OT-2, OT-3, OT-4, and OT-5. A series of 37 columns transmitted the weight of the tank roof and overlying fill to the floor of the tank.

**BGOURI**

The objectives of the BGOURI at Site 23 were to further characterize the nature and extent of groundwater contamination and to quantify the risks to human receptors from the groundwater. Groundwater sampling results for Site 23 indicated that the water quality is generally good, with only sporadic, low-concentration detections of VOCs, SVOCs, and metals in site monitoring wells. A preliminary evaluation of natural attenuation data indicated that biodegradation and other natural attenuation processes might be acting to reduce organic contaminants to relatively insignificant levels in

the Tank Farm. However, it was not recommended that a monitored natural attenuation alternative be pursued for the site.

The HHRA determined that risks posed by exposure of construction workers to groundwater at Site 23 are within USEPA and CTDEP acceptable levels, assuming that the workers are exposed to the maximum observed concentrations of site contaminants. Risks for hypothetical future adult residents exposed to groundwater at Site 23 were less than or within USEPA and CTDEP acceptable levels, assuming that the residents are exposed to the maximum observed concentrations of site contaminants. However, the chemical-specific ILCR for PCE exceeded CTDEP's target level for individual chemicals, although the maximum detected concentration for PCE was less than its CTDEP RSR. The Integrated Exposure Uptake Biokinetic (IEUBK) model indicated that no adverse effects are anticipated for hypothetical future child residents exposed to lead in groundwater at Site 23.

Based on the results of the risk assessment and the fact that groundwater at Site 23 is not used for human consumption and it is not likely to be used for human consumption in the foreseeable future because of its current classification (i.e., GB groundwater is not suitable for direct human consumption without treatment), it was recommended that the decision for preparation of an FS for the groundwater OU at the Tank Farm (a portion OU9) be postponed until site conditions stabilize and the results of the sampling and analysis program for the groundwater collection system determined the trends in groundwater contaminant concentrations.

## 20.3 REMEDIAL ACTIONS

### 20.3.1 Remedy Selection

The soil at Site 23 was investigated and remediated under the CTDEP RCRA UST Program. The Navy conducted three removal actions to address the contamination identified in the soil. Soil and free product were removed in the vicinity of OT-8 and OT-3 during the removal actions. Contaminated soil was also removed along Tang Avenue. The remedial goal for the removal actions at OT-8 and Tang Avenue was 2,500 mg/kg for TPH. In addition, BTEX compounds were historically detected in groundwater in the Tank Farm, and it was determined that the contamination was related to leaking USTs from an adjacent site (NEX Gas Station). The leaking USTs were repaired, and an AS/SVE system was installed and operated to address the associated BTEX plumes.

A final remedy for Site 23 groundwater has not been selected or implemented. The BGOURI (TtNUS, 2002a) recommended evaluating the results of the sampling and analysis program for the groundwater collection system to determine if an FS or NFA ROD is required for the groundwater OU. The groundwater OU is currently proceeding through the CERCLA process.

### 20.3.2 Remedy Implementation

The soil at Site 23 was investigated and remediated under the CTDEP RCRA UST Program. No additional information regarding the RCRA actions will be presented in this report.

A final remedy has not yet been chosen for Site 23 groundwater, a portion of OU9. It is expected that a decision regarding the need for an FS or an NFA decision document for groundwater will be made in 2007.

## 20.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of the Site 23. The recommendations from the First Five-Year Review Report are provided below along with the actions that were taken to address the recommendations.

It was recommended that the decision for preparation of an FS for the groundwater OU at the Tank Farm be postponed until site conditions stabilize and the results of the current sampling and analysis program of the groundwater collection system determine the trends in groundwater contaminant concentrations. If the results of the monitoring program support that there are no unacceptable risks to human health or the environment, then an FS will not be prepared and the Navy will pursue an NFA ROD for the groundwater OU. If the results suggest that further actions are required, then the Navy will prepare an FS for the groundwater OU to develop appropriate remedial alternatives.

- It is expected that a decision regarding the need for an FS or an NFA decision document for Site 23 groundwater will be made in 2007.

Also, it was recommended that there be enforcement of the IR Site Use Restriction instruction.

- The instruction was updated to include the Goss Cove Landfill and was reissued in 2003. The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information from Site 2A - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON. The instruction has been enforced as appropriate at Site 23.

## 20.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 20.5.1 Document Review

The BGOURI (TtNUS, 2002a) and New London Instruction 5090.18C were the only documents reviewed for the second five-year review of Site 23. No other documents have been completed regarding this site within the past 5 years. The results of the BGOURI are discussed in Section 20.2.

### 20.5.2 Data Review

Groundwater/storm water data continue to be collected at Site 23. It is expected that the data will be presented and evaluated in an RI Update to be completed in 2007.

### 20.5.3 ARAR and Site-Specific Action Level Changes

A remedy has not been selected and a ROD has not been signed for Site 23 groundwater; therefore, ARARs and site-specific action levels have not been identified.

### 20.5.4 Site Inspection

A site inspection conducted on April 4, 2006 included visual observations of the Site 23/Site 9 area. Weather conditions during the inspection were cold (mid-40s) and overcast with light precipitation. Representatives from the Navy, USEPA, CTDEP, TtNUS, ECC, and Gannett Fleming participated in the inspection. Appendix A contains one photograph taken of the Site 23/Site 9 (OT-5) area. During the inspection, the representatives discussed the information required to close the site.

Site 23 is within a partially fenced area that is currently used for recreation. Groundwater at the Tank Farm is not used for human consumption and it is not likely to be used for human consumption in the foreseeable future because of its current classification (i.e., GB groundwater that indicates that it is not suitable for direct human consumption without treatment). There is no short-term or long-term plan to convert this area to any other use.

### 20.5.5 Site Interviews

No formal interviews were conducted for this site as part of the second five-year review because there were no active site issues to discuss.

## 20.6 ASSESSMENT

Because a final remedy has not been selected or implemented for Site 23 groundwater, conclusions cannot be made to support the determination that the remedy for Site 23 groundwater is protective of human health and the environment. The results of the BGOURI did not indicate any imminent threats to human health or the environment under the current land use scenario.

The Navy has an IR Site Use Restriction Instruction in place at NSB-NLON [SOPA (ADMIN) NLONINST 5090.18C]. The policy restricts ground surface disturbance of soils and any subsurface disturbance of soils and/or groundwater at IR sites.

## 20.7 ISSUES

A final remedy has not been implemented for Site 23 groundwater; therefore, deficiencies cannot be determined at this time.

## 20.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that the results of the monitoring program be evaluated and a decision for preparation of an FS for the groundwater at the Tank Farm be made in 2007. If the results of the monitoring program and evaluation support that there are no unacceptable risks to human health or the environment, an FS should not be prepared and an NFA ROD for the groundwater OU should be prepared. It is also recommended that there be enforcement of the IR Site Use Restriction Instruction.

## 20.9 PROTECTIVENESS STATEMENT

Previous actions completed under RCRA have addressed the soil OU at Site 23. The results of the BGOURI do not indicate any imminent threats to human health or the environment from groundwater under current land use scenarios. The Navy has instituted an instruction that provides land use controls and restricts excavation activities. The instruction should minimize unauthorized and unplanned exposure to contaminated groundwater at Site 23 until a remedy is selected and implemented.

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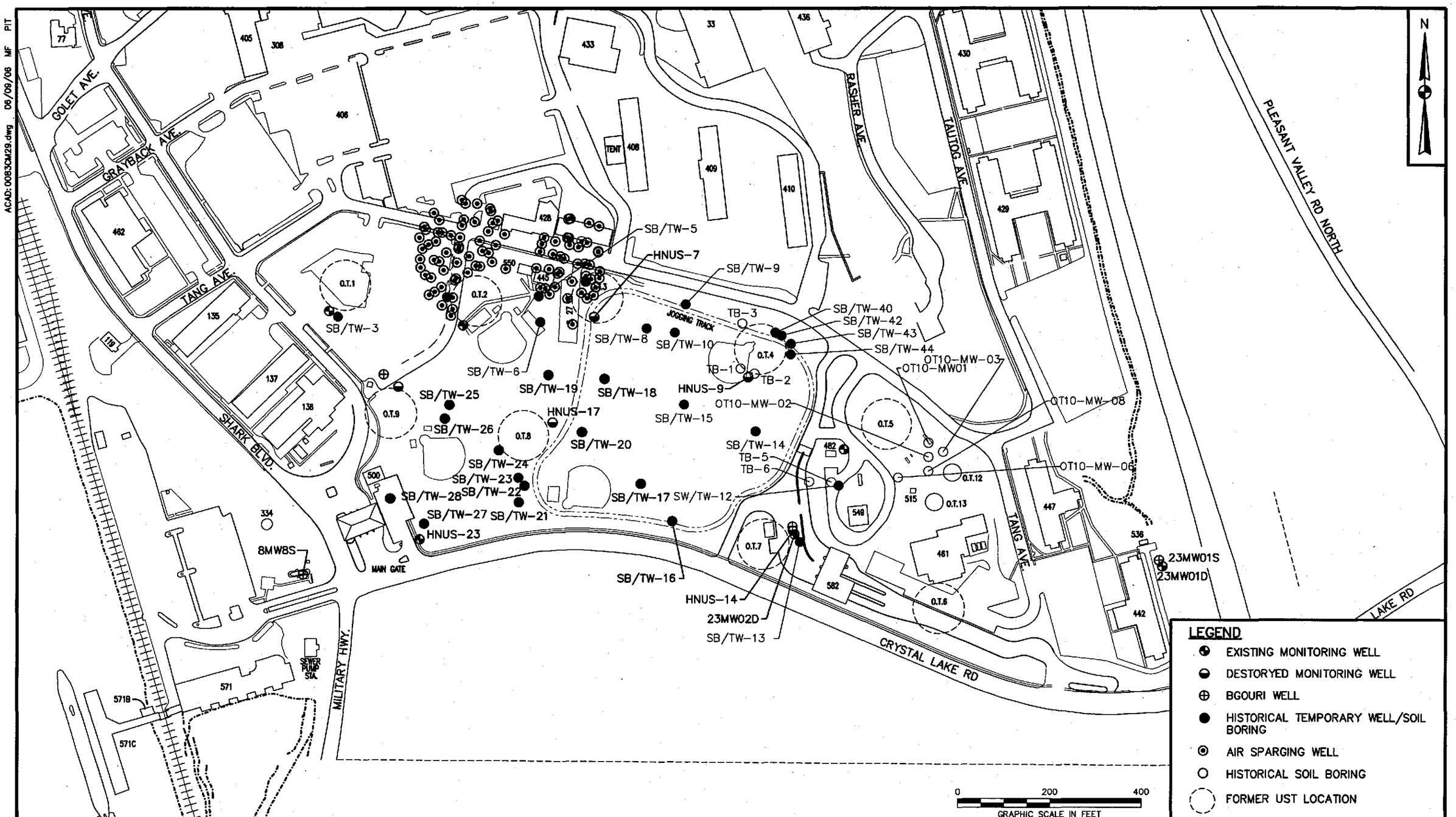


**LEGEND**

- EXISTING MONITORING WELL
- DESTORYED MONITORING WELL
- BGOURI WELL
- HISTORICAL TEMPORARY WELL/SOIL BORING
- AIR SPARGING WELL
- HISTORICAL SOIL BORING
- FORMER UST LOCATION

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| DRAWN BY MF | DATE 6/4/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 23 - TANK FARM<br>NSB-NLON<br>GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

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| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAL | DATE 6/9/06 |
| DRAWING NO. FIGURE 20-1 | REV. 0 |

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

# 21.0 SITE 24 – LOWER SUBASE – CENTRAL PAINT ACCUMULATION AREA (OU4)

This five-year review is being conducted for Site 24 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. Site 24 is currently being investigated under CERCLA. No decision documents have been prepared for this site.

## 21.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 24 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| **Event** | *Date* |
|---|---|
| Building 174 was refitted to contain boat anchor sandblasting and painting activities. | 1982 |
| Building 174 used as the primary paint storage facility for all paints used for boat maintenance activities. | Late 1980s |
| Final Lower Subase RI Report completed. | 1999 |
| First Five-Year Review completed. | December 2001 |
| Draft Final FS for soil and groundwater at the Lower Subase completed. | July 2002 |
| SOPA (ADMIN) New London Instruction 5090.18C updated. | December 2006 |

## 21.2 BACKGROUND

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

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

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

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

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

- The nature and extent of organic and inorganic contamination in soil are well defined to the extent practical considering limitations from existing infrastructures. Organic and inorganic contamination was infrequently detected at low concentrations in groundwater.

- The contaminants generally detected at Zone 6 are related to petroleum hydrocarbons and not to the historical operations at Site 24 - Central Paint Accumulation Area.

- The baseline HHRA indicates that there are minimal risks to human receptors and they are not in excess of the USEPA acceptable risk range, and only the hypothetical future resident under the RME scenario slightly exceeds the CTDEP risk level. The baseline HHRA indicates that there are minimal risks to human receptors. Noncarcinogenic risks for all receptor groups were less than the USEPA and CTDEP acceptable limit. Carcinogenic risks for all receptors were either less than or within USEPA's acceptable target risk range. With the exception of the future resident under the RME scenario, all cancer risks were less than the CTDEP acceptable risk level. Benzo(a)pyrene and arsenic were the main contributors to the cancer risk for the future resident. In addition, lead was not a COC for this zone; therefore, modeling was not necessary to evaluate exposure to lead.

- Although reported concentrations of TPH in site soil samples exceeded the State RSRs for direct exposure and pollutant mobility, the chemical-specific risk assessment for the compounds assumed to be the major constituents of the observed TPH contamination (PAHs) indicated minimal risks to potential human receptors.

- Evidence suggests that organic contamination is generally not migrating from the site but that limited inorganic contamination may be migrating from the site. Natural attenuation processes seem to be at work in the groundwater. These processes can reduce concentrations of petroleum contamination

that reach the aquifer and convert the petroleum contamination to a less toxic form. Groundwater monitoring will confirm natural attenuation and the limited migration of inorganics.

- A tiered groundwater monitoring program will allow for further actions to be completed if the results show significant impacts.

- The ERA for the Thames River adjacent to Zone 6 shows that risks to ecological receptors in this area are relatively low.

- The Thames River provides significant dilution and mixing, which minimize the impact of any contaminant migration from Zone 6.

- The zone is generally covered with pavement and a building, which minimizes direct exposure to contaminated soil by human receptors.

- The groundwater at Zone 6 is not currently or anticipated to be used in the future as a potable water source because it is brackish (classified by CTDEP as GB groundwater); therefore, there is no imminent threat to human health.

- Elevated levels of inorganics, particularly lead, were detected in sediment collected from a catch basin between Zones 5 and 6. Both zones contribute surface water to this catch basin. Slightly elevated levels of inorganics were also detected in surface water samples collected from the storm sewer system for the NPDES permit. Therefore, the storm sewer system in Zone 6 may be acting as a migration pathway for inorganic contaminants. The lead contamination is believed to be the result of storage of lead ballast in this area and surface water runoff. The Navy has eliminated the storage of ballast in this area.

- The storm sewer is Zone 6 is a potential migration pathway for contaminants present in groundwater.

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

A FS is currently being prepared for Zone 6 soil and groundwater. The Navy is currently resolving ecological risk issues related to the adjacent Thames River. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy for Zone 6 will be selected after the FS is finalized.

## 21.3 REMEDIAL ACTIONS

### 21.3.1 Remedy Selection

A final remedy has not been selected or implemented for Zone 6. An FS is currently being prepared to evaluate remedial alternatives for this zone. The Lower Subase RI (TtNUS, 1999b) recommended that the FS for Zone 6, which includes Site 24, should focus to the extent possible on alternatives that rely on institutional controls to limit exposure to contaminated soil and passive and/or in-situ remedial alternatives.

### 21.3.2 Remedy Implementation

A final remedy has not been chosen for Zone 6. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy will be selected after the FS is finalized.

## 21.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of the Site 24. The recommendations from the First Five-Year Review Report are provided below along with the actions that were taken to address the recommendations.

It was recommended that the FS be completed to determine the appropriate remedial action for Zone 6 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative.

- The FS for the Lower Subase is in progress, and it is expected to be completed in 2007. Ecological issues related to the Thames River are currently being resolved. A decision document will be prepared upon completion of the FS.

In addition, it was recommended that there be enforcement of the IR Site Use Restriction instruction.

- The instruction was updated to include the Goss Cove Landfill and was reissued in 2003 (Navy, 2003). The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information for Site 2A - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON. The instruction has been enforced as appropriate at Site 24.

## 21.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 21.5.1 Document Review

New London Instruction 5090.18C was the only document reviewed for the second five-year review of Site 24. Within the past 5 years, no other documents have been completed regarding this site.

### 21.5.2 Data Review

No new data were collected from the site over the past 5 years. No monitoring or O&M activities have been initiated at the site because a final remedy has not been selected.

### 21.5.3 ARAR and Site-Specific Action Level Changes

A remedy has not been selected and a ROD has not been signed for Zone 6; therefore, ARARs and site-specific action levels have not been identified for Zone 6.

### 21.5.4 Site Inspection

The Lower Subase was visually inspected on April 4, 2006 as the inspection team drove through the area. Zone 6 is covered with pavement or buildings and is adjacent to the Thames River and railroad. The Lower Subase is a high-security area at NSB-NLON, and to avoid security issues, the team conducted a drive-through inspection lead by the Navy. Weather conditions during the inspection were cold (mid-40s), overcast, and windy. Representatives from the Navy, USEPA, CTDEP, TtNUS, ECC, and Gannett Fleming participated in the inspection. No issues were identified during the inspection and no photos of the zone were taken during the inspection. The Navy has no additional plans to change the current use of the site.

### 21.5.5 Site Interviews

No official interviews were conducted as part of the second five-year review.

## 21.6 ASSESSMENT

Because a final remedy has not been selected for Zone 6, conclusions cannot be made to support the determination that the remedy at Zone 6 is protective of human health and the environment. The results

of the Lower Subase RI do not indicate any imminent threats to human health or the environment under the current land use scenario.

The Navy has an IR Site Use Restriction Instruction in place at NSB-NLON [SOPA (ADMIN) NLONINST 5090.18C]. The policy restricts ground surface disturbance of soils and any subsurface disturbance of soils and/or groundwater at IR sites.

## 21.7 ISSUES

A final remedy has not yet been selected for Site 24; therefore, deficiencies cannot be determined at this time.

## 21.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that the FS be completed to determine the appropriate remedial action for Zone 6 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative. It is also recommended that there be enforcement of the IR Site Use Restriction Instruction.

## 21.9 PROTECTIVENESS STATEMENT

A protectiveness determination for Zone 6, which includes Site 24, cannot be made at this time because a remedy has not yet been selected for the zone. The results of the Lower Subase RI do not indicate any imminent threats to human health or the environment under current land use scenarios. The Navy has instituted an instruction that provides land use controls and restricts excavation activities. The instruction should minimize unauthorized and unplanned exposure to contaminated media at the zone until a remedy is selected and implemented. The Navy is currently addressing data gaps for the zone as part of development of the FS.

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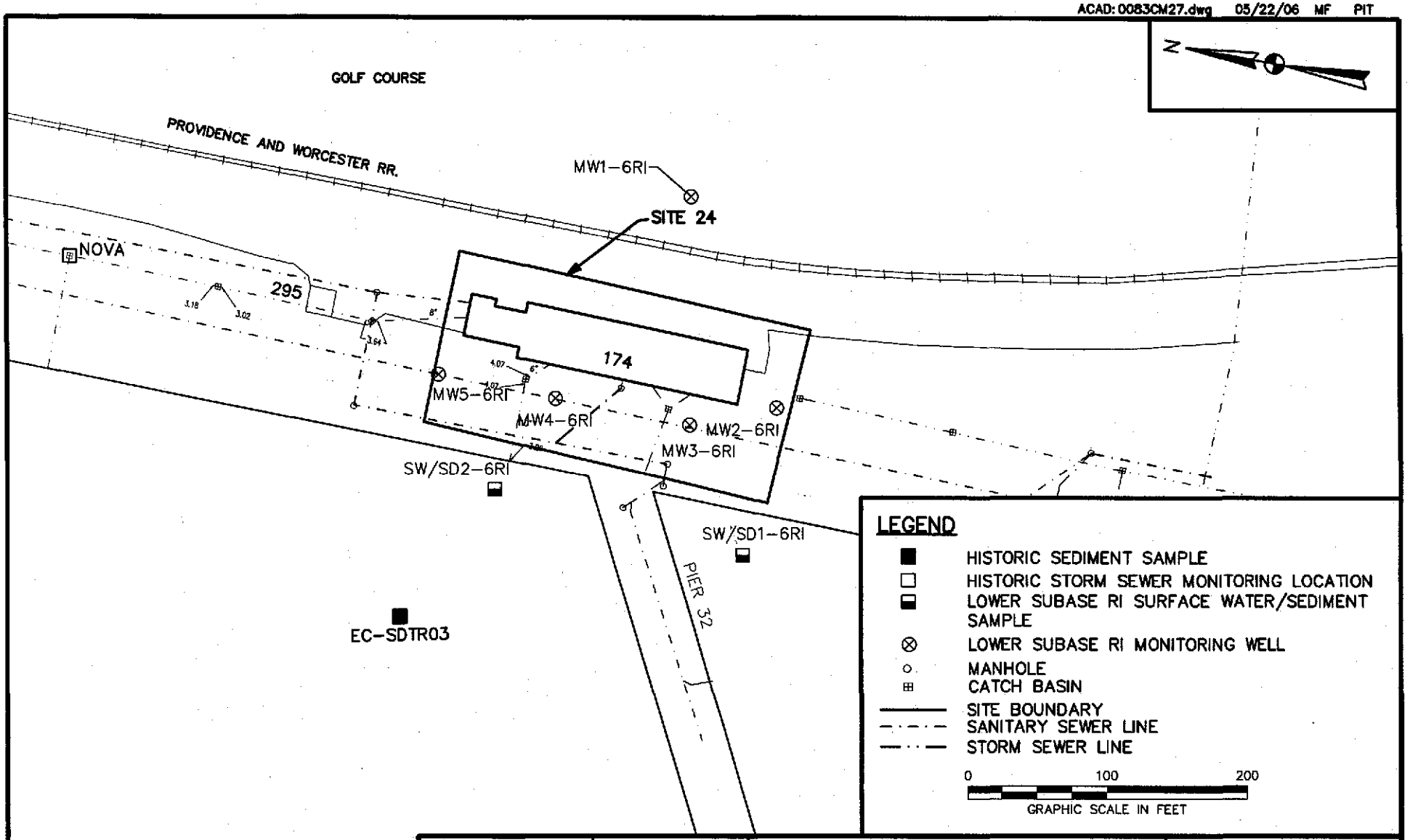


| | | | |
|---|---|---|---|
| DRAWN BY MF | DATE 5/22/06 | Tetra Tech NUS, Inc. | SITE MAP<br>SITE 24 CENTRAL PAINT ACCUMULATION AREA A (BUILDING 174)<br>NSB-NLON<br>GROTON, CONNECTICUT |
| CHECKED BY | DATE | | |
| REVISED BY | DATE | | |
| SCALE AS NOTED | | | |

| | |
|---|---|
| CONTRACT NO. 0083 | |
| OWNER NO. 038 | |
| APPROVED BY CAR | DATE 6/7/06 |
| DRAWING NO. FIGURE 21-1 | REV. 0 |

FORM CADD NO. TTNUS-AH.DWG – REV 1 –9/10/98

# 22.0 SITE 25 – LOWER SUBASE – CLASSIFIED MATERIALS INCINERATOR (OU4)

This five-year review is being conducted for Site 25 because of CERCLA statutory requirements. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. Site 25 is currently being investigated under CERCLA. No decision documents have been prepared for this site.

## 22.1 HISTORY AND SITE CHRONOLOGY

A list of important Site 25 historical events and relevant dates in the site chronology is shown below. The identified events are illustrative, not comprehensive.

| Event | Date |
|---|---|
| Classified materials and solid wastes were burned in the incinerator. | 1944-1963 |
| Incinerator demolished. | 1979 |
| Final Site Inspection Report for Pier 33 and Berth 16 completed. | 1995 |
| Final Lower Subase RI Report completed. | 1999 |
| First Five-Year Review completed. | December 2001 |
| Draft Final FS for soil and groundwater at the Lower Subase completed. | July 2002 |
| SOPA (ADMIN) New London Instruction 5090.18C updated. | December 2006 |

## 22.2 BACKGROUND

Site 25 consists of the former classified materials incinerator located on the Lower Subase, approximately 300 feet east of Pier 17. The site map is included as Figure 18-1. The site's location relative to other IR sites is shown on Figure 1-2.

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

The Site Inspection completed for the site included soil gas surveys, a utility inspection, drilling soil borings, installing monitoring wells, and soil, groundwater, and sediment sampling (Atlantic, 1995a). Petroleum and metals contamination were identified during the Site Inspection.

Soil, groundwater, and sediment sampling in the adjacent Thames River and analysis were completed for this site in conjunction with the Lower Subase RI (TtNUS, 1999b). This site was evaluated collectively with Site 21 as Zone 7 during the RI. Because of this approach, the remainder of this section discusses information in terms of Zone 7.

The Lower Subase RI Report (TtNUS, 1999b) recommended that Zone 7, which includes Site 21 - Berth 16, Site 25 - Classified Materials Incinerator, and Transformers at Building 157, Vault 31, proceed to an FS for evaluation of appropriate remedial alternatives for soil. Because of the extensive amount of underground utilities in Zone 7 and the sensitive nature of the activities conducted at this location (i.e., national security), the FS for this zone should focus, to the extent possible, on alternatives that rely on institutional controls to limit exposure to contaminated soil and passive and/or in-situ remedial alternatives. Hot spot removal actions for lead contamination should also be evaluated during the FS. In addition, it was recommended that the FS evaluate limited action scenarios for groundwater and the storm sewer system of Zone 7 in conjunction with the soil remedial alternatives. The scenario should include a tiered groundwater monitoring program. These recommendations are based on the following information:

- The nature and extent of organic and inorganic contamination in soil are well defined to the extent practical considering limitations from existing infrastructures.

- The baseline HHRA indicated that carcinogenic risks for full-time employees and hypothetical future residents under the RME scenario are in excess of the USEPA acceptable risk range and the CTDEP cumulative target ILCR. Noncarcinogenic risks for all receptor groups were less than the USEPA and CTDEP acceptable limit of 1.0, except for construction workers under the RME scenario. Although the RME HI for the construction workers slightly exceeded unity, adverse impacts are not anticipated because the major contributors (antimony and manganese) to the cumulative risk do not affect the same target organs. Cumulative risks to each individual target organ are expected to be less than unity. In addition, modeling performed to evaluate exposure to lead showed that all receptors (i.e., small children, fetuses of pregnant women, future employees, and construction workers) are at risk in Zone 7. These elevated risks (for lead, as well as other chemicals) assume that, sometime in the future, soils currently covered by pavement or buildings would be exposed and available for human contact.

- Evidence suggests that inorganic contamination (mainly lead) is migrating from soil to groundwater.

- Natural attenuation or bioremediation could be feasible alternatives for the petroleum contamination in soil.

- The Navy decommissioned the fuel lines within Zone 7. Therefore, the historical source of petroleum contamination has been eliminated.

- The zone is covered with pavement or buildings, which minimizes direct exposure to the contaminated soil by human receptors.

- The data do not suggest that the petroleum contamination in soil is significantly migrating to groundwater. In addition, natural attenuation processes seem to be at work in the groundwater. These processes can reduce concentrations of petroleum contaminants that reach the aquifer and convert the petroleum contamination to a less toxic form. Groundwater monitoring will confirm this information.

- A tiered groundwater monitoring program will allow for further actions to be completed if results show significant impacts.

- The source of the lead contamination in groundwater is the unsaturated soil of Zone 7. Appropriate remedial alternatives for Zone 7 soil will be evaluated in the FS. After the appropriate actions are taken, concentrations of lead in the groundwater will decrease.

- The ERA for the Thames River adjacent to Zone 7 showed that maximum concentrations of several non-AVS inorganics in Zone 7 sediments near the Lower Subase exceeded conservative guidelines (e.g., ER-Ls), indicating that potential risks may be present. The AVS/SEM analysis suggested that cadmium, copper, nickel, lead, and zinc are not bioavailable. Beryllium, cobalt, and vanadium were retained as COCs because no conservative sediment guidelines were available. No alternate guideline was available for barium, the maximum detected concentration of which exceeded the conservative guideline. The COCs were concluded to not be of ecological significance in the NSB-NLON Phase II RI ERA for the Thames River. Benzo(a)pyrene was the only organic in Zone 7 sediments that had maximum and average concentrations in excess of guidelines. HQ values were low, 1.39 for the maximum concentration and 1.11 for the average concentration. The maximum concentration of benzo(a)pyrene was much less than its ER-M. Significant toxicity was not observed in Zone 7 sediment toxicity tests from the NSB-NLON Phase II RI using *Leptocheirus*. Survival of *Ampelisca* was significantly lower than survival in reference sediments. Significant mortality was not

observed in Pier 17 EA toxicity tests with *Ampelisca*. The Pier 17 EA benthic community analyses concluded that the Pier 15 benthic community was relatively health, and the Pier 17 benthic community appeared to be disturbed. Significant bioaccumulation of some PAHs was observed in Pier 17 EA bioaccumulation studies with *Macoma* and *Nereis*. Some bioaccumulation of PCBs was noted in *Nereis* but not in *Macoma*. Significant bioaccumulation of inorganics was not observed in either species. Low concentrations of some inorganics and pesticides were detected in a blue mussel sample collected in Zone 7. The weight of evidence appears to be equivocal, suggesting significant potential risks to sediment-dwelling organisms from contaminants in Zone 7 near Pier 17 but not near Pier 15. However, most of the Pier 15 and Pier 17 sediments have been subsequently dredged, making interpretation of biological analyses from historical studies difficult. Sediments were replaced with "clean" fill after dredging, which may have ameliorated some of the potential risks. The NSB-NLON Phase II RI suggested that potential risk in the Lower Subase were confined to the Piers 15 and 17 area.

- The groundwater at Zone 7 is not currently or anticipated to be used in the future as a potable water source because it is brackish (CTDEP classified as GB); therefore, there is no imminent threat to human health.

- The Thames River provides significant dilution and mixing, which minimize the impact of any contaminant migration from Zone 7.

- The storm sewer in Zone 7 is a potential migration pathway for contaminant present in groundwater.

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

An FS is currently being prepared for Zone 7 soil and groundwater. The Navy is currently resolving ecological risk issues related to the adjacent Thames River. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy for Zone 7 will be selected after the FS is finalized.

## 22.3 REMEDIAL ACTIONS

### 22.3.1 Remedy Selection

A final remedy has not been selected or implemented for Zone 7, which includes Site 25. An FS is currently being prepared to evaluate alternatives for the zone. The Lower Subase RI recommended that

the FS for Zone 7 evaluate appropriate remedial alternatives for soil including institutional controls, passive and/or in-situ technologies, and hot spot removal actions for lead contamination. In addition, it was recommended that the FS evaluate limited action scenarios for groundwater at Zone 7.

### 22.3.2 Remedy Implementation

A final remedy has not yet been chosen for Zone 7. It is expected that the FS for the Lower Subase will be finalized in 2007. A remedy will be selected after the FS is finalized.

## 22.4 PROGRESS SINCE LAST REVIEW

This is the second five-year review of the Site 25. The recommendations from the First Five-Year Review Report are provided below along with the actions that were taken to address the recommendations.

It was recommended that the FS be completed to determine the appropriate remedial action for Zone 7 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative.

- The FS for the Lower Subase is in progress, and it is expected to be completed in 2007. Ecological issues related to the Thames River are currently being resolved. A decision document will be prepared upon completion of the FS.

In addition, it was recommended that there be enforcement of the IR Site Use Restriction instruction.

- The instruction was updated to include the Goss Cove Landfill and was reissued in 2003 (Navy, 2003). The instruction was also updated in 2006 (Instruction 5090.18C) to include Sites 3 and 7 and additional information for Site 2A - Area A Landfill. The instruction details the restrictions on disturbance of soils and/or groundwater at IR sites at NSB-NLON. The instruction has been enforced as appropriate at Site 25.

## 22.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

### 22.5.1 Document Review

New London Instruction 5090.18C was the only document reviewed for the second five-year review of Site 25. Within the past five years, no other documents have been completed regarding this site.

### 22.5.2 Data Review

No new data were collected from the site over the past 5 years. No monitoring or O&M activities have been initiated at the site because a final remedy has not been selected.

### 22.5.3 ARAR and Site-Specific Action Level Changes

A remedy has not been selected and a ROD has not been signed for Zone 7; therefore, ARARs and site-specific action levels have not been identified for Zone 7.

### 22.5.4 Site Inspection

The Lower Subase was visually inspected on April 4, 2006 as the inspection team drove through the area. Zone 7 is covered with pavement or buildings and is located near the Thames River and a set of railroad tracks. The Lower Subase is a high-security area at NSB-NLON, and to avoid security issues, the team conducted a drive-through inspection lead by the Navy. Weather conditions during the inspection were cold (mid-40s), overcast, and windy. Representatives from the Navy, USEPA, CTDEP, TtNUS, ECC, and Gannett Fleming participated in the inspection. It was noted during the site inspection that an extension to Building 157 (Zone 7) was being built. Excavated soil from near Building 157 had been stockpiled, and samples from the stockpile had been tested for TCLP lead and had failed. The soil was to be disposed at an approved off-site disposal facility. No photos of the zone were taken during the inspection. The Navy has no additional plans to change the current use of the site.

### 22.5.5 Site Interviews

No official interviews were conducted as part of the second five-year review.

## 22.6 ASSESSMENT

Because a final remedy has not been selected for Zone 7, conclusions cannot be made to support the determination that the remedy at Zone 7 is protective of human health and the environment. The results of the Lower Subase RI do no indicate any imminent threats to human health or the environment as long as site conditions remain the same.

The Navy has an IR Site Use Restriction Instruction in place at NSB-NLON [SOPA (ADMIN) NLONINST 5090.18C]. The policy restricts ground surface disturbance of soils and any subsurface disturbance of soils and/or groundwater at IR Sites.

## 22.7 ISSUES

A final remedy has not yet been implemented for Zone 7; therefore, deficiencies in the remedial action cannot be determined at this time.

## 22.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that the FS be completed to determine the appropriate remedial action for Zone 7 that is protective of human health and the environment. An appropriate decision document should be prepared after the FS is completed to document the selected remedial alternative. Also, it is recommended that there be enforcement of the IR Site Use Restriction Instruction.

## 22.9 PROTECTIVENESS STATEMENT

A protectiveness determination for Zone 7, which includes Site 25, cannot be made at this time because a remedy has not yet been selected for the zone. The results of the Lower Subase RI do not indicate any imminent threats to human health or the environment under current land use scenarios. The Navy has instituted an instruction that provides land use controls and restricts excavation activities. The instructions should minimize unauthorized and unplanned exposure to contaminated media at the zone until a remedy is selected and implemented. The Navy is currently addressing data gaps for the zone as part of development of the FS.

# 23.0 CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations of the second five-year review are presented below. They are provided in the form of a basewide protectiveness statement and a summary of the requirements of the next five-year review.

## 23.1 PROTECTIVENESS STATEMENT

The remedial actions that have been completed for the sites at NSB-NLON are protective of human health and the environment. Remedial actions to address immediate or potential future threats from exposure to soil and sediment have been implemented [Sites 1, 2 (Area A Landfill), 3, 4, 6, 7, 8, 9, 13, 14, 15, 17, 20, and 23] or are expected to be implemented by the end of the Year 2007 (Sites 3 – NSA). Groundwater monitoring programs are ongoing at Sites 2 (Area A Landfill), 3, 6, 7, and 8 to monitor contaminant trends and confirm the protectiveness of the soil remedial actions completed at the sites. Investigations found that no contamination was present in the soil at Sites 16 and 18 or the groundwater at Sites 14, 15, 18, and 20 that would result in immediate or potential future threats and NFA RODs were subsequently prepared for these sites. The Navy is continuing CERCLA investigations of the remaining IR sites. Additionally, the Navy has implemented and enforced an IR Site Use Restriction Instruction that restricts ground surface disturbance of soils and any subsurface disturbance of soils and/or groundwater at IR sites.

This five-year review shows that the Navy is generally meeting the requirements of the RODs for the sites at NSB-NLON. The deficiencies identified during the review and the approaches and milestone dates to address the deficiencies are provided in Table 23-1.

## 23.2 NEXT REVIEW

Five-year reviews are required by statute under CERCLA for NSB-NLON. Remedial actions were conducted at IRP sites at NSB-NLON that allowed hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. This report represents the Second Five-Year Review conducted at NSB-NLON. The next five-year review will be required in December 2011 (i.e., within 5 years of the signature date of this second five-year review). The anticipated requirements for the next five-year review are as follows:

- A review of the costs for implementing the removal action at Site 3 – NSA and the remedial action at Site 7.

- An evaluation of the groundwater monitoring activities at Sites 2 (Area A Landfill), 3, 6, 7, and 8.

- A review of the O&M activities at Sites 2 (Area A Landfill), 3, 6, 7, and 8 along with the costs for the activities. The O&M Manual should be updated as required over the next five years.

- A review of the ESD prepared for Site 3.

- Verify that New London Instruction 5090.18C for institutional controls has been properly implemented. Also, verify that at least yearly monitoring of Institutional Control compliance has been conducted.

### 23.2.1 Continued Reviews

Sites 2 (Area A Landfill), 3, 6, 7, and 8 will require evaluation during the next five-year review for NSB-NLON. Five-year reviews will continue at these sites because hazardous substances, pollutants, and contaminants remain at the sites that will not allow for the unlimited use or unrestricted exposure. Reviews will also be completed for Sites 2 (Area A Wetland) 9, 10, 11, 13, 17, 19, 21, 22, 23, 24, and 25 because CERCLA activities are ongoing at these sites. It is anticipated that RODs will be completed for these sites and remedial actions will be in progress at the time of the next review. The next review will update the appropriate sections to discuss the remedial actions that occurred at these sites.

### 23.2.2 Discontinue Reviews

Five-year reviews are not required in the future for Sites 1, 4, 14, 15, 16, 18, and 20 because NFA decision documents have been signed for these sites and there are no hazardous substances, pollutants, and contaminants remaining at the sites. Therefore, the use of these sites is unlimited and there are no exposure restrictions.

**TABLE 23-1**

**ISSUES IDENTIFIED DURING THE SECOND FIVE-YEAR REVIEW**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Issue | Effects Protectiveness | | Recommendation to Address Issue | Milestone Date |
|---|---|---|---|---|
| | Current | Future | | |
| **Site 2 – Area A Landfill** | | | | |
| Gas vents require screens | N | N | Install screens on gas vents. | 30 Jan 07 |
| O&M of cap system [vegetation (Phragmites, trees, etc.), sediment, and asphalt cracks] | N | Y | Continue O&M of cap system. | 30 Jan 07 |
| Improper storage of heavy equipment on cap | N | Y | Complete New London Instruction 5090.18C to include equipment storage information and<br><br>Develop and implement an equipment storage plan.<br><br>Initiate at least yearly monitoring of Institutional Control compliance. | 22 Dec 06<br><br>15 Jan 07<br><br>30 Nov 07 |
| Maintenance/abandonment of monitoring wells | Y | Y | Continue maintenance of monitoring wells in the monitoring program and develop and implement a well abandonment program for wells not included in the program. | 30 May 07 |
| Depression in rip rap along toe of the landfill | N | Y | Continue to monitor depression. | 30 Jan 07 |
| **Site 3 – Area A Downstream/OBDA** | | | | |
| New London Instruction 5090.18B does not include land use control information for Site 3. | N | Y | Complete New London Instruction 5090.18C to include Site 3 land use control information (soil and groundwater).<br><br>Initiate at least yearly monitoring of Institutional Control compliance. | 22 Dec 06<br><br>30 Nov 07 |

**TABLE 23-1**

**ISSUES IDENTIFIED DURING THE SECOND FIVE-YEAR REVIEW**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Issue | Effects Protectiveness | | Recommendation to Address Issue | Milestone Date |
|---|---|---|---|---|
| | Current | Future | | |
| Monitoring wells were not maintained or properly abandoned. | N | Y | Perform maintenance of monitoring wells in the monitoring program and develop and implement a well abandonment program for wells not included in the program. | 30 May 07 |
| An ESD is required to document the contaminated soil that was encapsulated at Stream 4. | N | Y | Complete an ESD for the encapsulated contaminated soil at Stream 4. | 29 Jun 07 |
| **Site 6 – DRMO** | | | | |
| Ponding of water along jersey barriers | N | Y | Provide drains in jersey barriers to eliminate ponding. | 30 Jan 07 |
| Cracks and depressions in asphalt | N | Y | Continue O&M of cap system. | 30 Jan 07 |
| Maintenance of monitoring wells and sampling equipment | N | Y | Continue maintenance of monitoring wells in the monitoring program.<br><br>Initiate at least yearly monitoring of Institutional Control compliance. | 30 Jan 07<br><br>30 Nov 07 |
| Abandonment of unused monitoring wells | N | Y | Develop and implement a well abandonment program for wells not included in the program. | 30 May 07 |
| **Site 7 – Torpedo Shops** | | | | |
| New London Instruction 5090.18B does not include land use control information for Site 7. | N | Y | Complete New London Instruction 5090.18C to include Site 7 land use control information (groundwater).<br><br>Initiate at least yearly monitoring of Institutional Control compliance. | 22 Dec 0<br><br>30 Nov 07 |

**TABLE 23-1**

**ISSUES IDENTIFIED DURING THE SECOND FIVE-YEAR REVIEW**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Issue | Effects Protectiveness | | Recommendation to Address Issue | Milestone Date |
|---|---|---|---|---|
| | Current | Future | | |
| Monitoring wells were not maintained or properly abandoned. | N | Y | Perform maintenance of monitoring wells in the monitoring program and develop and implement a well abandonment program for wells not included in the program. | 30 May 07 |
| **Site 8 – Goss Cove Landfill** | | | | |
| Gas vents require screens | N | N | Install screens on gas vents. | 30 Jan 07 |
| Sprinkler system requires repair | N | Y | Repair the sprinkler system. | 30 Jan 07 |
| Maintenance of monitoring wells and dedicated sampling equipment | N | N | Perform maintenance of monitoring wells and dedicated sampling equipment in the monitoring program.<br><br>Initiate at least yearly monitoring of Institutional Control compliance. | 30 Jan 0<br><br>30 Nov 07 |
| Abandon unused monitoring wells | N | N | Develop and implement a well abandonment program for wells not included in the program. | 30 May 07 |
| Hazardous materials not being properly stored in locked storage lockers | N | N | Install locks on the hazardous materials storage lockers. | Completed by 30 Nov 06 |
| No warning signs on gates | N | Y | Place signs on the front gate of the site that warn of site land use controls. | 30 Jan 07 |
| **Site 14 – OBDANE** | | | | |
| Abandon unused monitoring well | N | Y | Develop and implement a well abandonment program | 30 May 07 |
| **Site 15 – SASDA** | | | | |
| Abandon unused monitoring wells | N | Y | Develop and implement a well abandonment program | 30 May 07 |

**TABLE 23-1**

**ISSUES IDENTIFIED DURING THE SECOND FIVE-YEAR REVIEW**
**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**


| Issue | Effects Protectiveness | | Recommendation to Address Issue | Milestone Date |
|---|---|---|---|---|
| | Current | Future | | |
| **Site 20 – Area A Weapons Center** | | | | |
| Abandon unused monitoring wells | N | Y | Develop and implement a well abandonment program | 30 May 07 |

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