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NORTHNAVFACENGCOM 4335/3 (Rev 6/80)

Prepare in quintuplicate (original and 4 c
CONTROL NO. 27

CONTRACT NO.:	DELIVERY ORDER NO:	ACTIVITY LOCATION:
N62472-94-D-0398	**0024**	**Over Bank Disposal Area –Northeast Naval Submarine Base New London – Groton, CT**

PROJECT TITLE.s
Work Plan Amendment – Over Bank Disposal Area – Northeast (OBDANE)

FROM:	DATE:
Foster Wheeler Environmental Corp./Mr. Larry Kahrs—Project Manager	February 8, 2001
TO:	DATE:
Mr. Mark Evans	February 8, 2001

1. **THE CONTRACTOR SUBMITTALS LISTED BELOW ARE FORWARDED FOR YOUR:**

☐ **APPROVAL,** APPLY APPROPRIATE STAMP IMPRINT TO EACH SUBMITTAL, RETAIN ONE (1) COPY OF THIS TRANSMITTAL FORM.

☐ **REVIEW & COMMENT,** RETURN REVIEWED COMMENT COPIES.

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3. **APPROVAL REQUIRED BY:** ☐ NORTHDIV ☐ ROICC ☐ A/E ☐ OTHER _____

COPY TO:

☐ ROICC ☐ DESIGNER ☒ OTHER
M.Evans (1 copy), D. Conant (1 copy), M Miller (1 copy),
C. Davis (1 copy), K.Keckler (2 copies), M. Lewis (2 copies)

Martha for Larry Kahrs 2/8/01
SIGNATURE AND DATE

FROM:	DATE:
Approving Authority (No. 3 above)	
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_____
FOR COMMANDING OFFICER, NORTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
DATE:

ITEM NO.	SUBMITTAL DESCRIPTION	PREPARED/SUBMITTED BY	APPROVED	DISAPPROVED	REMARKS
1	DO. 0024: Final Work Plan Amendment For Over Bank Disposal Area –Northeast Remediation Naval Submarine base New London Groton, CT	D. Maher, B.Corbett/L. Kahrs			

U.S. NAVY NORTHERN DIVISION
REMEDIAL ACTION CONTRACT (RAC)
CONTRACT NO. N62472-94-D-0398
DELIVERY ORDER NO. 0024

WORK PLAN AMMENDMENT FOR OVER BANK DISPOSAL AREA NORTHEAST REMEDIATION

NAVAL SUBMARINE BASE NEW LONDON
GROTON, CONNECTICUT

February 2001

Prepared by

Foster Wheeler Environmental Corporation
133 Federal Street
Boston, Massachusetts 02110

Revision	Date	Prepared by	Approved by	Pages Affected
0	2/8/01	D. Maher/B. Corbett	L. Kahrs	All

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COC	Chain of Custody
DOT	Department of Transportation
IATA	International Air Transportation Association
LDR	Land Disposal Restriction
NorthDiv	Northern Division
OBDANE	Over Bank Disposal Area Northeast
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control
RAC	Remedial Action Contract
SHSP	Site Health and Safety Plan
SUBASENLON	Submarine Base New London
TAL	Target Analyte List
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 WORK DESCRIPTION

1.1 Introduction

1.1.1 Purpose and Scope of Work Plan Amendment

Foster Wheeler Environmental Corporation (Foster Wheeler) has prepared this Work Plan Amendment for Task Order No. 0024 under the U.S. Navy Northern Division (NorthDiv) Remedial Action Contract (RAC) N62472-94-D-0398. This Amendment describes soil removal from the Over the Bank Disposal Area Northeast (OBDANE) site at the Naval Submarine Base New London (SUBASENLON) located in Groton, Connecticut. During three initial assessments of the area, elevated levels of pesticides and metals were discovered along with miscellaneous surface debris that requires removal. This additional soil is located in a heavily wooded area at the edge of Stream 3 on the Area A Downstream/OBDA site, northwest of the Area A Landfill, west of the Area A Weapons Center, and south of the Torpedo Shops.

The site is located near the base of a nearly vertical 20-foot-high bedrock face that is located at the eastern edge of the site, and slopes southwest from the Area A weapons center. Upslope of the site there are bedrock exposures. Downslope of the site, the ground slopes to the southwest toward the Area A Downstream Watercourses. The site is wooded, approximately 80 feet in diameter. A dirt road provides limited access. Figure 1-1 shows the site vicinity map. Figure 1-2 displays the general site arrangement and it's proximity to the Area A Downstream watercourses. At one time, miscellaneous wastes were apparently dumped over the bedrock edge.

A *Removal Action Memorandum for Over Bank Disposal Area Northeast* prepared by Northdiv describes the proposed action at the OBDANE site. As a result, the proposed work is a continuation of the activities described in the 100% Design Area A Downstream/OBDA Remediation. This work plan amendment is intended to supplement the aforementioned 100% Design document. Specifically, this Work Plan Amendment describes the work to be performed to remediate the OBDANE site to meet the goals set forth in the Action Memorandum and the cleanup goals of the Area A Downstream remedial event. A copy of the memorandum has been included in Appendix A.

Specifically, this Work Plan Amendment involves the following tasks:

- **Erosion and Sedimentation Controls** – prior to the start of any work, hay bales and silt fence will be erected around the entire area. These erosion controls will remain in-place until restoration is complete.
- **Site clearing and cutting** – in order to access the soils, small trees and woody material will be removed, if applicable.
- **Debris Removal** – Surface debris will be removed at grade, consolidated on-site, characterized for disposal, and transported off-site for disposal.
- **Soil Removal** – excavation and disposal of contaminated soil material will be stockpiled outside of the buffer zone and transported off-site for recycling/disposal.
- **Restoration** – excavated portions will be restored to grade with common fill.

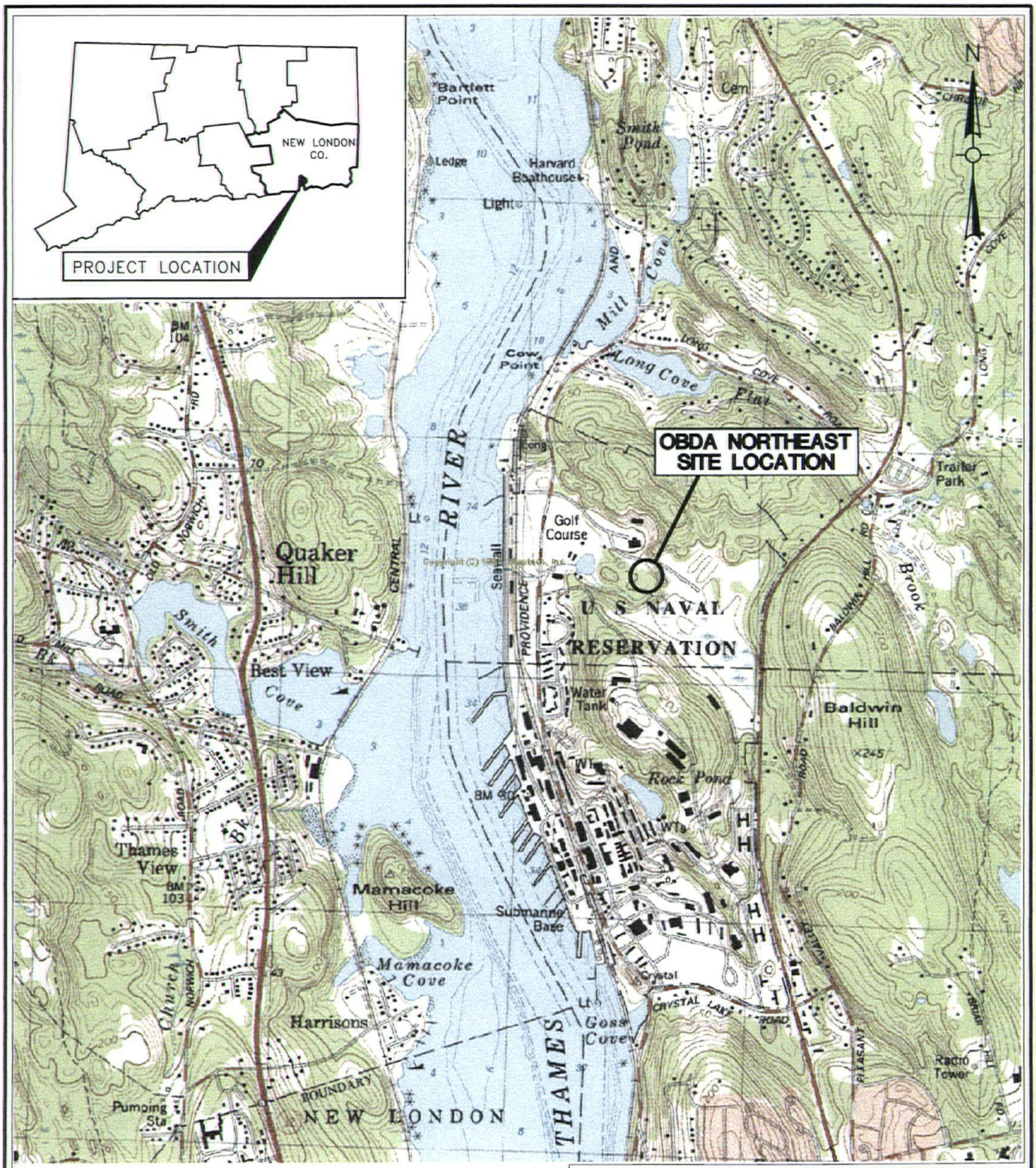


FIGURE 1-1

NAVAL SUBMARINE BASE NEW LONDON
GROTON, CONNECTICUT

SITE VICINITY MAP

SCALE: AS SHOWN

CADDFILE: 1284Y037.DWG

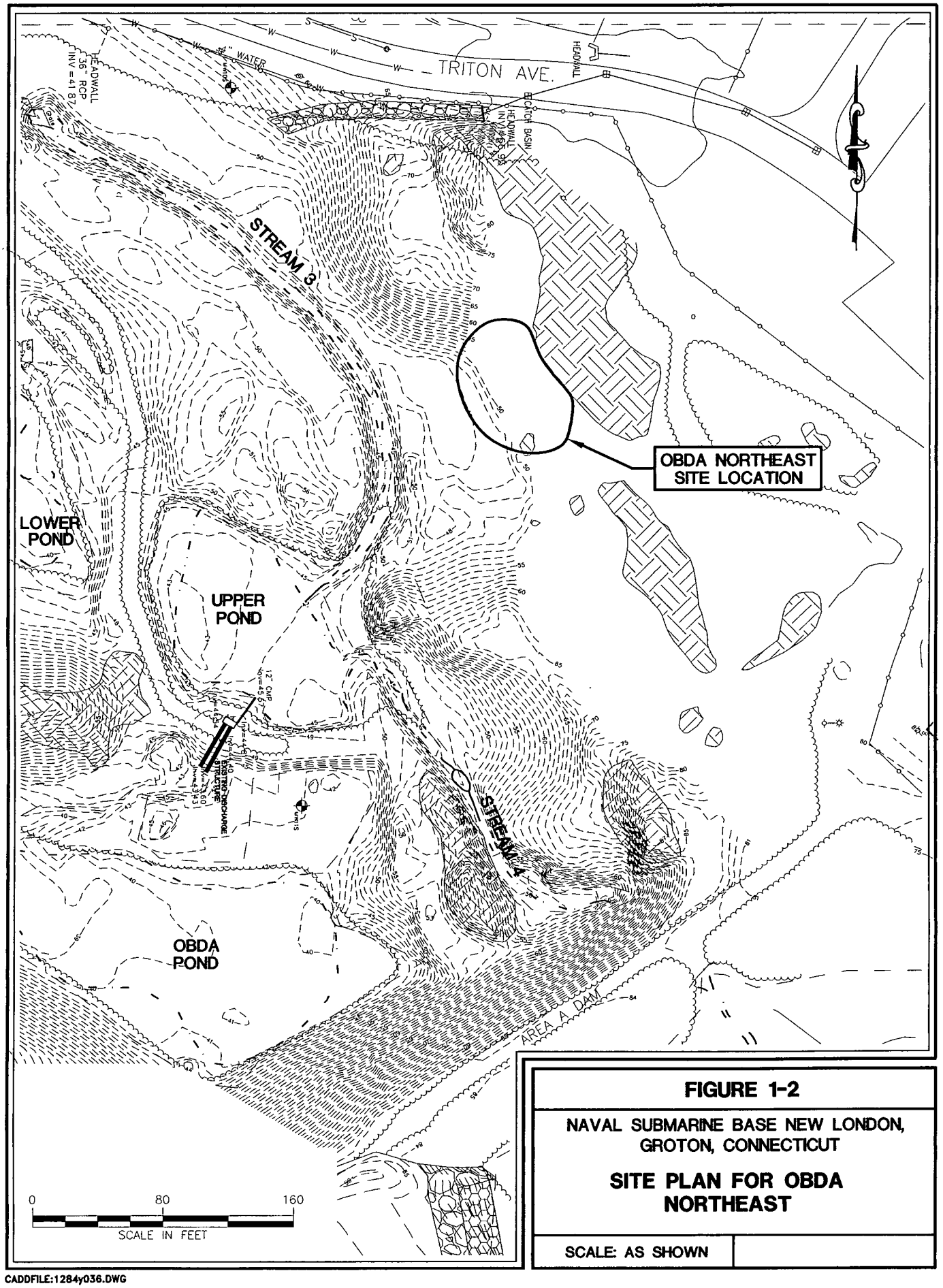


FIGURE 1-2

NAVAL SUBMARINE BASE NEW LONDON,
GROTON, CONNECTICUT

SITE PLAN FOR OBDA NORTHEAST

SCALE: AS SHOWN

CADDFILE:1284y036.DWG

1.2 Work Approach

1.2.1 Mobilization

Foster Wheeler will continue to utilize equipment storage and office trailers in-place at the Goss Cove Landfill site for all on-site operations.

Heavy Equipment Decontamination

Heavy Equipment decontamination shall be as in accordance with Section 3.1.2 of the 100% Design document.

Hand Held Equipment and Personnel Decontamination

Personnel and hand held equipment leaving the exclusion zone shall be thoroughly decontaminated in accordance with Section 8.2 of the SHSP. The following will be provided at the Contaminant Reduction Corridor (CRC) for personnel and hand held equipment decontamination: four small tubs (two sets of wash and rinse water), scrub brushes, towels, a PPE disposal bag or drum, and respiratory cleaning solution. Non-phosphate detergent and water will be used as the decontamination solution. All receptacles for PPE will be equipped with lids that can be closed to prevent the release of contaminants and the collection of rainfall. At the conclusion of the project, collected PPE and decontamination water will be characterized and disposed of off-site.

1.2.2 Silt Fence and Erosion Controls

Prior to any intrusive activities, Foster Wheeler will install silt fencing and erosion controls. These controls will be maintained and remain in place until all site activities are completed.

1.2.3 Site Clearing and Cutting

Once erosion controls are completed, the trees and woody material at the site will be removed, if applicable. All other material will be cut and chipped on site.

1.2.4 Staging Area and De-contamination Pad Construction

A staging area for the surface debris and potential contaminated soil will be constructed. A de-contamination pad will be constructed to allow for the de-contamination of transport vehicles prior to shipment off-site.

1.2.5 Miscellaneous Surface Debris Removal

Approximately 100 tons of surface debris, such as scrap steel, concrete, and wood, requires removal prior to excavation of contaminated subsurface soil. This debris will be removed and stockpiled on-site within an appropriate roll-off container. Sampling and analyses of the debris will be performed for waste characterization prior to disposal as discussed within section 3.0 of this report.

1.2.6 Soil Removal

Approximately 300 tons of contaminated soil will be excavated and disposed of off-site. During excavation, dump trucks will be live-loaded from upland contaminated areas. Excavators will be decontaminated within the contamination reduction zone.

The following general procedure will be followed for excavation:

- Removal of surface debris. Surface debris will be stockpiled on-site within a roll-off container.
- Removal of contaminated soil will be performed with a track-mounted excavator and a rubber-tire loader.
- Contaminated soil shall not be loaded over the sidewall height of the truck dump bed. If soil is inadvertently loaded over this height, the excess shall be compacted or removed. Before the truck leaves the loading area, it will be inspected to ensure that there is no visible contaminated soil on vehicle sides or tires and that the cover or tarp is appropriately secured. Trucks will be decontaminated, as necessary, in accordance with the procedures outlined in Section 3.1.2 of the 100% Design document.
- Dust generated during excavation activities will be managed using a fine water spray. All excavation surfaces will be kept adequately wet and all staged material will be covered prior to off-site disposal.
- All excavation activities will be conducted in accordance with the requirements of 29 CFR 1926, Subpart P and the U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual EM-385-1-1.
- Areas will be scraped and sampled where equipment, traveling between the excavation and the staging and/or loading area(s), may have tracked potentially contaminated soil.
- Backfill.

1.2.7 Site Restoration

Upon completion of removal, the excavated areas will be backfilled with common bank run gravel (3-inch minus) to final grade. All fill material and topsoil will be imported from off-site locations. Borrow materials will be compacted in-place by proof rolling.

1.2.8 Demobilization

Following completion of all site activities for the removal action, the site will be demobilized. Demobilization will involve removal of all trailers, equipment, portable facilities and temporary utilities.

1.2.9 Closeout Report

Closeout Report

Within 45 days after completion of the field activities, Foster Wheeler will prepare a Closeout Report, which will include the quantities of soil and surface debris removed, the post-excavation analytical

results, and conclusions relative to the removal action implementation. The following is a proposed outline for this report:

I. Introduction

II. Summary of Action

- A. Surface Debris Removal
- B. Soil Removal
- C. Waste Material Report
- D. Dates of Excavation
- E. Disposal Quantities
- F. Description of Any Deviations from Work Plan

III. Summary of Record Documents

- A. Laboratory Testing Reports (Including Data and Test Results)
- B. Disposal Site Certifications

2.0 CONSTRUCTION QUALITY CONTROL

2.1 General

Construction Quality Control shall be in accordance with Section 4.0 of the 100% Design Area A Downstream/OBDA Remediation document. Table 2-1 provides the Submittal Register.

2.2 Submittal Register

Table 2-1
Submittal Register

Description	Transmittal Control #	Planned Submittal Date	Northern Division	ROICC	Date Approved
Pre-construction Submittals					
Draft Work Plan Amendment	-	July 26, 2000	-	-	-
Work Plan Amendment	27	February 8, 2001	-	-	-
Records					
Waste Characterization Results	-	-	-	-	-
Disposal Documentation	-	-	-	-	-
Reports					
Closeout Report	-	-	-	-	-

Note: - To be included once completed or finalized.

3.0 SAMPLING AND ANALYSIS PLAN

Sampling and analysis will be performed in support of remedial construction activities at OBDANE. The sampling programs for this project will include the following:

- Confirmatory sampling and analysis to document conditions at excavation following soil removal.
- Waste characterization sampling and analysis to determine final dispositions for the following waste stream generated at the site:
    - miscellaneous surface debris

The following descriptions outline the sampling activities to be performed for each program. The approach and methodology for the investigative sampling is consistent with that conducted in support of the 100% Design Area A Downstream/OBDA Remediation (FWENC, April 2000).

Confirmatory Sampling and Analysis:

Sampling and analysis will be performed to characterize the limits of the excavation. Further screening in the area will not be performed. Samples will be grab samples, collected one per 50 ft^2, on the excavation floor. Analysis will include total (may be selective upon OBDA Area A Downstream cleanup goals) metals, total pesticides (may be selective upon OBDA Area A Downstream cleanup goals), and SPLP metals/pesticides (if applicable). The totals analysis for both metals and pesticides will be performed and then compared to the CTDEP SPLP Industrial/Commercial Criteria for the applicability of 20 times the CTDEP criteria according to the relation of leachate and total concentrations. In the event that total analysis indicates levels greater than 20-times the CTDEP SPLP Industrial/Commercial Criteria, a specific SPLP metals and/or pesticide analyses will be performed to show that the leachable concentrations are below the CTDEP SPLP criteria for the confirmatory data. This sampling frequency will be supplemented with additional sidewall samples should the excavated area exceed two feet in depth. Sidewall samples will be collected one per 50 linear feet. Soil samples will be sent off-site for laboratory analysis for total metals (may be selective upon OBDA Area A Downstream cleanup goals), total pesticides (may be selective upon OBDA Area A Downstream cleanup goals), and SPLP metals/pesticides (if applicable). In the event that total analysis indicates levels greater than 20-times the CTDEP SPLP Industrial/Commercial Criteria, a specific SPLP metals and/or pesticide analyses will be performed to show that the leachable concentrations are below the CTDEP SPLP criteria for the confirmatory data.

No bedrock or other consolidated material will be sampled. Should the limits of excavation reach bedrock surface, the remediation will be considered to be complete. Large rocks (over 2 feet in diameter) and glacial erratics encountered during removal will be stockpiled and decontaminated as described in Section 2.7 of the 100% OBDA Area A Downstream Design document.

Waste Characterization Sampling and Analysis:

Waste characterization sampling of excavated soil will not occur as they have been pre-characterized using the Phase II RI data for the site dated March 1997. Two further initial assessments were recently performed to further characterize the soil requiring removal. An event conducted on September 2000 collected one surface composite sample (sample ID: OBDANE) at the OBDANE site. This sample was

analyzed for TCLP RCRA 8 metals. Results indicated non-hazardous levels. The second event was conducted on October 28, 2000 and sampled four locations (OBDA-NE-WC-C, OBDA-NE-WC-1, OBDA-NE-WC-2, and OBDA-NE-WC-3). Three locations (OBDA-NE-WC-1, OBDA-NE-WC-2, and OBDA-NE-WC-3) were analyzed for TCLP VOCs. Analytical results indicated non-detect levels. One location (OBDA-NE-WC-C) was analyzed for TCLP SVOCs, TCLP herbicides, and TCLP pesticides. Analytical results indicated non-detect levels for all parameters. Appendix B includes this data.

The sampling data acquired through the initial assessments discussed above will be used for waste characterization purposes for soils requiring removal. Since, RCRA 8 metals, SVOCs, VOCs, pesticides, and herbicides indicated non-hazardous levels for these various parameters, the media is considered non-RCRA regulated and non-hazardous.

Surface debris stockpiled on-site will be analyzed for TCLP metals and TCLP pesticides. One representative composite sample of the debris will be taken for waste characterization. Should any liquid material be discovered in un-opened and/or in-tact containers (i.e. 55-gallon drums), additional sampling and analysis will be performed as appropriate.

Sampling of Laboratory PPE and solid wastes will not occur as they have been pre-characterized as F003 waste by the SUBASENLON Environmental Department. Field laboratory solvents will not be analyzed because they have been pre-characterized as F003 (Methanol) and D001 (Ignitable) wastes.

3.1 QA/QC

All QA/QC sample requirements will be met in accordance with Section 3.1 of the 100% Design Area A Downstream/OBDA Remediation document.

3.2 Soil Sampling

Sampling procedures and activities are identified in the following subsections. A summary of the sampling analyses, analytical methods, number of samples, and QA/QC sample requirements anticipated for this project are including in Table 3-1. Sample containers, preservations, and holding time requirements are included in Table 3-2.

3.2.1 Sampling Equipment

Soil samples will be collected using a designated stainless steel sampling spoon. A list of equipment to be used during this sampling effort includes the following:

- designated sampling spoons (stainless steel)
- stainless steel scoops and bowls (to homogenize samples)
- tape measure
- wooden stakes and flagging
- equipment decontamination materials
- sample jars, labels, and packaging material
- site logbooks

Surface debris samples will be collected by hand using the proper PPE (i.e. sampling gloves) and decontaminated cutting (shears) or crushing tools.

Table 3-1
Summary of Analyses, Analytical Methods, Sample Requirements, and QA/QC Requirements

Analysis	Method	Field Samples Frequency	Field Dup. Frequency	MS/ MSD Frequency	Equip. Blanks[1] Frequency	Reporting Limit[2]
CONFIRMATORY SAMPLING						
Soil Sampling						
Total Pesticides (may be selective – see sect. 3.0)	SW846 8081A	1 per 50 ft^2 on floor if excavation leaves a sidewall of > 2 ft, 1 per 50 linear ft	1 per 20 samples	1 per 20 samples	1 per 20 samples or 1 per day	Varies
SPLP Metals (if applicable)	SW 846 1311mod/6010, 7000	See sect. 3.0.[3]	1 per 20 samples	1 per 20 samples	1 per 20 samples or 1 per day	Varies
Total Metals (may be selective – see sect. 3.0)	SW846 6010,7000	1 per 50 ft^2 on floor if excavation leaves a sidewall of > 2 ft, 1 per 50 linear ft	1 per 20 samples	1 per 20 samples	1 per 20 samples or 1 per day	Varies
WASTE CHARACTERIZATION						
Debris Sampling						
TCLP Pesticides	SW846 1311/8081A	1 per stockpile of 500 c.y.	1 per 20 samples	1 per 20 samples	1 per 20 samples or 1 per day	Varies
TCLP Metals	SW846 1311/6010,7000	1 per stockpile of 500 c.y.	1 per 20 samples	1 per 20 samples	1 per 20 samples or 1 per day	Varies

(1) In the case that disposal sampling equipment is used, equipment blank samples will be taken at the discretion of the sampler, subject to approval of the on-site QA/QC representative.

(2) Reporting limits will increase if dilution is required.

(3) In the event that total analysis indicates levels greater than 20-times the CTDEP SPLP Industrial/Commercial Criteria, a specific SPLP metals and/or pesticide analyses will be performed to show that the leachable concentrations are below the CTDEP SPLP criteria for the confirmatory data.

Table 3-2
Sample Containers, Preservatives, and Holding Times

Media/Analysis	Container	Preservative	Holding Time[1]
Solid Sampling			
Total Pesticides	8 oz. glass	Ice to 4 °C	Extract within 14 days; analyze extract within 40 days.
Total Metals	8 oz. glass	Ice to 4 °C	Analyze mercury within 28 days, other metals 180 days.
TCLP Pesticides	8 oz. glass soil/ 4 oz. debris	Ice to 4 °C	Extract within 14 days; analyze extract within 40 days.
SPLP Metals	8 oz. glass	Ice to 4 °C	Leachate 28 days, analyze mercury within 28 days, other metals 180 days.
TCLP Metals	8 oz. glass/ 4 oz. debris.	Ice to 4 °C	Leachate 28 days, analyze mercury within 28 days; analyze all other metals within 180 days.

(1) Holding time is calculated from sampling date.

3.2.2 Preliminary Site Activities

Minimal vegetation clearing may also be required prior to sampling to gain access to the proposed sampling locations. If required, clearing will be completed by the Foster Wheeler field sampling crew at the same time that the sampling locations are being laid out.

3.2.3 Soil Field Sampling Procedures

Prior to collection of field samples, non-dedicated sampling equipment shall be decontaminated following the procedure detailed in Section 3.1.2 of the 100% OBDA Area A Downstream Design document.

Once the desired sampling location has been identified, the following procedure will be used to collect soil samples:

1. Clear the sampling location of all rocks, twigs, vegetation, and other debris.

2. Select the appropriate sampling tool and begin collecting the sample.

3. All samples with standing water (if applicable) will be decanted by the field personnel and/or the laboratory personnel. The laboratory has been instructed to follow the listed precautionary steps to ensure that pesticide samples meet the 30% solids requirements for data validation:

   - Visible water shall be decanted.
   - Lab shall extract a minimum of 10 grams (dry weight) per sample for analysis.
   - Lab will maintain communication with project chemist regarding any question or questionable sample.

4. The sample collection procedure will be repeated until all samples have been collected.

5. When placing the sampler back in the hole to collect multiple samples from a single location, care should be taken to ensure that material from the upper zones is not knocked into the lower zones.

6. Following collection of samples, sample jars will be labeled and the field logbook will be filled out with all the required information as described in Sections 3.3 and 3.4.

3.2.4 Surface Debris Field Sampling Procedures

Once surface debris removal activities have been completed and the material stockpiled within an appropriate roll-off container, one representative composite sample will be taken per stockpile.

Once the desired sampling location has been identified, the following procedure will be used to collect soil samples:

1. Clear the sampling location of all rocks, twigs, vegetation, and other debris.

2. Select the appropriate sampling tool and begin collecting the sample.

3. Collect composite sample from within the storage container (i.e. roll-off). Use decontaminated shears to cut metal, decontaminated cutting tool to cut wood, and a decontaminated hammer to crush concrete.

3.2.5 Post-Sampling Site Activities

Once 300 tons of contaminated soil have been removed from the OBDANE site, the excavation will remain open until sample results confirm that the cleanup goals have been met. Once cleanup goals have been met the excavation will be closed. If off-site analyses indicates that the cleanup criteria has not been met, Foster Wheeler will await the Navy's direction to complete the work.

3.3 Documentation Procedures

Detailed, bound, weatherproof field logbooks with numbered pages shall be maintained by the field representative to record information related to sampling or field activities. This information will be written in ink and will include the following:

- date and time of site visit
- climatic conditions
- key personnel on-site
- health and safety levels of protection
- description of field activities, including any approved work changes and/or deviations from approved project plans
- comments to/from government party representatives
- sampling location and identification
- sampling sequence and time of each sample collection
- types of sample bottles used and sample identification numbers
- parameters requested for analysis
- field observations during sampling event, including a visual description of sample (color, odor, etc.)
- name of sample collector(s)
- QA/QC data for field instruments
- any problems encountered
- description of all sampling equipment
- field instrument calibration results

Field data will be reported in field logbooks and/or on specific reporting forms. Documentation will include the following as applicable: calibration and blank information, sample preparation and dilution procedures, screening kit lot numbers, expiration dates, and ambient temperature.

3.4 Sample Identification, Chain of Custody, Packing, and Shipping

3.4.1 Sample Identification and Labeling

3.4.1.1 Sample Identification

The sample identification system that will be used for this project will assign a unique sample identifier to each sample collected. Data management will be consistent with this sample identification system.

The protocols for assigning field sample numbers are described below. Each sample collected will have its own identifier, which will apply for the duration of the project. The sample identifier will consist of an alpha-numeric code that will identify the site designation, sample number, and QC sample designation (if applicable). The QC sample identifier will also consist of an alpha-numeric code that will identify the QC sample designation, sampling date, and sample number (if applicable). Note: all sample identifiers and their corresponding locations will be carefully logged in the field notebook and may be identified on figures or drawings.

Sampling documentation, including chain of custody forms and report tables, will include reference to the site designation (the OBDANE). Samples will be further termed according to the following location and matrix identifiers:

OBDANE-BA	Base of the OBDANE excavation
OBDANE-SW	Side-wall of the OBDANE excavation
SS	Soil Sample
SD	Surface Debris Sample
LW	Lab waste samples

Soil samples collected from the OBDANE will be sequentially numbered (01, 02, 03, etc.) as they are collected. Depths will be designated as the lower depth in the 1-foot interval preceded with a hyphen (-2 indicates the 1- to 2-foot interval). Split samples will named in the same manner as field screening samples. Duplicate samples will include the suffix 02. For example, sample ID OBDANE–BA-01-02 will designate the duplicate soil sample collected from the base of the excavation at the 01 location.

Additional QC samples will be designated using the following identifiers:

TB	Trip Blank
ER	Equipment Rinsate
RD	Referee Duplicate
MS/MSD	Matrix Spike/Matrix Spike Duplicate

3.4.1.2 Sample Labeling

Sample labels will be completed by field personnel in indelible ink. Labels will include the project identification, sample identification, date and time of collection, sampler's initials, sample matrix, type of sample (grab or composite), analyses to be performed, and preservative used (if applicable).

3.4.2 Sample Chain of Custody

To maintain and document sample possession, chain of custody (COC) procedures will be implemented. These procedures are necessary to insure the integrity of samples from the time of collection through data reporting. The COC protocol provides the ability to trace possession and handling of samples. A sample is considered under custody if it is/was:

- In a person's possession;
- In a person's view after being in possession;
- In a person's possession and locked up; or
- In a designated secure area.

Personnel collecting samples are responsible for the care and integrity of those samples until they are properly transferred or dispatched. Therefore, the number of people handling a sample will be kept to a minimum.

COC records will be completed by the sampler and shall accompany the samples at all times. The following information shall be indicated on the COC record:

- Project identification;
- Signature of sampler(s);
- Sample identification, sample matrix, date and time of collection, grab or composite sample designation, number of containers corresponding to that sample identification, analyses required, remarks or sample location (if applicable), and preservation method(s);
- Signature of the individual relinquishing the samples; and
- Name of the individual(s) receiving the samples and air bill number, if applicable.

The COC preparer will then check the sample label and COC record for accuracy and completeness.

3.4.3 Sample Packing and Shipping

Samples for fixed laboratory analysis will be shipped via courier or by Federal Express for same day or overnight delivery in waterproof coolers using the following procedures. In general, the samples taken for this project will be considered low-level or environmental samples for packaging and shipping purposes. If samples are encountered that contain sufficient concentrations of hazardous materials, Department of Transportation (DOT) and International Air Transport Association (IATA) shipping requirements will be observed. The sample packing procedures for low level samples are:

- After filling out the pertinent information on the sample label, cover the label with clear tape and put the sample in the bottle or vial and screw on the lid.
- Place about three inches of inert cushioning material such as vermiculite or bubble-pack in the bottom of the cooler.
- Enclose the bottles in clear plastic bags through which sample labels are visible, and seal the bag. Place bottles upright in the cooler in such a way that they do not and will not touch during shipment.
- Put in additional inert packing material to partially cover sample bottles (more than halfway). Place bags of ice around, among, and on top of the sample bottles. Chemical ice should not be used.
- Fill cooler with cushioning material.
- Put paperwork (chain of custody record) in waterproof plastic and tape to the inside lid of the cooler.
- Tape the drain shut.
- Secure lid by taping. Wrap the cooler completely with strapping tape at a minimum of two locations.
- Attach completed shipping label to top of the cooler.
- Affix two signed and dated custody seals on opposite corners. Cover seals with wide, clear tape.

Prior to shipping, samples will be stored on ice and a trip blank will be placed with any VOC samples from the time of sample collection.

3.5 Reporting Requirements

3.5.1 Laboratory Reporting Requirements

Laboratory reports submitted to Foster Wheeler will be in compliance with all USEPA Region I and the Navy Installation Restoration Laboratory Quality Assurance Guide specified reporting requirements and will include but not be limited to the following:

- The name, address, and phone number of the analytical laboratory.
- Signature of an authorized laboratory individual indicating the acceptability of the data.
- A copy of signed chain of custody records indicating the condition of samples at the time of receipt at the laboratory.
- Sample results reported in units of microgram or milligram to kilogram, dry weight.
- A summary of pertinent chain of custody and tracking information (i.e., dates of preparation and analysis, analytical instrumentation, associated QC samples, etc.).
- Quality control results reported are to include spiking concentration and acceptable limits. QC results that exceeded criteria and corrective actions should be discussed with the laboratory.
- Copies of raw data including instrument outputs such as chromatograms, quantitation reports, other instrument output data and relevant logbooks, including instrument injection logs, standard prep logs, sample prep logs.

4.0 ENVIRONMENTAL PROTECTION

The purpose of this section is to identify the applicable environmental regulatory requirements relevant to Foster Wheeler during the remedial action and to establish the appropriate project controls to meet these requirements. This section also identifies Foster Wheeler's environmental compliance procedures and training requirements for this project. The Delivery Order Manager will be responsible for verifying that all project personnel are aware of the requirements outlined in this Plan.

4.1 Regulatory Drivers

The removal action at the OBDANE will be conducted pursuant to the requirements, policies, and procedures set forth in the Removal Action Memorandum and the cleanup goals specified within the 100% OBDA Area A Downstream Design document, dated April 2000. A copy of this document is included in Appendix A.

4.2 Release Reporting

An Emergency Response Plan is included in the project SHSP for the Area A Downstream project. The information contained in these sections details how Foster Wheeler will address spill control, prevention, and emergency response activities on-site.

In the event of a release, the Delivery Order Manager must notify the project Regulatory Specialist as soon as possible to determine federal and state release reporting time frame requirements.

5.0 WASTE MANAGEMENT

5.1 Objective

The objective of this section is to facilitate the proper handling, on-site management, transportation and disposal of hazardous (if applicable) and non-hazardous wastes generated during the remedial action at the OBDANE site. This objective will be achieved through compliance with federal, state and local regulations. This section identifies the waste streams and waste management responsibilities of Foster Wheeler, the Navy, transporters and disposal facilities. This section also describes the equipment and waste management practices that will be implemented for sampling, analyzing , classifying, segregating, staging, storing, packaging, transporting and disposing of the generated wastes.

5.2 Naval Assistance

The ROICC will review all submittals designated for Navy approval. These submittals will include waste analysis and classifications, waste profile/approval forms, Land Disposal Restriction (LDR) certifications, manifests/shipping papers, and manifest discrepancy and exception reports. After the submittals have been approved by the ROICC, no re-submittals will be given consideration unless accompanied by a written justification as to why a change is necessary. Foster Wheeler will rely on the Navy to provide approval of final waste characterizations and sign as the generator of all waste streams leaving the site. Treatment/disposal facilities and transporter approval will also be made by the Navy.

6.0 PROCUREMENT PLAN AND SCHEDULE

The procurement plan, providing anticipated dates of major subcontracts and procurements is presented in Table 6-1 below.

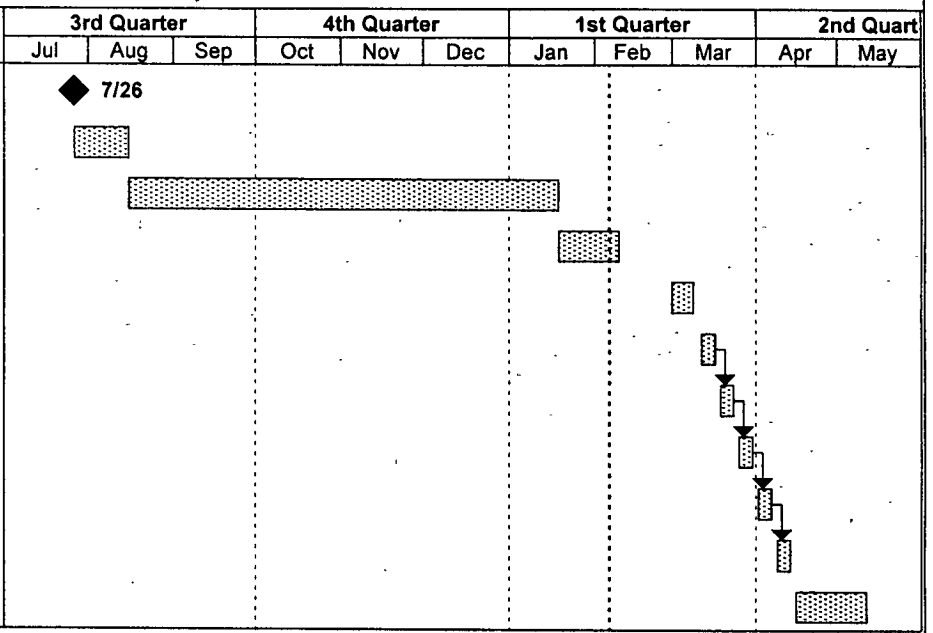
Table 6-1
Procurement Plan

Description	Complete SOW	Site Walk (Yes/No)	Award	Period of Performance	Comments
Subcontracts					
Fence	N/A	No	previous	completed	Fence previously erected and will remain in-place after work is completed
Lab (Chemistry Analysis)	N/A	No	previous	4/02/01 - project completion	Duration of project
T&D Soil	2/02/01	No	End-Feb	4/02/01 - project completion	Duration of project
T&D Surface Debris	2/02/01	No	End-Feb	4/02/01 - project completion	Contingent on stockpiling of debris and actual volume of debris removed
Procurements					
Clean Fill	N/A	No	Mid-April	4/02/01 - project completion	Performed at the completion of project under contract already in-place

The schedule, enclosed as Figure 6-1, illustrates the major tasks and their anticipated start and completion dates. The removal tasks will be conducted consecutively and the duration of field activities is anticipated to be one month.

Figure 6-1
OBDA NE Removal Action
Delivery Order No. 24

ID	Task Name	Duration	Start	Finish
1	Draft Work Plan Ammendment	0 wks	Wed 7/26/00	Wed 7/26/00
2	Regulatory Review	2.8 wks	Thu 7/27/00	Tue 8/15/00
3	Respond to Comments	112 days	Wed 8/16/00	Thu 1/18/01
4	Finalize Work Plan Ammendment	3.2 wks	Fri 1/19/01	Fri 2/9/01
5	Notice to Proceed	6 days	Thu 3/1/01	Thu 3/8/01
6	Site Mobilization	5 days	Mon 3/12/01	Fri 3/16/01
7	Debris Removal	1 wk	Mon 3/19/01	Fri 3/23/01
8	Soil Removal	1 wk	Mon 3/26/01	Fri 3/30/01
9	Confirmatory Soil Sampling	1 wk	Mon 4/2/01	Fri 4/6/01
10	Backfill and Restore	1 wk	Mon 4/9/01	Fri 4/13/01
11	Close-out Report	4 wks	Mon 4/16/01	Fri 5/11/01



Project: Schedule
Date: Tue 2/6/01

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
External Tasks
Project Summary
Split
Rolled Up Split

APPENDIX A

Removal Action Memorandum

ACTION MEMO

OVER BANK DISPOSAL AREA, NORTHEAST

NAVAL SUBMARINE BASE NEW LONDON

GROTON, CT

I. PURPOSE

The purpose of this Action Memorandum is to document the decision made for proposed action described herein for the Over Bank Disposal Area, Northeast (OBDANE) site at the Naval Submarine Base, New London, (NSB-NLON) located in Groton, Connecticut. The Department of Navy is identified as the lead agency for this non-time critical removal action at NSB-NLON.

II. SITE CONDITIONS AND BACKGROUND

A. SITE DESCRIPTION

1. Removal Site Evaluation

The OBDANE is located in a heavily wooded area on the edge of a ravine northwest of the Area A Landfill, west of the Area A Weapons Center and south of the Torpedo Shops (See Figure 1). At one time, miscellaneous wastes were apparently dumped over the bedrock edge. The site is circular and approximately 80 feet in diameter. A dirt road provides limited access to the wooded site. A nearly 20-foot high bedrock face is located at the eastern edge of the site. The rest of the site slopes to the southwest.

The Initial Assessment Study (IAS) stated that the vegetation at the site indicated that no dumping had occurred within ten years prior to the 1982 investigation. Atlantic personnel inspected the site on September 30, 1988, and verified the IAS report of the presence of several empty fiber drums. No visual staining or stressed vegetation were observed at this time. No development of this area is currently planned.

2. Physical Location

The OBDANE is located in a heavily wooded area on the edge of a ravine northwest of the Area A Landfill, west of the Area A Weapons Center and south of the Torpedo Shops (See Figure 1).

3. Site Characteristics

The OBDANE is located near the base of the bedrock high that slopes southwest from the Area A Weapons Center. Upslope of the site, there are bedrock exposures. The ground elevation of the site ranges from approximately 80 to 50 msl. Downslope of the site, the ground flattens toward the Area A Downstream Watercourses, which have a general ground elevation of 40 feet msl.

Surface runoff from the OBDANE site flows to the southwest into a stream (Stream 3) which originates in Area A Downstream Watercourses. The stream then flows along Triton Road and ultimately discharges into the Thames River at the southern edge of the DRMO site.

The geology of the OBDANE consists of sand and silt alluvium overlying metamorphic bedrock. During the phase II RI, one test boring (14TB1) was drilled within the boundary of the site. The overburden consists of silty sand with gneiss fragments. Outside the OBDANE boundary, the overburden at boring 14TB2A and well 14MW1S consists of sand with traces of mica. These deposits are either present-day stream deposits or stratified drift of former glacial streams. Bedrock (the Mamacoke) was encountered at depths of 14 and 12 feet at boring 14TB2A and well 14MW1S, respectively. Well and boring locations can be found in Figure 2.

Groundwater is present within both the overburden and bedrock underlying the OBDANE. Depth to groundwater at well 14MW1S was less than 5 feet. The saturated thickness of the overburden materials is approximately 6 to 10 feet at OBDANE along stream 3. Groundwater was not encountered at the higher elevation of boring 14TB1. Groundwater in the overburden flows west from the Area A Weapons Center across the OBDANE toward the Area A Downstream Watercourses and the Thames River. Figure 3 displays the overburden groundwater contours across the OBDANE.

4. Release or Threatened Release into the Environment f a Hazardous Substance, or Pollutant or Contaminant

The only significant contamination of surface soils and sediments in the OBDANE is associated with arsenic and lead. Debris such as fiber drums, and other containers are lying on or embedded in those surface soils and sediments.

5. National Priority List (NPL) Status

In 1975, the Department of Defense developed a program to investigate and clean up problem areas involving hazardous waste at federal facilities. That program, known as the Installation Restoration Program (IRP), is being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The NSB-NLON was placed on the National Priorities List (NPL) of federal Superfund sites on August 30, 1990 by the U.S. Environmental Protection Agency (EPA).

6. Maps, Pictures, and Other Graphic Representations

Maps of the site are included as Appendix A of this Action Memorandum.

B. OTHER ACTIONS ADDRESSING THE SITE

1. Previous Actions

A Phase I and Phase II Remedial Investigation Reports for the OBDANE have been prepared.

III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

A. THREATS TO PUBLIC HEALTH OR WELFARE

The Site is located in a secure area and is not accessible to the general public. Leaking tanks, drums, or other containers could cause contaminants to migrate to accessible areas.

B. THREATS TO THE ENVIRONMENT

The benefit of this removal action will be to eliminate any potential adverse impacts on human and ecological receptors from leakage and migration of contaminants from containers and other materials at the site.

IV. ENDANGERMENT DETERMINATION

Actual or threatened releases of pollutants and contaminants from the Site, if not addressed by implementing the response action selected for this Action Memorandum, may present an imminent and substantial endangerment to public health, or welfare, or the environment.

V. PROPOSED ACTION AND ESTIMATED COSTS

A. PROPOSED ACTIONS

1. Proposed Action Description

Prior to performance of any site work, erosion and sedimentation control measures will be installed down slope to protect the wetlands and stream. A bermed and lined staging area and decontamination pad will be constructed. The OBDANE will be cleared as required to allow removal of debris.

Debris on the ground surface, or protruding through the ground surface, will be removed and containers with contents will be over-packed. Debris will be decontaminated and then moved to the staging area, where containers and contents will be sampled and analyzed to determine proper disposal methods at a designated disposal facility or disposed in the Area A Landfill.

2. Contribution to Remedial Performance

The OBDANE response action will be implemented in accordance with all administrative procedures in the National Contingence Plan (NCP) for non-time critical removal actions. Although the removal action may not be the final action under CERCLA, it is anticipated that this response action will be consistent with the final remedial action of the site.

3. Description of Alternative Technologies

Alternative technologies have been considered. Removal and off-site disposal is the most effective and least expensive action.

4. Engineering Evaluation/Cost Analysis (EE/CA)

An Engineering Evaluation/Cost Analysis has been prepared (Appendix B) and contains a discussion of alternatives considered before proposing this removal action.

5. Applicable or Relevant and Appropriate Requirements (ARARs)

The Connecticut Department of Environmental Protection (CTDEP) pollutant mobility criteria for soil, the CTDEP DEC for soil and the FFDC action tolerance level are used as soil remediation goals for soils at this site. The target remedial level for total DDTR is risk-based. Disposal of debris and contents will be in accordance with RCRA requirements.

6. Project Schedule

This removal action will be performed in conjunction with the Area A Downstream Watercourses field work between October and December 1999.

B. ESTIMATED COSTS

The cost of the removal action is approximately $200,000. A detailed cost estimate is provided in the EE/CA.

VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

Although the debris itself is stable, a delay in action would increase the potential for spills of any contained contents and migration of these substances via surface water run-off and groundwater infiltration, as well as result in an increase in project cost.

VII. OUTSTANDING POLICY ISSUES

There are no outstanding policy issues that have not been discussed.

VIII. ENFORCEMENT

The Department of Navy is the lead agency for this removal action and is responsible for funding. Enforcement strategies do not apply as all funds are provided by the Navy.

IX. RECOMMENDATION

This decision document represents the selected removal action for the OBDANE at Naval Submarine Base, New London, Groton, Connecticut, developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by SARA, and is consistent with the National Contingency Plan (NCP). Conditions at the OBDA meet the NCP Section 300.415(b)(2) criteria for removal actions. Therefore, the removal action is recommended.

_____ _____

CO, Subase DATE

APPENDIX A

MAPS

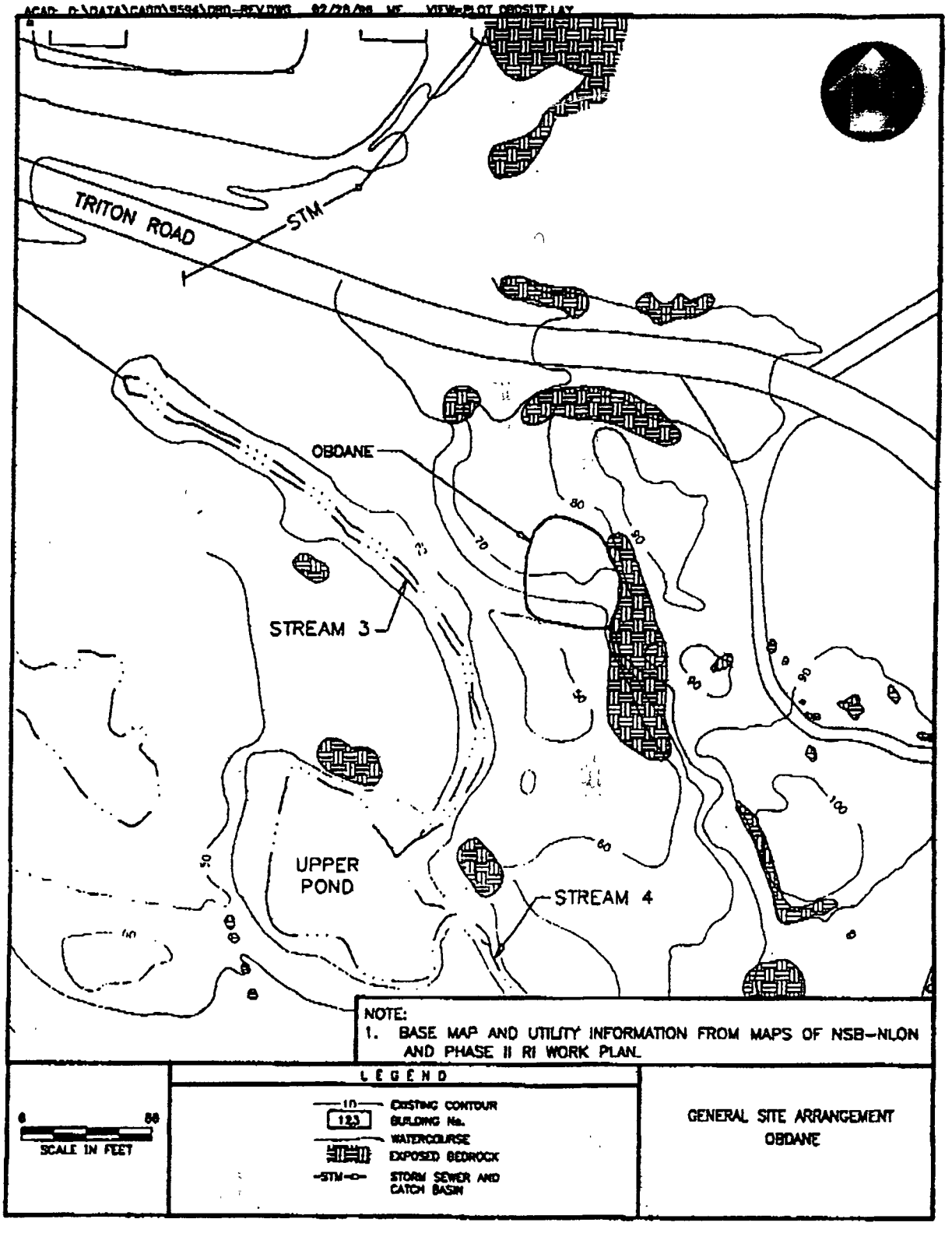


Figure 1. OBDANE – General Site Arrangement

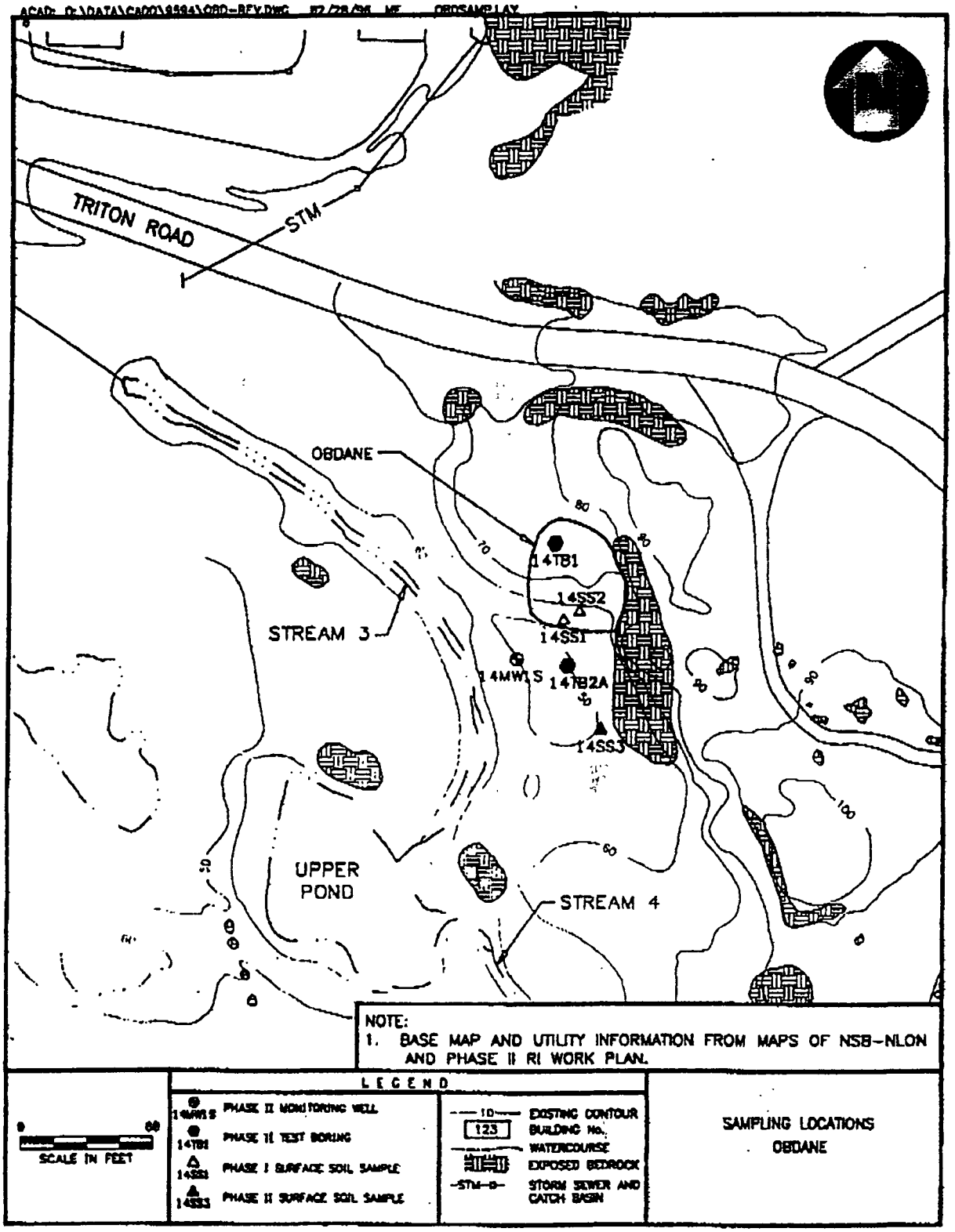


Figure 2. OBDANE – Sampling Locations

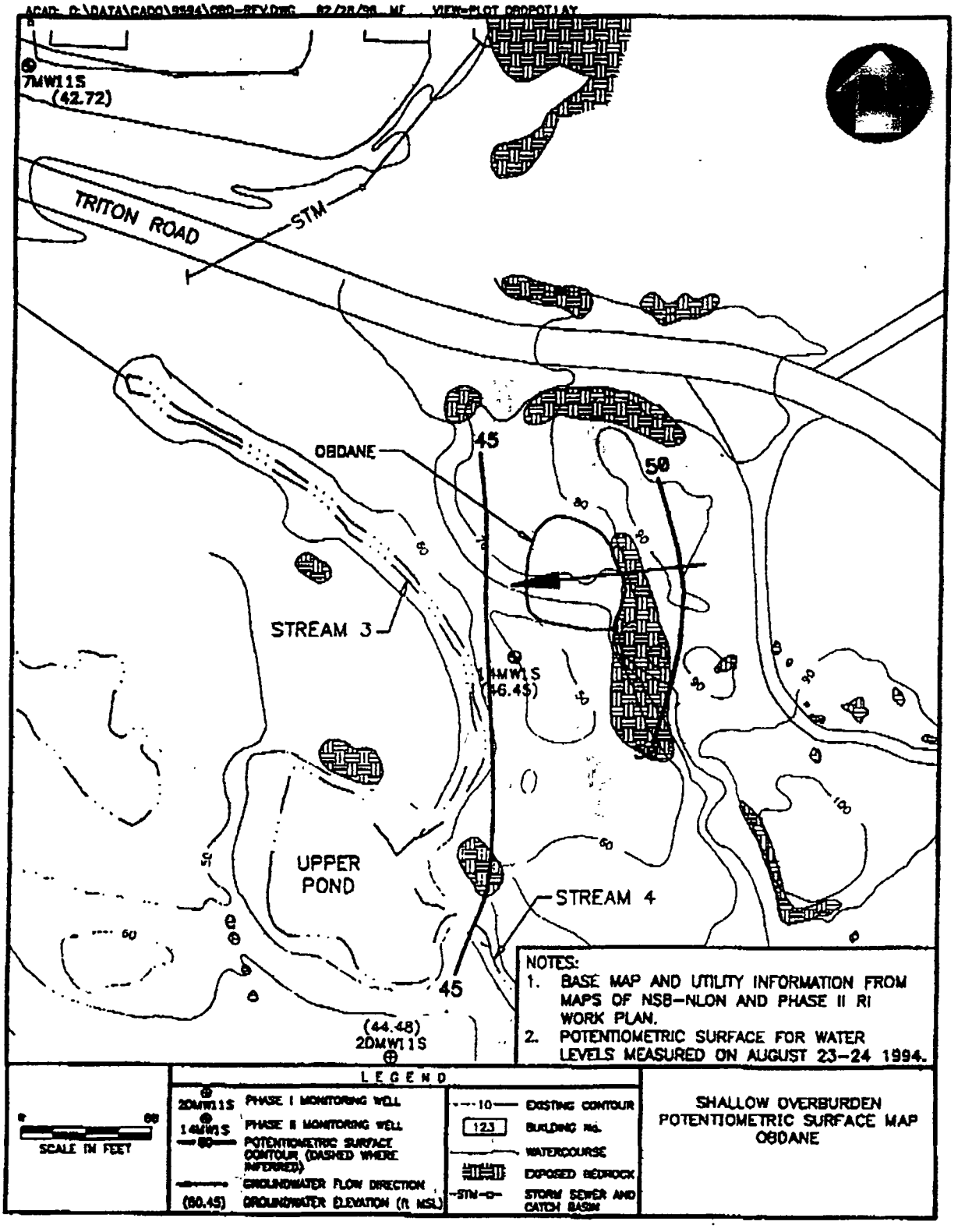


Figure 3. OBDANE – Shallow Overburden Potentiometric Surface Map

APPENDIX B

ENGINEERING EVALUATION/COST ANALYSIS

ENGINEERING EVALUATION/COST ANALYSIS
SITE 14 – OVER BANK DISPOSAL AREA, NORTHEAST
NAVAL SUBMARINE BASE, NEW LONDON
GROTON, CT

SEPTEMBER 1999

1. EXECUTIVE SUMMARY

This Engineering Evaluation/Cost Analysis (EE/CA) presents a comparative analysis and selection of remedial options proposed at the Over Bank Disposal Area Northeast site at the Naval Submarine Base New London. The EE/CA develops, evaluates and selects alternatives that will provide an effective interim remedy which is consistent with anticipated final remediation goals.

The Over Bank Disposal Area Northeast (OBDANE) is located in a heavily wooded area on the edge of a ravine northwest of the Area A Landfill where drums and other miscellaneous debris have been disposed. Debris was dumped over the bank and came to rest on the slope and in a wetland area.

The objective of the removal action is to remove the debris and any contaminated substances from the site. The removal action will serve to eliminate the potential for container leakage and resulting contaminant migration via surface water run-off and groundwater infiltration.

The Site is located in a secured area, surrounded by a chain link fence. There is no short-term or long-term plan to convert this area to any other use; the current military-unique land use in the area is expected to prevail.

2. SITE CHARACTERIZATION AND BACKGROUND

2.1 SITE DESCRIPTION AND BACKGROUND

The OBDANE is located in a heavily wooded area on the edge of a ravine northwest of the Area A Landfill, west of the Area A Weapons Center and south of the Torpedo Shops (See Figure 1). At one time, miscellaneous wastes were apparently dumped over the bedrock edge. The site is circular and approximately 80 feet in diameter. A dirt road provides limited access to the wooded site. A nearly 20-foot high bedrock face is located at the eastern edge of the site. The rest of the site slopes to the southwest.

2.2 PREVIOUS REMOVAL ACTIONS

There have been no previous removal actions at the Site. The type of debris and number of containers is consistent with the original Initial Assessment Study documentation from 1988.

2.3 SOURCE, NATURE, AND EXTENT OF CONTAMINATION

The debris at OBDANE consists of several fiber drums. It is believed that these drums are empty, however any contents discovered will be characterized and disposed of properly as part of this removal action.

Currently a remediation of the pesticide contamination of Area A Dowstream Watercourses is in progress. The debris located in the OBDANE is believed to be unrelated to the pesticide application. No pesticide containers have been found to indicate improper pesticide disposal at the OBDANE. This removal action is designed to eliminate the possible risk of container leakage.

2.4 ANALYTICAL DATA

Since the accessibility to most of the containers is limited by debris obstruction, the contents of the containers, if any, have not been characterized. The most up to date information regarding the pesticide contamination can be found in the Phase II Remedial Investigation (RI), NLSB (TTNus March 1997).

2.5 SITE RISK ASSESSMENT

Based on the limited investigation already conducted, levels of arsenic in the surface soil exceed the state remediation standard under an industrial reuse scenario, therefore posing a risk to potential receptors. The RI recommended further investigation and characterization to better quantify the extent of contamination.

3. IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

3.1 STATUTORY LIMITS ON REMOVAL ACTIONS

Removal actions are generally limited by statute to a maximum cost of two million dollars and a maximum duration of 12 months, except as provided for under two types of exemptions available (emergency and consistency). The 12 month time limit and two million dollar statutory limit are governed by applicable portions of CERCLA Section 104(b)(1). As described in this report, the proposed removal action is to incur costs less than two million dollars and occur within a time period shorter than 12 months.

3.2 DETERMINATION OF REMOVAL SCOPE

The scope of work for the Site will include the removal, transportation, and disposal of debris and contents. Based on the small area of the disposal site and the limited depth, a total volume of debris to be removed is approximately 500 cubic yards.

3.3 DETERMINATION OF REMOVAL SCHEDULE

As stated earlier, the remediation of Area A Downstream Watercourses is currently underway. With the contractor on site, this removal action should be accomplished between October and December 1999.

4. IDENTIFICATION OF REMOVAL ACTION ALERNATIVES

4.1 ALTERNATIVE 1 – NO ACTION

No action is not a technology, but it is an option. The option entails taking no measures. No action does not include future monitoring or future migration assessment. This option is generally considered a baseline for comparison to other remedial actions.

INITIAL SCREENING

The initial investigation has produced soil samples with levels of arsenic above the State of Connecticut's acceptable industrial levels. Although the contents of the fiber tanks are assumed to be empty, the contents and extent of contamination in the OBDANE is unknown. No action is not an acceptable alternative because leaving debris poses an unknown risk to human and ecological receptors, and may be a potential source of contamination for areas outside the OBDANE.

4.2 ALTERNATIVE 2 – INSTITUTIONAL CONTROLS AND CONTAINMENT

Institutional controls and containment is a grouping of options that would minimize or eliminate the containment exposure to receptors, and in some cases the environment. These options include land use restrictions and capping with various materials.

Land use restriction is the official limiting access to the Site, either by Naval instruction or local code. The OBDANE is within a Naval Installation that presently has limited public access. Additionally, this site is within a secure area.

Capping is the construction of a cap over the Site using any of the available capping materials such as asphalt, concrete, clay, bentonite, or synthetic membranes to provide a low permeability cover.

INITIAL SCREENING – LAND USE RESTRICTION

Although land use restrictions would reduce the potential for risks associated with exposure, it would neither protect the environment, nor would it reduce the potential spread of contamination. Even under limited access, contaminants may be transported via erosion / deposition and infiltration processes.

INITIAL SCREENING - CAPPING

The geographic setting, a steep slope and wetlands, of this site does not lend itself to capping within reasonable cost constraints; the inability of using this technology alone to meet the remediation goal removes it from further consideration.

4.3 ALTERNATIVE 3 – REMOVAL AND DISPOSAL OF DEBRIS

Implementation of this alternative assures the removal of a potential contaminant source and is a common, cost effective remedial alternative. The debris will be removed, transported, and disposed of off-site at a permitted disposal facility. This removal will, by necessity, involve entering the OBDANE area and surrounding wetlands to remove the debris. This activity would be similar to that for collecting samples and performing studies, except that the large debris will be removed. This removal action does not entail removal or displacement of water or sediments within the wetlands.

INITIAL SCREENING

This option will provide for an effective remedy to remove a potential source of contamination. The total potential volume of debris to be removed, transported, and disposed is approximately 500 cubic yards.

5. COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Based on the initial screening of alternatives, the most effective alternative is described in paragraph 4.3. Attachment 1 is the cost estimate for the total effort. This is the only alternative which effectively removes the source.

6. RECOMMENDED REMOVAL ACTION ALTERNATIVE

Alternative 3 – Removal and Disposal of Debris, described in paragraph 4.3, is the recommended alternative. The recommended alternative provides excellent protection to human health and the environment by removing the sources of contamination which pose a potential risk to receptors.

ATTACHMENT 1
Removal Action Cost Estimate

Clean Up of Over Bank Disposal Area Northeast
Remedial Action Contract
Naval Submarine Base, New London
September 1999

Remediation Field Labor (includes transportation labor)	$35,100
Remediation Equipment Rental / Delivery Charges (to site)	$33,075
Landfill Disposal Charges	$50,400
Laboratory Analysis	$25,520
Report Preparation	$30,450
Fee	$17,454
TOTAL	**$191,999**

APPENDIX B

Sampling Data

15.0 OVER BANK DISPOSAL AREA - NORTHEAST - SITE 14

This section provides a site-specific summary of various aspects of the Over Bank Disposal Area, Northeast (OBDANE) site investigation. Section 15.1 provides a brief site description. The sampling and analysis program is summarized in Section 15.2. Section 15.3 discusses site physical features. The nature and extent of contamination is discussed in Section 15.4. Contaminant fate and transport is summarized in Section 15.5. Section 15.6 provides the baseline human health risk assessment, Section 15.7 presents the ecological risk assessment and Section 15.8 includes a comparison to state standards. Section 15.9 provides a summary and conclusions.

15.1 SITE DESCRIPTION

The OBDANE site is located in a heavily wooded area on the edge of a ravine northwest of the Area A Landfill, west of the Area A Weapons Center and south of the Torpedo Shops. At one time, miscellaneous wastes were apparently dumped over the bedrock edge. The site is circular and approximately 80 feet in diameter. A dirt road provides limited access to the wooded site. Figure 15-1 displays the general site arrangement. The site location is shown on Drawing 1 (Volume III). 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 stated that the vegetation at the site indicated that no dumping had occurred within ten years prior to the 1982 investigation. Atlantic personnel inspected the site on September 30, 1988, and verified the IAS report of the presence of several empty fiber drums. No visual staining or stressed vegetation were observed at this time. No development of this area is currently planned.

15.2 SITE INVESTIGATIONS

Section 2.0 included a detailed discussion of the general sampling procedures and analytical methods employed during the Phase II RI at NSB-NLON. Sample locations (both Phase I and Phase II RIs) are depicted on Figure 15-2. The remainder of this section summarizes the scope of both the Phase I and Phase II investigations.

15.2.1 Phase I RI

The Phase I RI field investigation at this site consisted of surface soil sampling. Four surface soil samples were collected from two locations within the limits of the identified disposal area during the 1990 Phase I RI. A sample was collected from the 0 to 6 inch and 12 to 18 inch interval from each location. A fifth sample (14SS3C) plus a field duplicate were composites of the two surface samples. Sample locations are depicted on Figure 15-2. Table 15-1 presents a sample-specific summary of the sampling and analysis program for the Phase I RI.

15.2.2 Phase II RI

A single shallow monitoring well (14MW1S) was installed in the presumed downgradient direction from the site during the Phase II RI. The well was sampled during Rounds 1 and 2 of the Phase II RI.

Six additional soil samples were collected from three different borings during the Phase II RI. Samples were collected from depths of 0 to 2 feet and 8 to 10 feet from boring 14TB1 (located within the limits of the disposal area), and from depths of 0 to 2 feet and 2 to 4 feet from boring 14TB2 (located south of the disposal area). Two soil samples were also collected from the boring drilled for the installation of a monitoring well (14MW1) from depth intervals of 0 to 2 feet and 2 to 4 feet. In addition, a single surface soil sample (0 to 6 inches) was collected approximately 75 feet south of the disposal area. Sample locations are shown on Figure 15-2. Table 15-2 presents a sample-specific summary of the sampling and analysis program for the Phase II RI.

15.3 PHYSICAL CHARACTERISTICS

This section presents a summary of site physical characteristics for the OBDANE based on information generated during the Phase I and Phase II RIs. Topography and surface features, surface water, soils, geology, and hydrogeology are discussed in the subsections that follow.

15.3.1 Topography and Surface Features

Figure 15-1 shows the topography and surface features of the OBDANE. The OBDANE is located near the base of the bedrock high that slopes southwest from the Area A Weapons Center. Upslope of the site, there are bedrock exposures. The ground elevation of the site ranges from approximately 80 to 50 feet msl. Downslope of the site, the ground flattens toward the Area A Downstream Watercourses, which have a general ground elevation of 40 feet msl.

15.3.2 Surface Water F atures

Surface runoff from the OBDANE site flows to the southwest into a stream (stream 3) which originates in the Area A Downstream Watercourses. The stream then flows along Triton Road and ultimately discharges into the Thames River at the southern end of the DRMO site.

15.3.3 Soil Characteristics

The SCS Soils Map (SCS, 1983) classifies the soil at the OBDANE as the Hollis-Charlton-Rock complex. This soil is defined as stones and boulders intermingled with a dark, fine, sandy loam. Bedrock outcrops are prevalent.

15.3.4 Geology

The geology of the OBDANE consists of sand and silt alluvium overlying metamorphic bedrock. During the Phase II RI, one test boring (14TB1) was drilled within the boundary of the site. The overburden consists of silty sand with gneiss fragments. Outside the OBDANE boundary, the overburden at boring 14TB2A and well 14MW1S consists of sand with traces of mica. These deposits are either present-day stream deposits or stratified drift of former glacial streams. Bedrock (the Mamacoke) was encountered at depths of 14 and 12 feet at boring 14TB2A and well 14MW1S, respectively. The bedrock surface across the OBDANE is shown on Drawing 4 (Volume III). Geologic conditions are shown on cross-section F-F' on Drawing 20 (Volume III).

The bedrock at the OBDANE slopes toward the southwest according to the general trend shown on Drawing 4 (Volume III) of the northern ridge. Because the bedrock elevation at well 2DMW11D, which is downgradient of the OBDANE, is similar to those present at the site, the bedrock surface slope appears to flatten to the southwest.

15.3.5 Hydrogeology

Groundwater is present within both the overburden and bedrock underlying the OBDANE. Depth to groundwater at well 14MW1S was less than 5 feet. The saturated thickness of the overburden materials is approximately 6 to 10 feet at OBDANE along Stream 3. Groundwater was not encountered at the higher elevation of boring 14TB1.

Figure 15-3 shows overburden groundwater contours across the OBDANE. Groundwater in the overburden flows west from the Area A Weapons Center across the OBDANE toward the Area A Downstream Watercourses and the Thames River. The groundwater flow pattern in the underlying bedrock is expected to be similar to that observed for the overburden. Upgradient of the OBDANE, there is a steep hydraulic gradient. The water table surface generally mimics the approximate 30 foot drop in the topographic surface from the Area A Weapons Center to the OBDANE.

The hydraulic gradient within the overburden across the OBDANE based on the August 1994 Phase II RI water level data (Figure 15-3) is 0.045. Assuming a hydraulic conductivity of 6.8 feet/day (2.4E-3 cm/sec) for the sandy alluvium, which was reported for the alluvium in the Area A Downstream Watercourses during the Phase I RI (based on a slug test for well 2DMW16S), and a porosity of 0.30, the estimated groundwater seepage velocity in the shallow overburden is approximately 1 foot/day.

The hydraulic gradient and topographic surface flattens downgradient of the OBDANE (cross-section D-D' Drawing Number 19). Based on the March 1994 Phase II RI water level data, the hydraulic gradient between wells 14MW1S and 2DMW26S is 0.022. Assuming the hydraulic conductivity for the sandy alluvium in the Area A Downstream Watercourses is 6.8 feet/day (2.4E-3 cm/sec) and a porosity of 0.30, the estimated groundwater seepage velocity downgradient of the site in the shallow overburden is 0.50 foot/day.

15.3.6 Ecological Habitat

The OBDANE is located in a heavily wooded area on the edge of a ravine northwest of the Area A Landfill and west of the Area A Weapons Center. This wooded area is classified as upland deciduous forest and is dominated by red/black oak, black birch, red maple, beech, witch hazel, mountain laurel, sweet pepperbush, and bayberry (Atlantic, 1992). The streams and ponds associated with the Area A Downstream Watercourses (described in Section 9.3.6) are located nearby. This portion of the NSB-NLON provides a good habitat for terrestrial receptors.

15.4 NATURE AND EXTENT OF CONTAMINATION

This section contains a summary of the chemical analytical results for samples collected at this site during both the Phase I (1990) and the Phase II (1994) RIs. The complete data base is contained in Appendix D.11.

15.4.1 Soil

Positive analytical results for all soil samples are presented in Table 15-3. TCLP results are presented in Table 15-4. Table 15-5 presents a summary of the analytical results for soil samples.

The analytical results, as summarized in Table 15-5, indicate that only a few volatile organics were present at very low concentrations. Tetrachloroethene was detected in two surface soil samples at concentrations of 2 μg/kg and 3 μg/kg. Several additional volatile organic compounds were also detected in single surface or subsurface soil samples. Surface soil sample 14SS3 contained the majority of these compounds. Toluene (18 μg/kg) and chloromethane (8 μg/kg) were detected in surface soil samples from borings 14MW1S and 14SS3, respectively, while methylene chloride was detected at a concentration of 7 μg/kg in the subsurface soil sample from boring 14TB2A. The concentrations of other volatile organic compounds, which were detected in surface sample only and included several halogenated aliphatics and two monocytic aromatics, were 2 or 3 μg/kg. These results are not considered indicative of a major source of mobile, volatile organic chemicals. The analytical results for groundwater and sediment support this position.

Several PAHs were detected in the surface and subsurface soil samples. The shallow samples (0 to 2 feet deep) from the onsite boring (14TB1) and the well boring (14MW1) as well as surface soil sample 14SS3 contained several PAHs (at concentrations below 100 μg/kg) and benzoic acid (C_{max} = 64 μg/kg). Fluoranthene and pyrene were the only semivolatile organics detected in the 0 to 2 foot sample from boring 14TB2. Maximum concentrations of all semivolatiles except benzoic acid in surface soil samples were found in the 0 to 2 foot sample from boring 14TB1, located in the northwest portion of the site.

The subsurface soil samples collected from outside the actual disposal area contained notably fewer chemicals at lower concentrations. For example, the sample collected at a depth of 2 to 4 feet from the well boring (14MW1) contained only benzoic acid (29 μg/kg). The subsurface sample from boring 14TB2 contained no detectable semivolatile organics. The deepest sample collected (8 to 10 feet) from the on-site boring (14TB1) contained a wide variety of PAHs. All concentrations were at or below 110 μg/kg.

Surface soil samples 14SS3 and 14SS3C were also analyzed for pesticides. 4,4'-DDT (400 μg/kg) and related compounds, 4,4'-DDE (74 μg/kg) and 4,4'-DDD (11 μg/kg), were detected in sample 14SS3. The results do not appear to indicate that pesticide-contaminated material was disposed at this site, but rather that this site may have been affected by past base-wide applications of 4,4'-DDT.

Metals concentrations were generally higher in surface soils than in subsurface soils. A majority of maximum concentrations were found in samples collected from well 14MW1S and boring 14TB1. Only concentrations of beryllium and cobalt were less than the NSB-NLON background concentrations.

Three metals (arsenic, boron, and lead) were detected in surface sample 14SS3 at concentrations (16.3 mg/kg, 27.6 mg/kg, and 403 mg/kg, respectively) notably greater than in the other soil samples. Figure 15-4 contains information on the spatial distribution of lead in surface soil at this site. All other metals in surface soil sample 14SS3 were reported at concentrations below the maximum detected result for the other samples. Since the disposal area does not appear to contain these metals at elevated concentrations, no source can be identified.

Barium, cadmium, chromium, and lead were detected in the TCLP extracts of one or two surface soil samples. All results were below Federal toxicity characteristic regulatory levels and Connecticut remediation standards for pollutant mobility for GB waters. Overall, the analytical results do not indicate the presence of a significant source area at the site.

15.4.2 Groundwater

A summary of positive analytical results for all groundwater samples are presented in Table 15-6. Only one volatile organic chemical (carbon disulfide) and one semivolatile organic chemical [bis(2-ethylhexyl)phthalate] were detected in the sample from well 14MW1S during either sampling round of the Phase II RI. Both were detected at an estimated concentration of 1 μg/L, which is below the Contract Required Quantitation Limit (CRQL) of 10 μg/L. Neither of these compounds were detected in any of the soil samples collected at the site. Therefore, as stated in the preceding section, the OBDANE does not appear to represent a major source of organic contamination. However, it should be noted that monitoring well 14MW1S is located in close proximity to, but not immediately downgradient of, the site (see Figure 15-3). Nonetheless, groundwater samples from this well probably provide an accurate representation of groundwater conditions downgradient of the site.

With the exception of aluminum (detected at 171 μg/L in unfiltered sample 14GW1S only), there were no significant differences between filtered and unfiltered metals data from Rounds 1 and 2 of the Phase II RI. Notable detections include barium (C_{max} = 39.3 μg/L), boron (C_{max} = 130 μg/L), and manganese (C_{max} = 779 μg/L) in both filtered and unfiltered samples.

15.5 CONTAMINANT FATE AND TRANSPORT

The soil samples collected at the OBDANE contained several volatile and semivolatile organic compounds. Most of the reported results for these chemicals are less than the CRQLs. These results indicate that the soil at this site is not a significant source of organic contaminants. Several pesticides (4,4'-DDT and its metabolites) were detected in one site soil sample; however, the site does not appear to represent a major source of pesticide contamination (C_{max} = 400 mg/kg). None of the organic compounds identified in soil were detected in the monitoring well.

A sample collected outside the boundaries of the known disposal area contained elevated levels of some metals. However, since these metals were found at lower concentrations within the disposal area, the OBDANE does not appear to be the source. In conclusion, the data indicate no identifiable offsite transport of contaminants from this site.

15.6 BASELINE HUMAN HEALTH RISK ASSESSMENT

This section presents the site-specific risk assessment performed for the OBDANE. The selection of Chemicals of Concern (COCs) is presented in Section 15.6.1, the potential exposure scenarios are presented in Section 15.6.2, and the results of the risk assessment are presented in Section 15.6.3.

15.6.1 Data Evaluation

COCs were selected for soil and groundwater at this site by comparing the maximum detected concentrations to the risk-based COC screening values, as described in Section 3.3.3. All data collected during the Phase I and II RIs, except composite soil sample data (14SS3C-0-6 and the associated field duplicate sample), were used to identify COCs for the OBDANE site. Appendix F.14 contains the COC summary screening tables for the site.

The following analytes were selected as COCs for soil:

- Benzo(a)pyrene.
- Metals (antimony, arsenic, beryllium, chromium, lead, manganese, and vanadium).

Benzo(a)pyrene was retained for "all soil" (soil from depths of 0 to 10 feet) only. The maximum detection of this chemical in the surface soils was below the risk-based screening criteria.

As presented in the site-specific COC summary tables in Appendix F.14, maximum soil detections were also compared to USEPA SSLs for migration to groundwater. Maximums for several chemicals (chloromethane, cis-1,3-dichloropropene, 1,1,2,2-tetrachloroethane, arsenic, barium, and chromium) detected in the site soil samples exceeded the SSLs, indicating that there is a potential for these chemicals to migrate to groundwater and potentially impact water quality.

Two rounds of groundwater samples were collected during the Phase II RI from the shallow well (14MW1S) at the site. The list of COCs for groundwater includes metals only (arsenic and manganese). Arsenic, which was not detected in the unfiltered groundwater samples, was selected as a COC for the filtered matrix. The two organic compounds detected in the groundwater samples, carbon disulfide and bis(2-thylhexyl)phthalate, were reported at concentrations below the risk-based COC screening levels. No exceedances of primary MCLs were observed.

Benzo(g,h,i)perylene, phenanthrene, and several inorganic essential human nutrients (calcium, magnesium, potassium, and sodium) were detected in the site media, but were not retained as COCs because no toxicity criteria are available to quantitatively assess exposure to these chemicals. In addition, USEPA Region I does not advocate a quantitative evaluation of exposure to aluminum and iron because the only available toxicity criteria for these chemicals are provisional reference doses based on allowable intakes rather than adverse effect levels. Exposure to these chemicals is addressed in the general uncertainty section of the baseline human health risk assessment, Section 3.3.5.

For groundwater, average concentrations were used as exposure concentrations for risk evaluation. Exposure concentrations for surface soil and "all soil" (soil from depths of 0 to 10 feet) categories were defined as the maximum (RME) and average (CTE) detections because of the limited number of samples collected for these media. Table 15-7 provides a summary of the COCs and exposure concentrations for the OBDANE.

15.6.2 Exposure Assessment

Two receptor groups, older child trespassers (ages 6 to 16) and construction workers, were evaluated as potential receptors for the OBDANE site. The trespasser is expected to come in contact with surface soil only, while "all soil" (soil from depths of 0 to 10 feet) exposure is assumed for the construction worker. The construction worker may also be dermally exposed to groundwater. These exposures were assumed to occur between 52 and 120 days/year over a 3 to 10 year period for the trespasser and between 80 and 120 days/year over the entire length of the construction project (assumed to be 1 year) for the construction worker. Additional details on specific exposure parameters are presented in Section 3.3.3.

Dermal contact with soil was not evaluated in a quantitative fashion since the list of COCs for the site did not include PCB, dioxins, or cadmium. Dermal exposure to other chemicals detected in the site soil samples was addressed qualitatively in Section 3.3.3.

The identified potential receptors could also be exposed to chemicals in soil via inhalation of fugitive dust and volatile emissions. This exposure pathway was evaluated qualitatively by a comparison of maximum soil concentrations to USEPA SSLs for the inhalation pathway, as summarized in the site-specific COC summary screening tables in Appendix F.14. Maximum detections for all soil chemicals were below the inhalation SSLs, indicating that the inhalation pathway is not expected to be a significant exposure route at the OBDANE. Consequently, this exposure route was eliminated from further quantitative risk evaluation.

15.6.3 Risk Characterization

The quantitative risk assessment for the OBDANE is summarized in this section. Total noncarcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risks for the RME and CTE, are presented in Table 15-8 for the construction worker and older child trespasser. Sample calculations are provided in Appendix F.3. Chemical-specific risks for the site are contained in Appendix F.14.

15.6.3.1 Noncarcinogenic Risks

Cumulative Hazard Indices (HIs) for the construction worker and the older child trespasser under both CTE and RME scenarios were less than unity. Therefore, no toxic effects are anticipated for potential receptors at the OBDANE.

15.6.3.2 Carcinogenic Risks

The cumulative incremental cancer risk for the RME older child trespasser is 3.0E-6. This carcinogenic risk is attributed solely to arsenic and beryllium in soil at their maximum concentrations. Arsenic was the main contributor with a chemical-specific incremental cancer risk for incidental ingestion of soil of 2.7E-6. All other carcinogenic risks for other receptors are less than 1E-6.

15.6.3.3 Exposure to Lead

Lead was identified as a potential COC for soil at the site. Maximum detected concentrations of this chemical in surface soil and "all soil" (soil from depths of 0 to 10 feet) samples slightly exceeded 400 mg/kg, which is the OSWER interim soil screening level for residential land use. As seen in Table 15-7, the

maximum detection is defined as the exposure concentration for the RME scenario for surface soil and "all soil" (soil from depths of 0 to 10 feet). Exposure to lead in soil was addressed using the USEPA IEUBK Model, as discussed in Section 3.3.3. For the RME, the maximum lead detection, as well as several default parameters (for air, dust, drinking water, etc.), were used to estimate blood lead levels in children in a residential setting. The estimated geometric mean blood lead level is 4.6 μg/dL. This value is less than the established level of "concern", 10 μg/dL, indicating that no adverse effects would be anticipated for a child receptor in a residential setting exposed to surface soil or "all soil" (soil from depths of 0 to 10 feet).

15.6.3.4 Uncertainties

A detailed discussion of general uncertainties associated with the various aspects of human health risk assessment, was provided in Section 3.3.5. Site-specific uncertainties for the OBDANE risk evaluation are presented below.

Some inorganic chemicals detected in site soil samples may be attributable to naturally occurring background levels. Background levels for metals in soil at NSB-NLON, developed by Atlantic Environmental Services, Inc., were presented on Table 1-2. Reported concentrations of beryllium and cobalt in the site soils were below the established NSB-NLON background levels. Detections of aluminum and copper may also be a result of background since reported concentrations of these chemicals were similar to background levels. None of the aforementioned chemicals were identified as significant contributors to the estimated noncarcinogenic and carcinogenic risks for the OBDANE.

15.7 ECOLOGICAL RISK ASSESSMENT

This section contains a site-specific ecological risk assessment for the OBDANE. Both maximum and average exposure point concentrations were considered in determining potential risks to ecological receptors. The process followed to determine exposure point concentrations and the methodology used to characterize risks to ecological receptors is summarized in Section 3.4. Detailed calculations are provided in Appendix I.10.

15.7.1 Site-specific Conceptual Model

Ecological receptors inhabiting this area are most likely to be exposed to chemicals associated with this site by direct contact with the surface and shallow subsurface soils (0 to 2 feet) as a result of foraging, movement through the area, or burrowing in the soil (e.g., soil invertebrates).

15.7.2 Exposure Assessm nt

As discussed in Section 15.3.6, the OBDANE is located in a heavily wooded area on the edge of a ravine near the Area A Landfill and the Area A Weapons Center and slopes southwest toward the Area A Downstream Watercourses. This area supports upland deciduous forest and provides good habitat for terrestrial wildlife species. Complete exposure pathways for this site include potential uptake via roots by terrestrial vegetation and exposure of soil invertebrates by direct contact with contaminants present in soil moisture or through soil ingestion. Complete exposure pathways for small mammals include direct contact with soil, incidental ingestion of soil while foraging, and consumption of contaminated prey. Predators could be exposed to chemicals at this site by consumption of prey or incidental ingestion of soil.

15.7.3 Receptor Organisms

The habitat associated with the OBDANE is likely to support populations of wildlife receptors. As noted above, it is heavily wooded and located near several bodies of water. The site is, however, very small (80 feet in diameter). To evaluate potential impacts to wildlife receptors, it was assumed that the OBDANE supported a population of soil invertebrates and that short tail shrews both inhabited and foraged in the area. The short tail shrew, in turn, preys on soil invertebrates and the shrew ultimately serves as prey for barred owls. The same conservative assumptions summarized in Section 3.4.4.2 were retained for this assessment.

15.7.4 Site-specific Contaminants of Concern

As discussed in Section 15.7.1, ecological receptors are likely to come in contact with surface and shallow subsurface soils (0 to 2 feet). COCs associated with this site medium were selected by comparing exposure point concentrations (both maximum and average values; Appendix I.11) to the following (see also Section 3.4.2):

- Inorganic chemicals were compared to concentrations of inorganic constituents present in samples collected from NSB-NLON background locations.

- Inorganics present at concentrations greater than background and all detected organic compounds were compared to conservative benchmark values protective of terrestrial vegetation, soil invertebrates, the short-tailed shrew, and the barred owl.

COCs identified as a result of comparing both the maximum and average concentrations of chemicals detected in surface soils collected from the OBDANE to benchmark values are summarized in Table 15-9.

15.7.5 Risk Characterization

The ecological risk characterization for Site 14 - OBDANE is summarized in this section. Risks to terrestrial vegetation, soil invertebrates are evaluated. Detailed media and receptor-specific calculations used to determine ecological risks for this site are contained in Appendix I.10.

15.7.5.1 Terrestrial Vegetation

As discussed in Section 3.4.2.3, potential risks to terrestrial vegetation were determined by comparing chemical concentrations to conservative, phytotoxic benchmarks. The benchmark values listed in Will and Suter (1994) are conservative and do not consider site-specific soil characteristics which may affect bioavailability (and their potential toxicity) to plants (Section 3.4.2.3). Maximum and average chemical concentrations detected in surface soil samples (0 to 2 feet) collected from this site were compared to these phytotoxic benchmark values and Hazard Quotients (HQs) were determined. Chemicals associated with the OBDANE were considered to represent a risk to terrestrial vegetation if the HQs exceeded 1.0. The HQs determined for this site are summarized in Tables 15-10 (maximum concentrations) and 15-11 (average concentrations).

When maximum concentrations of analytes detected at the OBDANE surface soils were compared to phytotoxic benchmark values, eight inorganic contaminants with HQs greater than 1.0 were identified. The maximum concentrations of aluminum, chromium and boron produced the highest HQs with respect to th se receptors (HQs = 3.6E+2, 6.2E+1, and 5.5E+1), respectively. Other chemicals with HQs greater than 1.0 included arsenic, lead, vanadium, and zinc. When the average concentrations of soil contaminants were compared to phytotoxic benchmarks, HQs for the same metals decreased somewhat (the HQs for and boron equalled 3.3E+1 and 2.5E+1, respectively). However, with the exception of aluminum, arsenic, and zinc, the same chemicals identified as representing a potential risk to vegetation when maximum soil concentrations were considered still had HQs greater 1.0 when average concentrations were compared to benchmark values. Based on this conservative assessment, terrestrial vegetation associated with the OBDANE may be adversely impacted as a result of exposure to metals in surface soil.

15.7.5.2 Terrestrial Fauna

Soil Invertebrates

Conservative benchmark values protective of earthworms were used to identify potential risks to soil invertebrates inhabiting the OBDANE. The maximum and average concentrations of inorganics detected in surface soil (0 to 2 feet) samples were compared to the concentrations of constituents present in NSB-NLON background samples. Inorganics present in concentrations greater than background and all organic compounds were then compared to benchmark values developed for earthworms (see Section 3.4.2.3) and HQs were determined (see Appendix I.10). Chemicals associated with the OBDANE were considered to represent a risk to terrestrial invertebrates if the HQs exceeded 1.0. The HQs determined for this site are summarized in Tables 15-12 (maximum concentrations) and 15-13 (average concentrations).

The maximum concentrations in surface soil were compared to benchmark values developed to be protective of soil invertebrates. The results of this comparison determined that only lead (HQ = 6.8E+0) and chromium (HQ = 2.5E+0) were present in concentrations that could adversely impact these receptors (Table 15-12). As shown in Table 15-13, the average concentrations of these two surface soil chemicals also exceeded the soil invertebrate benchmark values. As discussed in Section 3.4.2.3.2, data regarding the toxicity of soil chemicals to soil invertebrates is limited and difficult to interpret, but the results of this assessment suggest that soil invertebrates exposed to both the maximum and average concentrations of lead and chromium present in these soils are potentially at risk.

Terrestrial Vertebrates

Potential risks to terrestrial ecological receptors coming in contact with surface soil at the OBDANE were assessed by examining risks to short-tailed shrews and barred owls. Exposure pathways considered in the assessment for this site included the ingestion of prey, direct contact with the soil, and the incidental ingestion of soil. Surface soil (0 to 2 feet) was the only site medium of ecological concern, potential risks associated with other media (e.g., ingestion of water) were not considered. All calculations performed for representative animals potentially inhabiting the OBDANE are contained in Appendix I.10.

As discussed in Section 3.5.3, risks to terrestrial receptors are expressed in terms of Hazard Indices (HIs), which are the sum of chemical-specific HQs. Tables 15-14 and 15-15 contain the HI values calculated for each receptor exposed to the maximum and average surface soil (0 to 2 feet) chemical concentrations associated with the OBDANE.

The HI calculated for the short-tailed shrew using maximum surface soil contaminant concentrations (HI = 7.2E+2) indicates that this species is potentially at risk (Table 15-14). Three inorganics (aluminum, vanadium, and antimony) contributed most significantly to this receptor's potential risk. Incidental ingestion of soil contributed the majority of the risk (58.8%; Table 15-14).

Use of average chemical concentrations in soil to determine the HI for this receptor resulted in somewhat lower risks (HI = 2.1E+2; Table 15-15). Antimony, vanadium, and chromium were the major contributors to this receptor's potential risk (HQ = 8.8E+1, 8.7E+1, and 3.3E+1, respectively; Table 15-15).

Using acute toxicity benchmark values, aluminum (HI = 2.0E+01) and vanadium (HI = 3.5E+00) had HIs > 1 for the maximum concentration scenario (Appendix I.10). Using mean concentrations, vanadium (HI = 2.5E+00) was the only COC for the short-tailed shrew.

When the maximum concentrations of soil chemicals at the OBDANE were compared to conservative benchmark values developed for the barred owl, an HI of 2.5E+1 was calculated (Table 15-14). The pesticide, 4,4'-DDT, was the primary contributor to this receptor's risk (68.9%), followed by 4,4'-DDE (12.8%). Antimony and aluminum also contributed significantly to risk (5.3% and 4.5%, respectively; Table 15-14). Unlike the short-tailed shrew, the ingestion of food (i.e., ingestion of shrews) represented the primary means of exposure to site chemicals for the barred owl, contributing 61.4% to the HI, while incidental ingestion of soil accounted for 38.6%.

Comparison of average surface soil concentrations to the benchmark values developed for the barred owl resulted in only a slight reduction in risk (HI = 2.4E+1; Table 15-15); these results indicate that exposure to the average chemical concentrations detected in surface soils collected from the OBDANE also represents a potential risk to these predators.

Using acute toxicity benchmark values, no HIs > 1 were calculated for the barred owl for either the maximum or average concentration scenarios (Appendix I.10), suggesting no potential acute risks to this receptor.

15.7.5.3 Uncertainties

As discussed in Section 3.4, the following conservative assumptions were maintained in performing this ecological risk assessment:

the site use factor was assumed to equal 100% (i.e., the organisms were assumed to live and forage exclusively within the boundaries of this site),

- minimum body weights were used to calculate receptor dose
- maximum ingestion rates were used to calculate receptor dose
- contaminants were assumed to be 100% biologically available
- the most sensitive life stage was assumed to be exposed to site contaminants
- it was assumed that only contaminated prey were consumed.

By adopting these conservative assumptions, the final risk estimates are deliberately conservative and are likely to overestimate the actual risk associated with contaminants detected at the OBDANE. This approach was taken so it may be concluded with confidence that certain chemicals detected at this site are unlikely to represent an ecological risk. While this process serves to significantly reduce the uncertainty associated with eliminating certain chemicals from further consideration, uncertainty is associated with concluding that exposure to the remaining chemicals are adversely impacting ecological receptors. An analysis of the uncertainty associated with the risk assessment process is important in that it identifies, and, to the extent possible, quantifies the uncertainty associated the entire process (problem formulation, data analysis and risk characterization). The uncertainty introduced into the risk assessment process stems from three sources: 1) imperfect knowledge of things that should be known, 2) systematic errors (e.g, computational, data, or analytical transformation errors), and 3) nonsystematic errors (i.e., random or stochastic errors) and variability in the system being assessed (Solomon et. al, 1996). A detailed discussion of uncertainties associated with the assessment process is contained in Section 3.4. This section focuses on uncertainties and assumptions that should be considered when interpreting the results of the ecological risk assessment performed at the OBDANE.

The results of the ecological risk assessment indicated that surface soil contaminants represented a potential risk to both the shrew and to the barred owl. For the purposes of this risk assessment, it was assumed that these receptors lived and fed exclusively in the OBDANE (i.e., the site use factor was assumed to equal 1.0). The shrew has the smallest home range of the vertebrate receptors considered. However, given the size of this site (80 feet in diameter), a site-use factor of 1.0 is very conservative not only for the bared owl, but also for the short-tailed shrew. This assumption results in an overestimation of ecological risks.

Uncertainty is also associated with characterizing the toxicity of contaminants detected at this site. It was determined that aluminum contributed most significantly to the potential risks calculated for terrestrial vegetation. According to Will and Suter (1994), aluminum exerts a toxic response in terrestrial vegetation by interfering with cellular division in roots, decreasing root respiration, binds with phosphorus so that it is not biologically available, interferes with the uptake of essential nutrients (calcium, magnesium, phosphorus)

and water, and disrupts enzyme activity. Seedlings are more susceptible to the effects of aluminum toxicity than are older plants (Will and Suter, 1994).

The aluminum benchmark value used to determine if this metal represented a potential risk to terrestrial vegetation was taken from Will and Suter (1994). The benchmark is based on the results of a single study that documented a 30% reduction in white clover seedling establishment when 50 mg/kg aluminum was added to a sandy loam soil with a pH of 5.0. Because only a single study describing the phytotoxicity of aluminum could be identified, the confidence in this benchmark, and therefore the conclusions regarding the potential impacts of aluminum on vegetation within the OBDANE, is limited.

It was also determined that aluminum was among the contaminants making the greatest contribution to the potential risk calculated for the short-tailed shrew. As summarized in Appendix H, although abundant in food, aluminum is not an essential element for mammals. Aluminum is not readily absorbed through the skin and gastrointestinal absorption of ingested aluminum is poor due to the transformation of aluminum salts into insoluble aluminum phosphate. The lack of accumulation of aluminum in animals with age or any increase in tissue levels of aluminum following high dietary intake suggests that mammals possess a homeostatic mechanism for this element. This suggests that the assumption that aluminum is 100% bioavailable is too conservative for this element.

The benchmark used to assess the potential risk to small mammals associated with aluminum was derived from toxicity tests performed on female mice. These results are summarized in Opresko et al. (1994). Female mice were exposed to a single dose of aluminum chloride added to drinking water. The tests extended for more than one year, including reproductive stages. The results of the test therefore represent the effects of long term chronic exposure and are consistent with the assumption that exposure to site contaminants is also probably chronic. Growth of the second and third generations was significantly reduced. Therefore, the single dose administered during these tests was regarded as the LOAEL. The LOAEL value was converted to an NOAEL by multiplying by 0.1. The lack of a NOAEL introduces uncertainty to these test results.

The risk assessment determined that vanadium also contributed significantly to the HI calculated for the short-tailed shrew. Vanadium is the 21st most abundant metal in the earth's crust and is a natural component of fuel oils. In addition, vanadium is commonly employed as an alloying agent by the steel industry and as a catalyst in the chemical industry (Ellenhorn and Barceloux, 1988). Vanadium appears to help regulate the Na^+/K^+ ATPase pump. The physiological mechanism associated with this metal's toxicity is unknown but is believed to be associated with its inhibition of oxidative phosphorylation (Ellenhorn and Barceloux, 1988). Vanadium compounds are poorly absorbed through the gastrointestinal wall. This

information indicates that the assumption that 100% of the vanadium consumed by short-tailed shrews at the OBDANE was absorbed is overly conservative.

As summarized in Table 3-17, the endpoint (NOAEL) used to assess risks to mammals associated with exposure to vanadium was based on a study summarized in Opresko et. al (1994). This study reported the results of a laboratory toxicity test conducted on female rats exposed to three doses of vanadium in the form of metavandate (41.78% V) administered via oral intubation. This method of administration introduces uncertainty to these test results in that it does not represent a natural means of exposure. The study performed on the female rats extended through 60 days prior to gestation and through gestation, delivery, and lactation. The results of the test therefore represent the effects of long term chronic exposure and are consistent with the assumption that exposure to site contaminants is also probably chronic. Because significant differences in reproductive effects were observed at all three administered doses, the lowest dose used in the study was selected as the LOAEL. The resulting LOAEL values were converted to NOAEL values by multiplying by 0.1. The lack of a NOAEL also introduces uncertainty to these test results.

The results of the ecological risk assessment determined that DDTR contributed significantly to the risk of the barred owl. DDTR manifests its toxic effect by affecting the nervous system and as a hepatotoxin. It's affect on avian reproduction (i.e., egg shell thinning) is also well known. As summarized in Appendix H, long-term dietary exposure to 2.8 to 3.0 mg/kg (wet weight) results in adverse reproductive effects in mallards, screech owls, and black ducks. When compared to other contaminants, the wildlife toxicity database for DDTR is relatively robust.

For the barred owl, the LOAEL for the brown pelican, as reported by Anderson et al. (1975), served as the basis for developing species-specific NOAELs. According to USEPA (1993), this study was deemed most appropriate for the development of avian wildlife.criteria for the Great Lakes because: "it represented a peer-reviewed field study that provided a chemical-specific dose-response curve for reproductive success". A UF of 4.00E-02 was applied to the brown pelican LOAEL (2.80E-03 mg/kg/day), resulting in a NOAEL of 1.12E-04 mg/kg/day for the mallard and barred owl. As noted by USEPA (1993), piscivorous (fish-eating) birds such as the brown pelican are among the avian species most severely affected by DDTR. Because development of wildlife criteria protective of piscivorous birds was among the goals of the Great Lakes Initiative, use of these data were particularly appropriate. However, the barred owl is not piscivorous. Therefore, employing the LOAEL generated for the brown pelican probably results in an overly conservative NOAEL for this species. The conservatism of this value (1.12 E-04 mg/kg/day) is indicated by the LOAELs reported for mallards. LOAELs for this species ranged from 0.58 to 2.91 mg/kg/day (USEPA, 1993). Using a UF of 2.00E-01 to convert from LOAELs to NOAELs produces mallard NOAELs that range from 0.116 to 0.582 mg/kg/day, significantly greater (less conservative) than the value used to evaluate risks to the barred

owl. While no similar DDTR toxicity data were identified for the barred owl, results of a study conducted on the American kestrel (LOAEL = 0.39 mg/kg/day; Peakall et. al, 1973) were reported. This species, like the barred owl, feeds on small mammals, rather than fish. When a UF of 4.00E-02 is used to account for taxonomic differences between kestrels and owls and to convert from a LOAEL to a NOAEL, a barred owl NOAEL of 1.56E-02 mg/kg/day is generated. This value, like those generated for the mallard, are substantially higher (less conservative) than the brown pelican NOAEL used to assess ecological risks to this receptor.

15.8 COMPARISON OF SITE DATA TO CONNECTICUT STANDARDS

Analytical data for the OBDANE were compared to Connecticut drinking water standards and remediation standards (CTDEP, January 1996). Tables summarizing the comparison of site data to Connecticut standards are provided in Appendix F.14. These tables, which follow the quantitative risk assessment spreadsheets in the cited appendix, identify, on a media-specific basis, those chemicals detected at concentrations in excess of state criteria. Maximum and average chemical concentrations are presented in the summary tables. Although the maximum concentration of a chemical may exceed an associated state criteria, the distribution of the chemical in the medium is also important with respect to decision making. Therefore, the average chemical concentration was included to provide some information on the potential distribution of the chemical. A brief narrative of the findings of this qualitative analysis is provided in the remainder of this section.

Site-specific soil data were compared to Connecticut remediation standards for direct exposure and pollutant mobility. Based on conversations with the State, USEPA, and Navy (October 25, 1995c), an industrial land use scenario is considered to be the most likely exposure scenario for the site. The only chemical found at a maximum concentration exceeding the state remediation standard for direct exposure under industrial land use was arsenic.

To address concerns regarding migration of chemicals from soil to groundwater, site soil data were compared to Connecticut remediation standards for pollutant mobility. The groundwater classification for the OBDANE is GB, which indicates that although the state recognizes that groundwater may not meet GA criteria at this time, the goal is to restore groundwater to GA quality. No exceedances of the GB pollutant mobility criteria were noted. A qualitative evaluation of the TCLP analytical results for the site soil samples (in relation to state pollutant mobility criteria for inorganics) is provided in Table 15-4.

Analytical groundwater data for the site were compared to Connecticut MCLs and remediation standards for groundwater and surface water protection. Sodium was detected at a maximum concentration of

45.8 mg/L which exceeded the State Notification Level of 28 mg/L. No exceedances of primary MCLs were observed in unfiltered and filtered groundwater samples. In addition, maximum groundwater concentrations for all detected chemicals were less than the Connecticut remediation standards for groundwater and surface water protection.

15.9 SUMMARY AND CONCLUSIONS

This section presents a summary of major findings of the investigations at the OBDANE site. A summary of the nature and extent of contamination is provided in Section 15.9.1. Sections 15.9.2 and 15.9.3 summarize the baseline human health risk assessment and ecological risk assessment for the site, respectively. Section 15.9.4 summarizes the comparison of site data to state standards and Section 15.9.5 provides recommendations regarding additional action or investigatory efforts for the site.

15.9.1 Nature and Extent of Contamination

Minimal organic contamination was identified in the environmental matrices sampled at this site. For example, although volatile organics were detected in the soil samples, concentrations ranged no higher than 18 μg/kg (toluene) and the concentrations of all remaining volatile organic analytes were less than 9 μg/kg. Although various PAHs were detected in the soil samples, concentrations of this class of chemicals ranged no higher than 110 μg/kg (benzo[a]pyrene). Pesticides were also detected in the soil samples, but concentrations ranged no higher than 400 μg/kg (4,4'-DDT).

However, more significant inorganic contamination was detected in surface soils to the south of the site. Arsenic was found at sample points 14MW1S-0002 and 14SS3 at concentrations of 10.4 mg/kg and 16.3 mg/kg, respectively. Also, lead was detected at sample point 14SS3 at a concentration of 403 mg/kg.

No organic chemicals other than carbon disulfide and bis(2-ethylhexyl)phthalate were detected in groundwater samples obtained at this site (1 μg/L each). Although the one monitoring well installed at the OBDANE is not located immediately downgradient of the source area (well is located somewhat to the side and downgradient of the source area), the low levels of groundwater contamination present in this well are probably representative of downgradient conditions because little contamination was noted in source area soils. Therefore, it is unlikely that groundwater is impacted from the site. Furthermore, based on the low concentrations of chemicals in the soil, it is highly unlikely that any impacts on downstream surface water bodies will occur.

15.9.2 Baseline Human Health Risk Assessment

Based on the relatively remote nature of the OBDANE site, construction workers and older child trespassers were considered the only potential receptors of concern for exposure to soil and groundwater. The noncarcinogenic risk estimates (HIs) for the evaluated exposure routes were all below the USEPA acceptable limit of one. Projected lifetime incremental cancer risks were either below or only slightly above the lower bound (1E-6) of the USEPA's acceptable target risk range (1E-6 to 1E-4). Therefore, it is concluded that the site poses little risk to human health.

15.9.3 Ecological Risk Assessment

The OBDANE provides both cover and foraging area for wildlife receptors. Organisms inhabiting this area may come in contact with site soil while searching for food or burrowing in the soil (e.g., soil invertebrates). Using the conservative assumptions discussed in Section 3.4.4.2, the maximum concentrations of chemicals detected in surface soils (0 to 2 feet) collected from this site were compared to benchmark values protective of various terrestrial ecological receptors. The results of these comparisons indicate that chemicals detected at the OBDANE could adversely impact terrestrial vegetation, soil invertebrates, and terrestrial vertebrates. When the risks associated with the average chemical concentrations in surface soil were evaluated, risks to these receptors were somewhat reduced but still exceeded 1.0. These results suggest that exposure to surface soil at the OBDANE presents a potential risk to terrestrial receptors. However, the OBDANE is relatively small and can only support a limited number of receptors. This fact, coupled with the conservative methods used in this assessment, suggest that actual risks to ecological receptors are likely to be less than those predicted in this assessment. It is concluded that the OBDANE represents little potential risk to ecological receptors.

15.9.4 Comparison of Site Data to State Standards

Arsenic in soil and sodium in groundwater were the only chemicals detected at maximum concentrations exceeding the state standards discussed in Section 15.8. Arsenic was selected as a COC in the baseline human health and/or ecological risk assessments. Sodium was not retained as a COC for direct exposure to groundwater because of the lack of published dose-response parameters. It should be noted that the applicable state standard for sodium is a Notification Level for a drinking water source.

15.9.5 Recommendations

It is recommended that further characterization of the surface soil with respect to arsenic and lead contamination be conducted at the OBDANE for the following reasons:

- Although minimal contamination was detected in soil samples collected within, and adjacent to, the confines of the waste disposal area, more significant lead contamination was detected in surface soil sample 14SS3 located approximately 80 feet to the south of the site. This contamination could potentially migrate further offsite.

- Arsenic was found in site surface soils (samples 14SS3 and 14MW1S-0002) at concentrations slightly exceeding the state remediation standard for direct exposure under the industrial land use scenario.

Although contamination has been detected in surface soils at levels that exceed state standards and further investigation is required to finialize the nature and extent of contamination, relatively low human health and ecological risks are present at the site. This belief is based on the following supporting information:

- Human health noncarcinogenic risk estimates for the evaluated exposure routes were all below one. Projected lifetime incremental cancer risk estimates were all less than 1E-6 or within the USEPA's acceptable target risk range of 1E-4 to 1E-6.

- The site is located in a remote area bounded by a chain link fence, thereby limiting access to human receptors.

- Although the Ecological Risk Assessment concluded that chemicals detected at the site could adversely impact terrestrial vegetation, soil invertebrates, and terrestrial vertebrates, no apparent visible impacts to these receptor groups have been observed. In addition, the risk assessment was conservative, such that potential risks to these receptors are over predicted.

- The site is relatively small in size (80 feet in diameter) with minimal soil contamination. Therefore, the total volume of contaminated material is relatively low, and the available surficial area for human and ecological exposure is somewhat limited. The site is also surrounded by large areas not known to be affected by waste disposal.

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TABLE 15-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - PHASE I RI
SITE 14 - OBDANE
NSB-NLON, GROTON, CONNECTICUT

Sample ID	Sample Depth (feet below ground)	Analysis				
		Target Compound List (TCL)			Target Analyte List (TAL)[2]	TCLP[3]
		Volatiles	Semivolatiles	Pesticides/PCBs[1]	Metals (total)	Metals
SOIL						
14SS3C	0-0.5		●[4]	●	●	
14SS4C-D[5]	0-0.5			●		
14SS1S	0-0.5					
14SS1D	1-1.5	●				
14SS2S	0-0.5	●				
14SS2D	1-1.5	●				

1 Polychlorinated Biphenyls.
2 Target Analyte List (TAL) metals, boron, and cyanide.
3 Toxicity Characteristic Leaching Procedure (TCLP) for metals only.
4 ● - Indicates samples analyzed at a fixed-base laboratory.
5 Sample 14SS4C-D is a field duplicate of 14SS3C.

TABLE 15-2

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - PHASE II RI
SITE 14 - OBDANE
NSB-NLON, GROTON, CONNECTICUT

Sample ID	Sample Depth (feet below ground)	Analysis					
		Target Compound List (TCL)			TCLP[2]	TAL Metals[1]	
		Volatiles	Semivolatiles	Pesticides/ PCBs[4]		Total	Dissolved
ROUND 1 - SOIL							
14MW1S-0002	0-2	●[3]	●		●	●	
14MW1S-0204	2-4	●	●		●	●	
14TB1-0002	0-2	●	●			●	
14TB1-0810	8-10	●	●			●	
14TB2A-0002	0-2	●	●			●	
14TB2A-0204	2-4	●	●			●	
14SS3	0-0.5	●	●	●		●	
ROUND 1 - GROUNDWATER							
14GW1S	- -	●	●			●	
ROUND 2 - GROUNDWATER							
14GW1S-2	- -	●	●			●	

1 TAL Metals plus boron and hardness.
2 Toxicity Characteristic Leaching Procedure (TCLP) for metals only.
3 ● - Indicates samples analyzed at a fixed base laboratory.
4 Polychlorinated Biphenyls.

TABLE 15-3

SUMMARY OF POSITIVE SOIL ANALYTICAL RESULTS
OVERBANK DISPOSAL AREA NORTHEAST; NSB-NLON; GROTON, CONNECTICUT

SAMPLE NUMBER:	14MW1S-0002	14MW1S-0204	14SS1D	14SS2D	14SS2S	14SS3	14SS3C-0-6
DEPTH (feet):	0 - 2	2 - 4	1 - 1.5	1 - 1.5	0 - 0.5	0 - 0.5	0 - 0.5
LOCATION:	14MW1S	14MW1S	14SS1D	14SS2D	14SS2S	14SS3	14SS3C
SAMPLE DATE:	02/28/94	02/28/94	11/28/90	11/28/90	11/28/90	12/04/93	11/28/90
INVESTIGATION:	PH2-1	PH2-1	PH1	PH1	PH1	PH2-1	PH1
SAMPLE TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	COMPOSITE
STATUS:							
VOLATILES (UG/KG)							
1,1,2,2-TETRACHLOROETHANE	18 U	15 U	5 U	5 U	6 U	2 J	
1,1,2-TRICHLOROETHANE	18 U	15 U	5 U	5 U	6 U	3 J	
1,1-DICHLOROETHENE	18 U	15 U	5 U	5 U	6 U	2 J	
BENZENE	18 U	15 U	5 U	5 U	6 U	2 J	
BROMODICHLOROMETHANE	18 U	15 U	5 U	5 U	6 U	2 J	
CHLOROMETHANE	18 U	15 U	11 U	11 U	11 U	8 J	
CIS-1,3-DICHLOROPROPENE	18 U	15 U	5 U	5 U	6 U	2 J	
METHYLENE CHLORIDE	18 U	15 U	5 U	5 U	6 U	17 U	
TETRACHLOROETHENE	18 U	15 U	5 U	2 J	6 U	3 J	
TOLUENE	18	15 U	5 U	5 U	6 U	17 U	
XYLENES, TOTAL	18 U	15 U	5 U	5 U	6 U	2 J	
SEMIVOLATILES (UG/KG)							
BENZO(A)ANTHRACENE	36 J	480 U				27 J	3300 U
BENZO(A)PYRENE	43 J	480 U				560 U	3300 U
BENZO(B)FLUORANTHENE	82 J	480 U				560 U	3300 U
BENZO(G,H,I)PERYLENE	600 U	480 U				560 U	3300 U
BENZO(K)FLUORANTHENE	600 U	480 U				560 U	3300 U
BENZOIC ACID	40 J	29 J				64 J	16000 U
CHRYSENE	53 J	480 U				44 J	3300 U
FLUORANTHENE	61 J	480 U				42 J	3300 U
INDENO(1,2,3-CD)PYRENE	600 U	480 U				560 U	3300 U
PHENANTHRENE	37 J	480 U				26 J	3300 U
PYRENE	78 J	480 U				45 J	3300 U
PESTICIDES/PCBs (UG/KG)							
4,4'-DDD						11 J	18 U
4,4'-DDE						74 J	18 U
4,4'-DDT						400 J	18 U
INORGANICS (MG/KG)							
ALUMINUM	18100	13900				13400 J	4360
ANTIMONY	6.5 R	4.6 U				31.0 U	5.8 UR
ARSENIC	10.4	2.0				16.3	1.3

TABLE 15-3
SUMMARY OF POSITIVE SOIL ANALYTICAL RESULTS
OVERBANK DISPOSAL AREA NORTHEAST; NSB-NLON; GROTON, CONNECTICUT

SAMPLE NUMBER:	14MW1S-0002	14MW1S-0204	14SS1D	14SS2D	14SS2S	14SS3	14SS3C-0-6
DEPTH (feet):	0 - 2	2 - 4	1 - 1.5	1 - 1.5	0 - 0.5	0 - 0.5	0 - 0.5
LOCATION:	14MW1S	14MW1S	14SS1D	14SS2D	14SS2S	14SS3	14SS3C
SAMPLE DATE:	02/28/94	02/28/94	11/28/90	11/28/90	11/28/90	12/04/93	11/28/90
INVESTIGATION:	PH2-1	PH2-1	PH1	PH1	PH1	PH2-1	PH1
SAMPLE TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	COMPOSITE
STATUS:							
INORGANICS (MG/KG)							
BARIUM	69.2	21.5				63.2	30.4
BERYLLIUM	0.59 J	0.61 J				0.36	0.25 J
BORON	18.4 U	15.3 U				27.6 J	46.0 R
CADMIUM	0.74 U	0.89 J				0.83 U	1.2
CALCIUM	1950	490				1050	1530
CHROMIUM	61.8	24 0				41.1 J	7.3
COBALT	6.7	4.2				5.7	3.3
COPPER	24.5	6 4				21.8	8.7 J
IRON	38000	8310				31600 J	7320
LEAD	193 U	10.4				403 J	16.0 J
MAGNESIUM	6750	1490				5580	1870
MANGANESE	214	55.1				172 J	199
MERCURY	0 18 U	0.15				0.16 U	0.12 U
NICKEL	18.8	7.4				16.7	6.5
POTASSIUM	3860	632 J				3480	1130 J
SELENIUM	1.1 U	0.92				0.71 UJ	0.52 J
SILVER	0.74 U	0.61				1.4 U	1.6 U
SODIUM	418	231 U				197	57.5 U
VANADIUM	56.3	25.1				49.1	12.9
ZINC	52.8	19.7				44.7	25.5 J

TABLE 15-3
SUMMARY OF POSITIVE SOIL ANALYTICAL RESULTS
OVERBANK DISPOSAL AREA NORTHEAST; NSB-NLON; GROTON, CONNECTICUT

SAMPLE NUMBER:	14SS4C-D	14TB1-0002	14TB1-0810	14TB2A-0002	14TB2A-0204		
DEPTH (feet):	0 - 0.5	0 - 2	8 - 10	0 - 2	2 - 4	-	-
LOCATION:	14SS4C	14TB1	14TB1	14TB2A	14TB2A		
SAMPLE DATE:	11/28/90	02/21/94	02/21/94	03/01/94	03/01/94	/ /	/ /
INVESTIGATION:	PH1	PH2-1	PH2-1	PH2-1	PH2-1		
SAMPLE TYPE:	COMPOSITE	GRAB	GRAB	GRAB	GRAB		
STATUS:							
VOLATILES (UG/KG)							
1,1,2,2-TETRACHLOROETHANE		11 U	11 U	14 U	12 U		
1,1,2-TRICHLOROETHANE		11 U	11 U	14 U	12 U		
1,1-DICHLOROETHENE		11 U	11 U	14 U	12 U		
BENZENE		11 U	11 U	14 U	12 U		
BROMODICHLOROMETHANE		11 U	11 U	14 U	12 U		
CHLOROMETHANE		11 U	11 U	14 U	12 U		
CIS-1,3-DICHLOROPROPENE		11 U	11 U	14 U	12 U		
METHYLENE CHLORIDE		11 U	11 U	14 U	7 J		
TETRACHLOROETHENE		11 U	11 U	14 U	12 U		
TOLUENE		11 U	11 U	14 U	12 U		
XYLENES, TOTAL		11 U	11 U	14 U	12 U		
SEMIVOLATILES (UG/KG)							
BENZO(A)ANTHRACENE		64 J	86 J	450 U	400 U		
BENZO(A)PYRENE		85 J	110 J	450 U	400 U		
BENZO(B)FLUORANTHENE		82 J	97 J	450 U	400 U		
BENZO(G,H,I)PERYLENE		57 J	75 J	450 U	400 U		
BENZO(K)FLUORANTHENE		74 J	93 J	450 U	400 U		
BENZOIC ACID		26 J	1800 UJ	2200 U	1900 U		
CHRYSENE		82 J	110 J	450 U	400 U		
FLUORANTHENE		98 J	100 J	25 J	400 U		
INDENO(1,2,3-CD)PYRENE		60 J	76 J	450 U	400 U		
PHENANTHRENE		39 J	40 J	450 U	400 U		
PYRENE		90 J	90 J	28 J	400 U		
PESTICIDES/PCBs (UG/KG)							
4,4'-DDD	18 U						
4,4'-DDE	18 U						
4,4'-DDT	18 U						
INOR ANICS (MG/KG)							
ALUMINUM		10000	11300	7840	18900		
ANTIMONY		13.7 U	12.6 U	4.9 J	3.7 U		
ARSENIC		2.5	3.2	2.8	2.3		

TABLE 15-3
SUMMARY OF POSITIVE SOIL ANALYTICAL RESULTS
OVERBANK DISPOSAL AREA NORTHEAST; NSB-NLON; GROTON, CONNECTICUT

SAMPLE NUMBER:	14SS4C-D	14TB1-0002	14TB1-0810	14TB2A-0002	14TB2A-0204		
DEPTH (feet):	0 - 0.5	0 - 2	8 - 10	0 - 2	2 - 4	-	-
LOCATION:	14SS4C	14TB1	14TB1	14TB2A	14TB2A		
SAMPLE DATE:	11/28/90	02/21/94	02/21/94	03/01/94	03/01/94	/ /	/ /
INVESTIGATION:	PH1	PH2-1	PH2-1	PH2-1	PH2-1		
SAMPLE TYPE:	COMPOSITE	GRAB	GRAB	GRAB	GRAB		
STATUS:							
INORGANICS (MG/KG)							
BARIUM		84.1	67.2	33.7	13.0		
BERYLLIUM		0.34	0.4	0.6	0.33 J		
BORON		11.7 U	11.2 U	13.5 U	12.2 U		
CADMIUM		0.47 U	0.45 U	0.64 J	0.49 U		
CALCIUM		1450	1140	549	705		
CHROMIUM		15.4	15.5	15.5	10.2		
COBALT		5.9	5.1	4.0	2.6		
COPPER		9 1	11.7	9.7	7.5		
IRON		14200	14600	9540	17500		
LEAD		15 4	9.0	160 U	2.9 U		
MAGNESIUM		4910	4420	1850	1400		
MANGANESE		330 J	260 J	113	75.4		
MERCURY		0.12 U	0.11 U	0.13 U	0.12 U		
NICKEL		11.3	10 4	8.8	7.4		
POTASSIUM		4190	3360	513	491		
SELENIUM		0.7 UJ	0.67 UJ	0.81 U	0.73 U		
SILVER		0.47 U	0.45 U	0.54 U	0.49 U		
SODIUM		202	181	186 U	151 U		
VANADIUM		27.0	27.5	31.3	15.4		
ZINC		45.6	40.3	34.9	13.7		

TABLE 15-4
SUMMARY OF POSITIVE TOXICITY CHARACTERISTIC LEACHING PROCEDURE ANALYTICAL RESULTS
OVERBANK DISPOSAL AREA NORTHEAST; NSB-NLON, GROTON, CONNECTICUT

SAMPLE NUMBER:	14MW1S-0002	14MW1S-0204	14SS1S(0-0 5)	14SS2S			
INVESTIGATION:	PH2-1	PH2-1	PH1	PH1			
SAMPLE DATE:	02/28/94	02/28/94	11/28/90	11/28/90			
LOCATION:	14MW1S	14MW1S	14SS1	14SS2S			
SAMPLE TYPE:	GRAB	GRAB	GRAB	GRAB			
STATUS:							
TCLP METALS (MG/L)*							
BARIUM (100.0/10.0)	0.0357 U	0.0537 U	0.100 J	0.110 J			
CADMIUM (1.0/0.05)	0.0020 UJ	0.0020 UJ	0.0079	0.0050 U			
CHROMIUM (5.0/0.5)	0.0032 J	0.0030 U	0.0500 U	0 0500 U			
LEAD (5.0/0.15)	0.0306	0.0140 UJ	0.300 U	0.300 U			

* Federal Toxicity Characteristic Regulatory Level (58 FR 46049)/Connecticut Remediation Standard P llutant Mobility Criteria f r B waters.

TABLE 15-5
SUMMARY OF SOIL ANALYTICAL RESULTS
SITE 14 - OBDANE
NSB-NLON, GROTON, CONNECTICUT
PAGE 1 OF 2

Analyte	Surface Soils (<2 Feet) (1)			Subsurface Soils (>2 Feet) (2)		
	Frequency of Detection	oncentratio Range	Location of Maximum Detection	Frequency of Detection	oncentratio Range	Location f Maximum Detection
VOLATILE ORGANICS (ug/kg)						
1,1,2,2-Tetrachloroethane	1/7	2	14SS3	0/3	-	ND (3)
1,1,2-Trichloroethane	1/7	3	14SS3	0/3	-	ND
1,1-Dichloroethene	1/7	2	14SS3	0/3	-	ND
Benzene	1/7	2	14SS3	0/3	-	ND
Bromodichloromethane	1/7	2	14SS3	0/3	-	ND
Chloromethane	1/7	8	14SS3	0/3	-	ND
Cis-1,3-dichloropropene	1/7	2	14SS3	0/3	-	ND
Methylene chloride	0/7	-	ND	1/3	7	14TB2A
Tetrachloroethene	2/7	2-3	14SS3	0/3	-	ND
Toluene	1/7	18	14MW1S	0/3	-	ND
Xylenes, total	1/7	2	14SS3	0/3	-	ND
SEMIVOLATILE ORGANICS (ug/kg)						
Benzo(a)anthracene	3/5	27-64	14TB1	1/3	86	14TB1
Benzo(a)pyrene	2/5	43-85	14TB1	1/3	110	14TB1
Benzo(b)fluoranthene	2/5	82	14TB1	1/3	97	14TB1
Benzo(g,h,i)perylene	1/5	57	14TB1	1/3	75	14TB1
Benzo(k)fluoranthene	1/5	74	14TB1	1/3	93	14TB1
Benzoic acid	3/5	26-64	14SS3	1/3	29	14MW1S
Chrysene	3/5	44-82	14TB1	1/3	110	14TB1
Fluoranthene	4/5	25-98	14TB1	1/3	100	14TB1
Indeno(1,2,3-cd)pyrene	1/5	60	14TB1	1/3	76	14TB1
Phenanthrene	3/5	26-39	14TB1	1/3	40	14TB1
Pyrene	4/5	28-90	14TB1	1/3	90	14TB1
PESTICIDES/PCBs (ug/kg)						
4,4'-DDD	1/2	11	14SS3	-	-	NA (4)
4,4'-DDE	1/2	74	14SS3	-	-	NA
4,4'-DDT	1/2	400	14SS3	-	-	NA
INORGANICS (mg/kg)						
Aluminum	5/5	4360-18100	14MW1S	3/3	11300-18900	14TB2A
Antimony	1/3	4.9	14TB2A	0/3	-	ND
Arsenic	5/5	1.3-16.3	14SS3	3/3	2-3.2	14TB1
Barium	5/5	30.4-84.1	14TB1	3/3	13-67.2	14TB1
Beryllium	5/5	0.25-0.6	14TB2A	3/3	0.33-0.61	14MW1S
Boron	1/4	27.6	14SS3	0/3	-	ND
Cadmium	2/5	0.64-1.2	14SS3C	1/3	0.89	14MW1S
Calcium	5/5	549-1950	14MW1S	3/3	490-1140	14TB1
Chromium	5/5	7.3-61.8	14MW1S	3/3	10.2-24	14MW1S
Cobalt	5/5	3.3-6.7	14MW1S	3/3	2.6-5.1	14TB1
Copper	5/5	8.7-24.5	14MW1S	3/3	6.4-11.7	14TB1
Iron	5/5	7320-38000	14MW1S	3/3	8310-17500	14TB2A
Lead	3/5	15.4-403	14SS3	2/3	9-10.4	14MW1S
Magnesium	5/5	1850-6750	14MW1S	3/3	1400-4420	14TB1
Manganese	5/5	113-330	14TB1	3/3	55.1-260	14TB1

TABLE 15-5
SUMMARY OF SOIL ANALYTICAL RESULTS
SITE 14 - OBDANE
NSB-NLON, GROTON, CONNECTICUT
PAGE 2 OF 2

Analyte	Surface Soils (<2 Feet) (1)			Subsurface Soils (>2 Feet) (2)		
	Frequency of Detection	Concentration Range	Location of Maximum Detection	Frequency of Detection	Concentration Range	Location of Maximum Detection
Zinc	5/5	25.5-52.8	14MW1S	3/3	13.7-40.3	14TB1
TCLP (mg/L)						
Barium (100.0/10) (5)	2/3	0.10-0.11	14SS2S	0/1	-	ND
Cadmium (1.0/0.05)	1/3	0.0079	14SS1	0/1	-	ND
Chromium (5.0/0.5)	1/3	0.0032	14MW1S	0/1	-	ND
Lead (5.0/0.15)	1/3	0.0306	14MW1S	0/1	-	ND

1 Includes samples 14MW1S-0002, 14SS1D, 14SS2D, 14SS2S, 14SS3, 14SS3C, 14SS4C-D (field duplicate of 14SS3C), 14TB-0002, and 14TB2A-0002.
2 Includes samples 14MW1S-0204, 14TB1-0810, and 14TB2A-0204.
3 Not Detected.
4 Not Analyzed.
5 Values in parentheses represent Federal Toxicity Characteristic Regulatory Level (58FR46049)/Connecticut Clean-Up Standard Pollutant Mobility Criteria for GB Waters.

TABLE 15-6
SUMMARY OF POSITIVE GROUNDWATER ANALYTICAL RESULTS
OVERBANK DISPOSAL AREA NORTHEAST; NSB-NLON, GROTON, CONNECTICUT

SAMPLE NUMBER:	14GW1S	14GW1S	14GW1S-2	14GW1S2			
INVESTIGATION:	PH2-1	PH2-1	PH2-2	PH2-2			
SAMPLE DATE:	03/21/94	03/21/94	07/10/94	07/10/94	/ /	/ /	/ /
LOCATION:	14MW1S	14MW1S	14MW1S	14MW1S			
SCREEN DEPTH:	Shallow	Shallow	Shallow	Shallow			
FILTERING:	Unfiltered	Filtered	Unfiltered	Filtered			
VOLATILES (UG/L)							
CARBON DISULFIDE	1 J		10 U				
SEMIVOLATILES (UG/L)							
BIS(2-ETHYLHEXYL)PHTHALATE	10 U		1 J				
INORGANICS (UG/L)							
ALUMINUM	171	64.5 U	66.0 U	51.1 U			
ARSENIC	2.0 U	2.1	5.0 UJ	5.0 U			
BARIUM	39.3	37.9	35.5	35.1			
BORON	89.3 J	99.8 J	130	120			
CALCIUM	6600	6730	4190	4430			
COBALT	22.6 U	18.2 U	7.0	5.9 U			
IRON	2260	2040	4430	4680 J			
LEAD	2.0 U	2.0 UJ	2.0 UJ	2.2 J			
MAGNESIUM	3700	3600	2780	2820			
MANGANESE	770	779	458	476			
POTASSIUM	4460	4510	4080	4390			
SODIUM	43800	44000	45800	47400			
VANADIUM	5.0 U	6.9	3.0 U	1.0 U			
ZINC	9.1	6.5	9.1 U	12.6 U			
MISCELLANEOUS PARAMETERS (MG/L)							
HARDNESS as CaCO3	32		24				

TABLE 15-7

CHEMICALS OF CONCERN AND EXPOSURE CONCENTRATIONS
SITE 14 - OBDANE
NSB-NLON, GROTON, CONNECTICUT

Chemical of Concern	Exposure Concentration[1]		
	Surface Soil (mg/kg)	All Soil (mg/kg)	Groundwater (mg/L)
Benzo(a)pyrene	NA[2]	0.11[3]	NA
Antimony	4.9[3]	4.9[3]	NA
Arsenic	8.0/16.3	5.6/16.3	0.0021[3]
Beryllium	0.47/0.60	0.46/0.61	NA
Chromium	33.5/61.8	26.2/61.8	NA
Lead	149/403	88.0/403	NA
Manganese	207/330	174/330	0.614
Vanadium	40.9/56.3	33.1/56.3	NA

1 Average concentration for groundwater. Average and maximum detections for soil.
2 NA - Not applicable. Chemical is not a chemical of concern for this medium.
3 Maximum for dissolved fraction. Average exceeds maximum. Chemical not detected in unfiltered samples.

TABLE 15-8

ESTIMATED RISKS[1]
SITE 14 - OBDANE
NSB-NLON, GROTON, CONNECTICUT

Exposure Route	Hazard Index				Incremental Cancer Risk			
	Construction Worker		Older Child Trespasser		Construction Worker		Older Child Trespasser	
	RME[2]	CTE[3]	RME	CTE	RME	CTE	RME	CTE
Incidental Ingestion of Soil	2.1E-1	1.8E-2	7.0E-2	4.8E-3	9.0E-7	6.0E-8	3.0E-6	5.0E-8
Dermal Contact with Groundwater	1.2E-1	8.2E-2	NA[4]	NA	6.4E-9	4.3E-9	NA	NA
Cumulative Risk:	**3.3E-1**	**1.0E-1**	**7.0E-2**	**4.8E-3**	**9.1E-7**	**6.4E-8**	**3.0E-6**	**5.0E-8**

1 Chemical-specific risks presented in Appendix F.14.
2 RME - Reasonable Maximum Exposure.
3 CTE - Central Tendency Exposure.
4 NA - Not Applicable; exposure route not evaluated for this receptor.

TABLE 15-9

ECOLOGICAL CHEMICALS OF CONCERN
SITE 14 - OBDANE
NSB-NLON, GROTON, CONNECTICUT

Chemical of Concern	Terrestrial Vegetation[1,2]		Soil Invertebrates		Short-Tailed Shrew		Barred Owl	
	MAX	MEAN	MAX	MEAN	MAX	MEAN	MAX	MEAN
4,4'-DDE	NA[1]	NA	NA	NA	NA	NA	X[2]	X
4,4'-DDT	NA	NA	NA	NA	NA	NA	X	X
Aluminum	NA	NA	NA	NA	X	NA	X	NA
Antimony	NA	NA	NA	NA	X	X	X	X
Arsenic	X	NA	NA	NA	X	X	NA	NA
Barium	NA	NA	NA	NA	X	X	NA	NA
Boron	X	X	NA	NA	X	NA	NA	NA
Cadmium	NA	NA	NA	NA	X	X	NA	NA
Chromium	X	X	X	X	X	X	NA	NA
Lead	X	X	X	X	X	X	NA	NA
Manganese	NA	NA	NA	NA	X	X	NA	NA
Vanadium	X	X	NA	NA	X	X	NA	NA
Zinc	X	NA	NA	NA	NA	NA	NA	NA

Notes 1) NA - Not applicable. Chemical is not chemical of concern for this receptor.
2) X - Chemical of concern for this receptor.

TABLE 15-10

HAZARD QUOTIENTS FOR TERRESTRIAL VEGETATION
BASED ON MAXIMUM CONCENTRATIONS
SITE 14 - OBDANE
NSB-NLON, GROTON, CONNECTICUT

Chemical of Concern	Hazard Quotient
Aluminum	3.6E+2
Chromium	6.2E+1
Boron	5.5E+1
Vanadium	2.8E+1
Lead	8.1E+0
Arsenic	1.6E+0
Zinc	1.1E+0

TABLE 15-11

HAZARD QUOTIENTS FOR TERRESTRIAL VEGETATION
BASED ON MEAN CONCENTRATIONS
SITE 14 - OBDANE
NSB-NLON, GROTON, CONNECTICUT

Chemical of Concern	Hazard Quotient
Chromium	3.3E+1
Boron	2.5E+1
Vanadium	2.0E+1
Lead	3.0E+0

TABLE 15-12

HAZARD QUOTIENTS FOR SOIL INVERTEBRATES
BASED ON MAXIMUM CONCENTRATIONS
SITE 14 - OBDANE
NSB-NLON, GROTON, CONNECTICUT

Chemical of Concern	Hazard Quotient
Lead	6.8E+0
Chromium	2.5E+0

TABLE 15-13

HAZARD QUOTIENTS FOR SOIL INVERTEBRATES
BASED ON MEAN CONCENTRATIONS
SITE 14 - OBDANE
NSB-NLON, GROTON, CONNECTICUT

Chemical of Concern	Hazard Quotient
Lead	2.5E+0
Chromium	1.3E+0

TABLE 15-14

MAJOR CONTRIBUTORS TO RISK FOR TERRESTRIAL VERTEBRATES
BASED ON MAXIMUM CONCENTRATIONS
SITE 14 - OBDANE
NSB-NLON, GROTON, CONNECTICUT

Receptor	Chemical of Concern	Total HI per COC for all Pathways	% Contribution of COC to Total Receptor HI
Short-Tailed Shrew	Aluminum	3.2E+2	44.9
	Vanadium	1.2E+2	16.6
	Antimony	8.8E+1	12.1
	Chromium	6.0E+1	8.3
	All others	1.3E+2	18.1
	Total Receptor HI	7.2E+2	
	Pathway	**Total HI per Pathway**	**% Contribution of Pathway to Total Receptor HI**
	Soil	4.2E+2	58.8
	Food	3.0E+2	41.2
	Water	0.0E+0	0.0
	Chemical of Concern	**Total HI per COC for all Pathways**	**% Contribution of COC to Total Receptor HI**
Barred Owl	4,4'-DDT	1.8E+1	68.9
	4,4'-DDE	3.2E+0	12.8
	Antimony	1.4E+0	5.3
	Aluminum	1.1E+0	4.5
	All others	2.2E+1	8.5
	Total Receptor HI	2.5E+1	
	Pathway	**Total HI per Pathway**	**% Contribution of Pathway to Total Receptor HI**
	Soil	9.8E+0	38.6
	Food	1.6E+1	61.4
	Water	0.0E+0	0.0

TABLE 15-15

MAJOR CONTRIBUTORS TO RISK FOR TERRESTRIAL VERTEBRATES
BASED ON MEAN CONCENTRATIONS
SITE 14 - OBDANE
NSB-NLON, GROTON, CONNECTICUT

R ceptor	Chemical of Concern	Total HI per COC for all Pathways	% Contribution of COC to Total Receptor HI
Short-Tailed Shrew	Antimony	8.8E+1	32.4
	Vanadium	8.7E+1	32.3
	Chromium	3.3E+1	12.0
	Arsenic	2.8E+1	10.5
	All others	3.5E+1	12.8
	Total Receptor HI	2.7E+2	
	Pathway	**Total HI per Pathway**	**% Contribution of Pathway to Total Receptor HI**
	Soil	1.6E+2	58.8
	Food	1.1E+2	41.2
	Water	0.0E+0	0.0
	Chemical of Concern	**Total HI per COC for all Pathways**	**% Contribution of COC to Total Receptor HI**
Barred Owl	4,4'-DDT	1.8E+1	74.6
	4,4'-DDE	3.2E+0	13.8
	Antimony	1.4E+0	5.8
	4,4'-DDD	4.8E-1	2.1
	All others	9.0E-1	3.8
	Total Receptor HI	2.4E+1	
	Pathway	**Total HI per Pathway**	**% Contribution of Pathway to Total Receptor HI**
	Soil	8.0E+0	33.9
	Food	1.6E+1	66.1
	Water	0.0E+0	0.0

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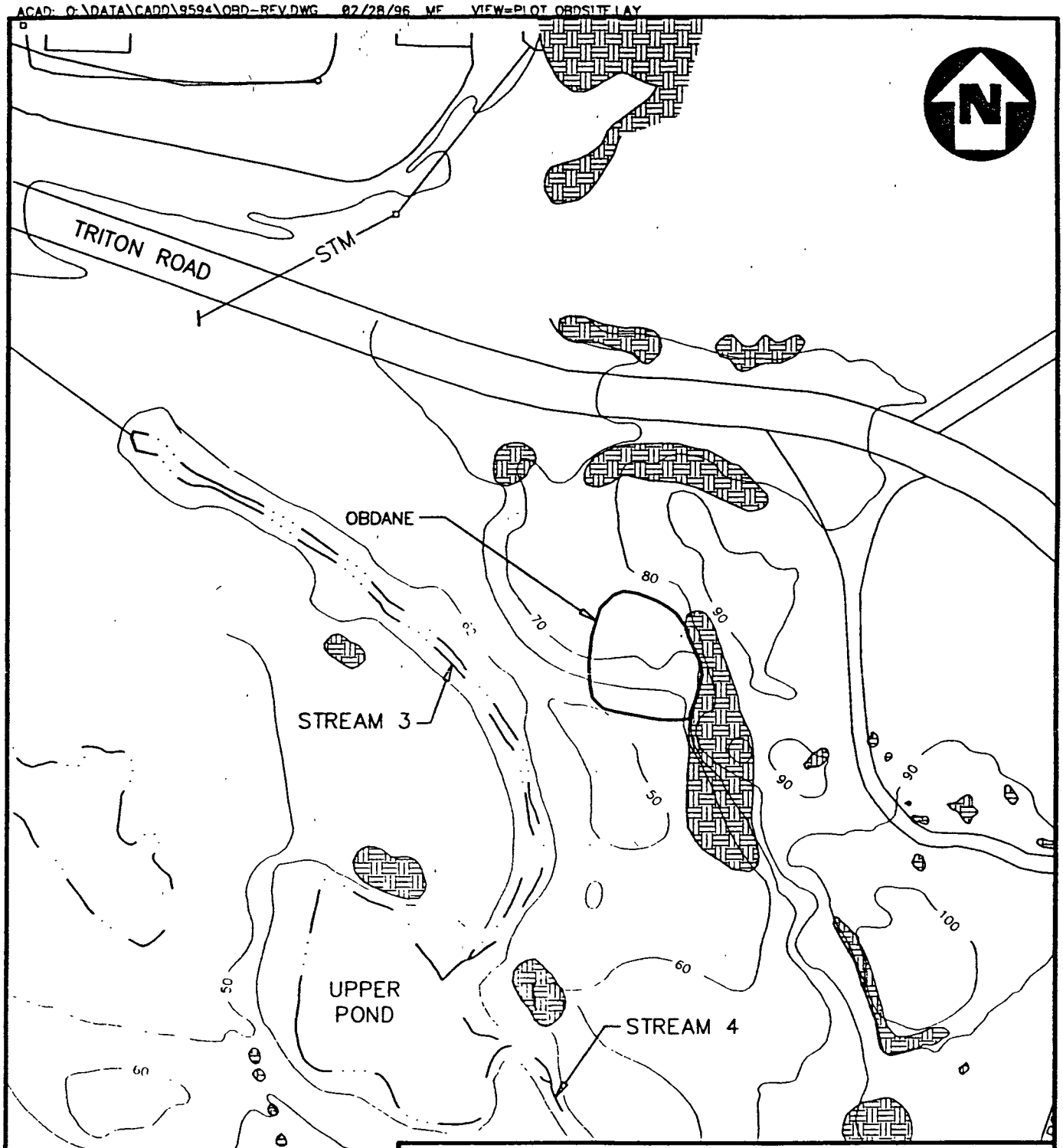


FIGURE 15-1
GENERAL SITE ARRANGEMENT
OBDANE

Brown & Root Environmental

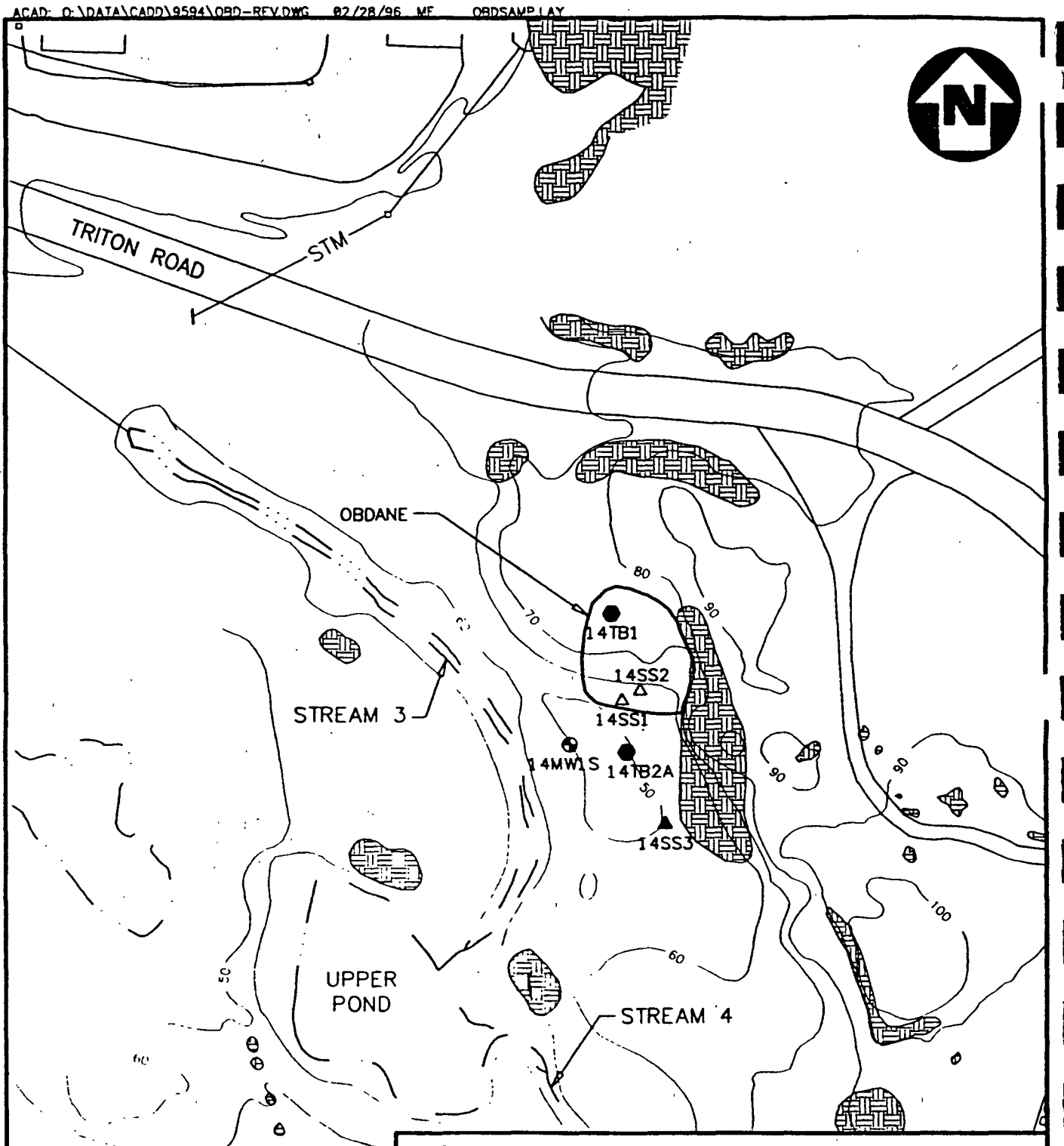
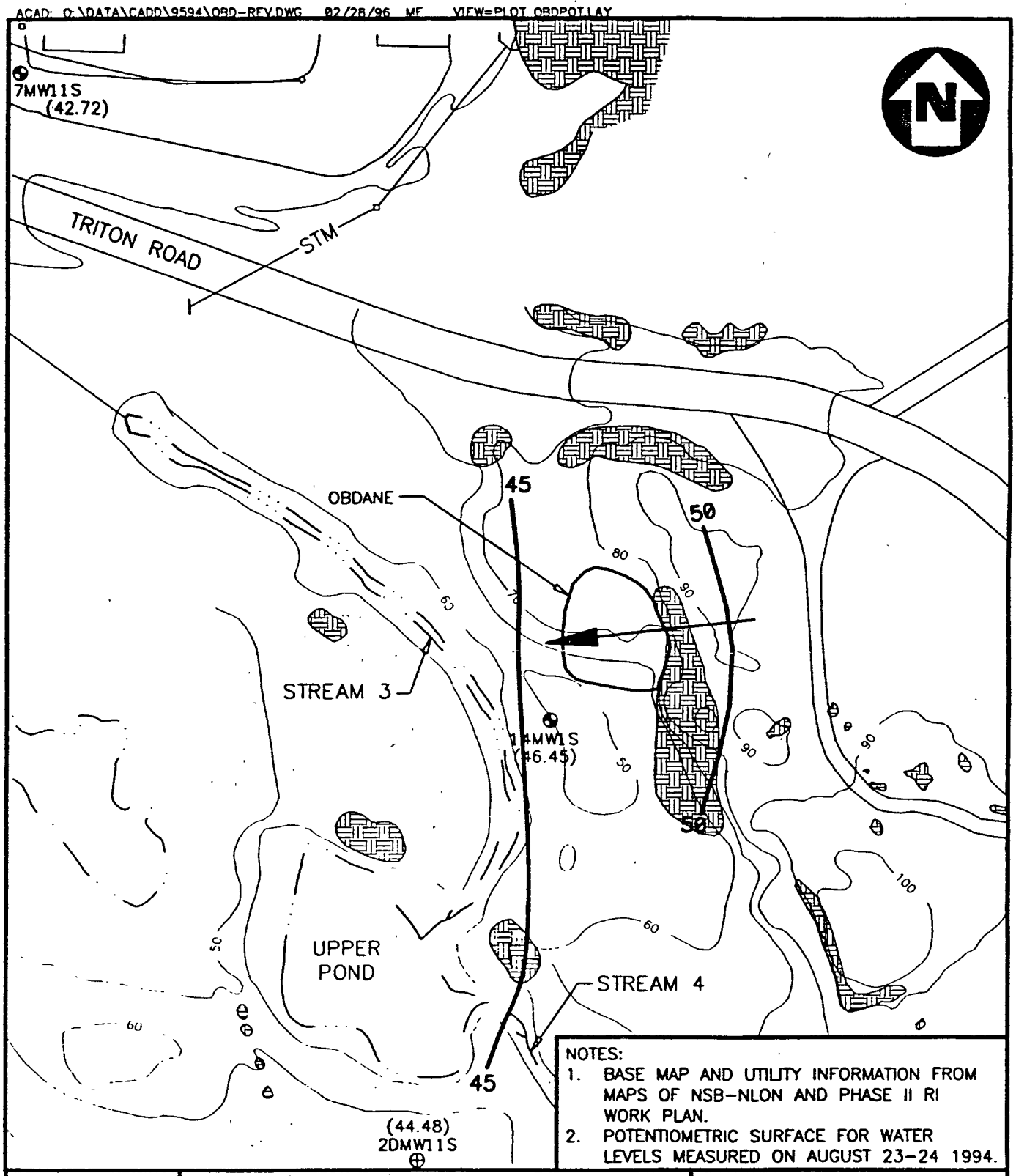


FIGURE 15-2
SAMPLING LOCATIONS
OBDANE

Brown & Root Environmental



NOTES:
1. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON AND PHASE II RI WORK PLAN.
2. POTENTIOMETRIC SURFACE FOR WATER LEVELS MEASURED ON AUGUST 23-24 1994.

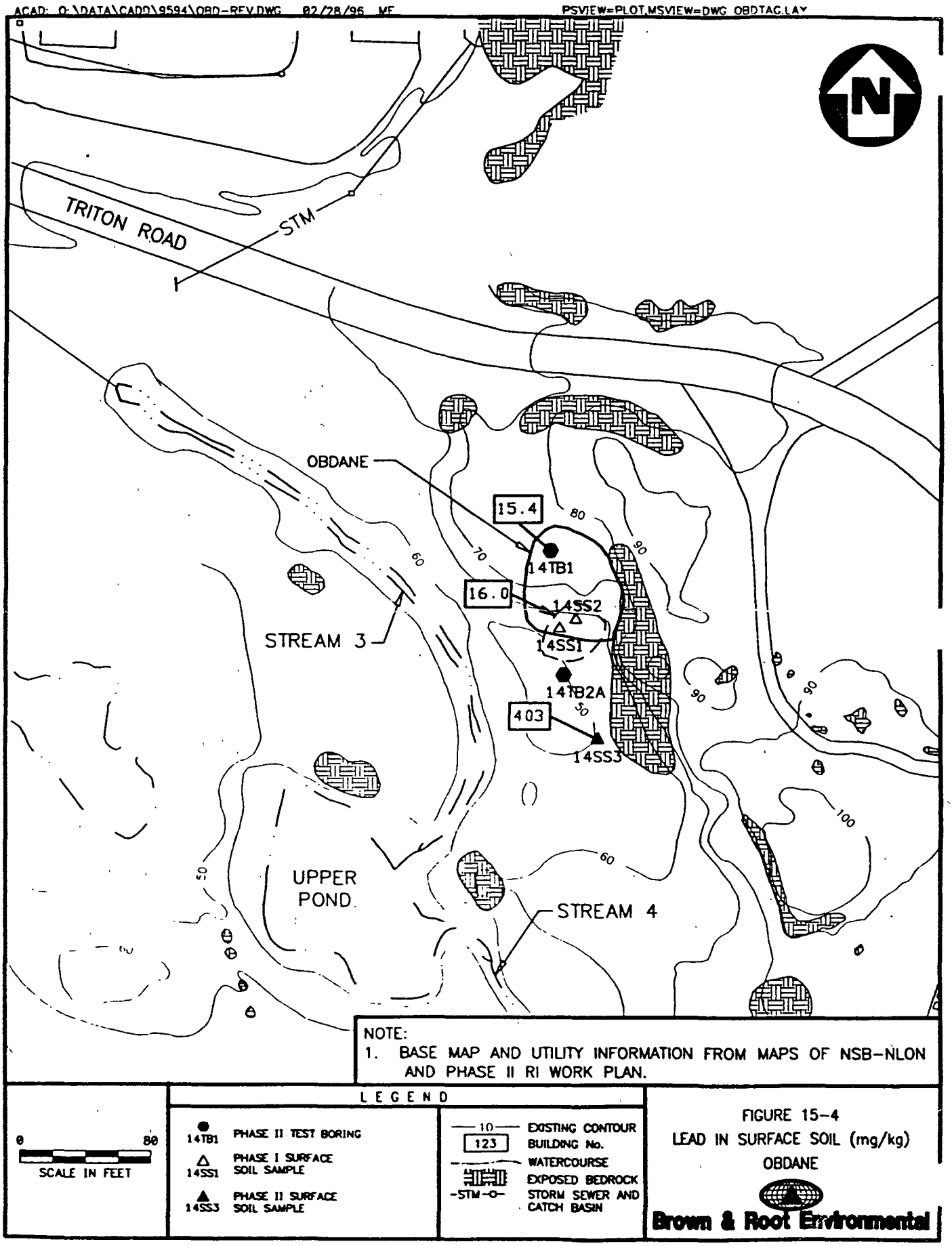
LEGEND

2DMW11S	PHASE I MONITORING WELL
14MW1S	PHASE II MONITORING WELL
80	POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)
	GROUNDWATER FLOW DIRECTION
(80.45)	GROUNDWATER ELEVATION (ft MSL)
10	EXISTING CONTOUR
123	BUILDING No.
	WATERCOURSE
	EXPOSED BEDROCK
-STM-o-	STORM SEWER AND CATCH BASIN

0 80
SCALE IN FEET

FIGURE 15-3
SHALLOW OVERBURDEN
POTENTIOMETRIC SURFACE MAP
OBDANE

Brown & Root Environmental


ACAD: O:\DATA\CADD\9594\OBD-REV.DWG 02/28/96 MF
PSVIEW=PLOT,MSVIEW=DWG OBDTAG.LAY
N
TRITON ROAD
STM
OBDANE
15.4
16.0
403
14TB1
14TB2A
14SS1
14SS2
14SS3
STREAM 3
STREAM 4
UPPER POND
60
70
80
90
100
50
NOTE:
1. BASE MAP AND UTILITY INFORMATION FROM MAPS OF NSB-NLON AND PHASE II RI WORK PLAN.
0
80
SCALE IN FEET
LEGEND
14TB1 PHASE II TEST BORING
14SS1 PHASE I SURFACE SOIL SAMPLE
14SS3 PHASE II SURFACE SOIL SAMPLE
10 EXISTING CONTOUR
123 BUILDING No.
WATERCOURSE
EXPOSED BEDROCK
-STM-O- STORM SEWER AND CATCH BASIN
FIGURE 15-4
LEAD IN SURFACE SOIL (mg/kg)
OBDANE
Brown & Root Environmental

CONTRACTOR DRAWINGS & INFORMATION SUBMITTAL
NORTHNAVFACENGCOM 4335/3 (Rev 6/80)

Prepare in duplicate (original and 2 copies)
CONTROL NO. 26

CONTRACT NO :	DELIVERY ORDER NO	ACTIVITY LOCATION:
N62472-94-D-0398	D.O. D024, Modification 11	SUBASE NLON, Groton, CT

Project Title:
Area A Downstream / OBDA Remediation

FROM:	DATE
Foster Wheeler Environmental Corp. SQCM: Tom Fowler	10/4/00
TO:	DATE:
NTR Art Coccoli (1 Copy)	10/4/00

1. THE CONTRACTOR SUBMITTALS LISTED BELOW ARE FORWARDED FOR YOUR:

[ ] APPROVAL, APPLY APPROPRIATE STAMP IMPRINT TO EACH SUBMITTAL, RETAIN ONE (1) COPY OF THIS TRANSMITTAL FORM.

[ ] REVIEW & COMMENT, RETURN REVIEWED COMMENT COPIES.

[X] INFORMATION ONLY.

2. SUBMITTALS SHOULD BE RETURNED BY: (DATE) _____ [X] NO RETURN REQUIRED

RETURN TO: [ ] ROICC [ ] FOSTER WHEELER ENVIRONMENTAL [ ] OTHER _____

3. APPROVAL REQUIRED BY: [ ] NORTHDIV [ ] ROICC [ ] A/E [ ] OTHER _____

COPY TO.

[X] ROICC [ ] DESIGNER [X] OTHER
R. Umashankar (1 Copy) M. Miller (Cover Sheet Only)

10/4/00
SIGNATURE AND DATE

FROM	DATE:
TO:	DATE:

1. THESE SUBMITTALS LISTED BELOW HAVE BEEN REVIEWED AND ARE RETURNED, WITH ACTION TAKEN AS INDICATED

2 _____

COPY TO.

[ ] ROICC [ ] DESIGNER [ ] OTHER

SIGNATURE AND DATE

FROM	DATE
TO:	DATE

1 THE SUBMITTALS LISTED BELOW HAVE BEEN REVIEWED AND ARE APPROVED/DISAPPROVED AS SHOWN BELOW AND ON EACH STAMP IMPRINT.

COPY TO

[ ] CONTRACTOR - FOSTER WHEELER ENVIRONMENTAL [ ] OTHER _____

FOR COMMANDING OFFICER, NORTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
DATE

ITEM NO	SUBMITTAL DESCRIPTION	PREPARED/SUBMITTED BY	APPROVED	DISAPPROVED	REMARKS
1	SD-10, Test Reports OBDANE Waste Characterization Test Results	T. Fowler			

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Memorandum

TO: Art Coccoli, Northern Division

CC: Mark Evans, Northern Division
Bob Umashankar, ROICC
Darlene Ward, SUBASENLON Environmental
Dick Conant, SUBASENLON Environmental

FROM: Larry Kahrs, Delivery Order Manager

DATE: October 4, 2000

SUBJECT: NORTHERN DIVISION RAC N62742-94-D-0398, D.O. NO. 0024
AREA A DOWNSTREAM/OBDA REMEDIATION
OBDA NORTHEAST (OBDANE) WASTE CHARACTERIZATION RESULTS

Please find attached analytical data for the waste characterization of soil from the OBDANE site. Note that none of the compounds exceeded their respective RCRA Characteristic criteria. Please do not hesitate to contact me at (617) 457-8243 if you have any questions or comments.

Attachment

CLIENT SAMPLE #

INORGANIC ANALYSIS DATA SHEET

OBDANE

Lab Name: CHEMTECH CONSULTING GROUP Contract:

Lab Code: CHEMED Case No.: SAS No.: SDG No.: L1382T

Matrix (soil/water): SOIL Lab Sample ID: 1382-01TS

Level (low/med): LOW Date Received: 09/19/00

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7440-38-2	Arsenic	73.4	B		P
7439-92-1	Lead	130			P
7440-39-3	Barium	136	B		P
7440-43-9	Cadmium	4.0	U		P
7439-97-6	Mercury	1.2	B		CV
7782-49-2	Selenium	22.0	U		P
7440-22-4	Silver	6.0	U		P
7440-47-3	Chromium	44.6	B		P

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

TCLPEXTRACT

Prepare in duplicate (original and 2 copies)

CONTRACTOR DRAWINGS & INFORMATION SUBMITTAL
NORTHNAVFACENGCOM 4335/3 (Rev. 6/80)

CONTROL NO. 26A

CONTRACT NO.:	DELIVERY ORDER NO.:	ACTIVITY LOCATION:
N62472-94-D-0398	D.O. D024, Modification 11	SUBASE NLON, Groton, CT

Project Title:
Area A Downstream / OBDA Remediation

FROM:	DATE:
Foster Wheeler Environmental Corp. SQCM: Tom Fowler	11/15/00
TO:	DATE:
NTR Art Coccoli (1 Copy)	11/15/00

1. THE CONTRACTOR SUBMITTALS LISTED BELOW ARE FORWARDED FOR YOUR:

[ ] APPROVAL, APPLY APPROPRIATE STAMP IMPRINT TO EACH SUBMITTAL, RETAIN ONE (1) COPY OF THIS TRANSMITTAL FORM.

[ ] REVIEW & COMMENT, RETURN REVIEWED COMMENT COPIES.

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2. SUBMITTALS SHOULD BE RETURNED BY: (DATE) _____ [X] NO RETURN REQUIRED

RETURN TO: [ ] ROICC [ ] FOSTER WHEELER ENVIRONMENTAL [ ] OTHER _____

3. APPROVAL REQUIRED BY: [ ] NORTHDIV [ ] ROICC [ ] A/E [ ] OTHER _____

COPY TO:

[X] ROICC [ ] DESIGNER [X] OTHER
R. Umashankar (1 Copy) M. Miller (Cover Sheet Only)
D. Conant (1 Copy)

11/15/00
SIGNATURE AND DATE

FROM:	DATE:
TO:	DATE:

1. THESE SUBMITTALS LISTED BELOW HAVE BEEN REVIEWED AND ARE RETURNED, WITH ACTION TAKEN AS INDICATED.

2. _____

_____

COPY TO:

[ ] ROICC [ ] DESIGNER [ ] OTHER

SIGNATURE AND DATE

FROM:	DATE.
TO:	DATE:

1. THE SUBMITTALS LISTED BELOW HAVE BEEN REVIEWED AND ARE APPROVED/DISAPPROVED AS SHOWN BELOW AND ON EACH STAMP IMPRINT.

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[ ] CONTRACTOR - FOSTER WHEELER ENVIRONMENTAL [ ] OTHER

FOR COMMANDING OFFICER, NORTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND

DATE

ITEM NO.	SUBMITTAL DESCRIPTION	PREPARED/SUBMITTED BY	APPROVED	DISAPPROVED	REMARKS
1	SD-10, Test Reports Additional OBDANE Waste Characterization Test Results	T. Fowler			

CHEMTECH 205 Campus Plaza 1 • Edison, NJ 08837 Phone: 732.225.4111 Fax: 732.225.4110

ANALYTICAL RESULTS SUMMARY

PROJECT NAME: OBDA

FOSTER WHEELER ENVIRONMENTAL
133 FEDERAL STREET
BOSTON, MA 02110
617-457-8243

CHEMTECH PROJECT#: L1947RQ
ATTENTION: LARRY KAHRS

Since 1967

1A

TCLP VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

OBDA-NE-WC-1

Lab Name: CHEMTECH Contract: FOSTER WHEELER ENVIRONMENTAL

Project No.: L1947 Site: OBDA Location: GROTON,CT Group: 5970-VOA

Matrix: (soil/water) WATER Lab Sample ID: O02

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: A7166.D

Level: (low/med) Date Received: 10/28/00

% Moisture: not dec. 100 Date Analyzed: 10/31/00

GC Column: DB624 ID: 0.53 (mm) Dilution Factor: 5.0

Soil Extract Volume: (uL) Soil Aliquot Volume: (uL)

CAS No.	Compound	Concentration Units: (ug/L or ug/Kg) ug/L	Q
75-01-4	Vinyl Chloride	25	U
75-35-4	1,1-Dichloroethene	25	U
67-66-3	Chloroform	25	U
56-23-5	Carbon Tetrachloride	25	U
71-43-2	Benzene	25	U
107-06-2	1,2-Dichloroethane	25	U
79-01-6	Trichloroethene	25	U
127-18-4	Tetrachloroethene	25	U
108-90-7	Chlorobenzene	25	U
78-93-3	2-Butanone	25	U

1A

TCLP VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

OBDA-NE-WC-2

Lab Name: CHEMTECH Contract: FOSTER WHEELER ENVIRONMENTAL

Project No.: L1947 Site: OBDA Location: GROTON,CT Group: 5970-VOA

Matrix: (soil/water) WATER Lab Sample ID: O03

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: A7167.D

Level: (low/med) Date Received: 10/28/00

% Moisture: not dec. 100 Date Analyzed: 10/31/00

GC Column: DB624 ID: 0.53 (mm) Dilution Factor: 5.0

Soil Extract Volume: (uL) Soil Aliquot Volume: (uL)

CAS No.	Compound	Concentration Units: (ug/L or ug/Kg) ug/L	Q
75-01-4	Vinyl Chloride	25	U
75-35-4	1,1-Dichloroethene	25	U
67-66-3	Chloroform	25	U
56-23-5	Carbon Tetrachloride	25	U
71-43-2	Benzene	25	U
107-06-2	1,2-Dichloroethane	25	U
79-01-6	Trichloroethene	25	U
127-18-4	Tetrachloroethene	25	U
108-90-7	Chlorobenzene	25	U
78-93-3	2-Butanone	25	U

1A

TCLP VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

OBDA-NE-WC-3

Lab Name: CHEMTECH Contract: FOSTER WHEELER ENVIRONMENTAL

Project No.: L1947 Site: OBDA Location: GROTON,CT Group: 5970-VOA

Matrix: (soil/water) WATER Lab Sample ID: O04

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: A7168.D

Level: (low/med) _____ Date Received: 10/28/00

% Moisture: not dec. 100 Date Analyzed: 10/31/00

GC Column: DB624 ID: 0.53 (mm) Dilution Factor: 5.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS No.	Compound	Concentration Units: (ug/L or ug/Kg) ug/L	Q
75-01-4	Vinyl Chloride	25	U
75-35-4	1,1-Dichloroethene	25	U
67-66-3	Chloroform	25	U
56-23-5	Carbon Tetrachloride	25	U
71-43-2	Benzene	25	U
107-06-2	1,2-Dichloroethane	25	U
79-01-6	Trichloroethene	25	U
127-18-4	Tetrachloroethene	25	U
108-90-7	Chlorobenzene	25	U
78-93-3	2-Butanone	25	U

1B

TCLP SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

OBDA-NE-WC-C

Lab Name: CHEMTECH Contract: FOSTER WHEELER

Project No.: L1947 Site: AREA A OBD Location: GROTON CT Group: OBDA-NE-W

Matrix: (soil/water) WATER Lab Sample ID: 001

Sample wt/vol: 500.0 (g/mL) ML Lab File ID: BK110616.D

Level: (low/med) Date Received: 10/28/00

% Moisture: 100 decanted: (Y/N): N Date Extracted: 10/31/00

Concentrated Extract Volume: 500 (uL) Date Analyzed: 11/6/00

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CAS No.	Compound	Concentration Units: (ug/L or ug/Kg) ug/L	Q
110-86-1	Pyridine	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
67-72-1	Hexachloroethane	10	U
65794-96-9	3+4-Methylphenols	20	U
98-95-3	Nitrobenzene	10	U
87-68-3	Hexachlorobutadiene	10	U
95-95-4	2,4,5-Trichlorophenol	10	U
88-06-2	2,4,6-Trichlorophenol	10	U
121-14-2	2,4-Dinitrotoluene	10	U
118-74-1	Hexachlorobenzene	10	U
87-86-5	Pentachlorophenol	10	U

CHEMTECH, 205 Campus Plaza 1, Edison, NJ, 08837, Tel (732)225-4111 Fax (732)225-4110

Tabulated Analytical Report
HERBICIDES

Project Name:	**O B D A**	**MATRIX:**	**LEACHATE**
Client:	**FOSTER WHEELER ENVIRONMENTAL**	**Batch:**	**PB 102600-02**
Client ID:	**OBDA-NE-WC-C**	**Date extracted:**	**10/31/00**
Lab ID:	**1947-01 TH**	**Date Analyzed:**	**11/3/00**
Filename:	**3HB10408.D**	**Dilution:**	**1**
Lab Project No:	**L1947RQ**	**Analyst:**	**AA**

COMPOUNDS	RESULTS(ug/L)	QUALIFIER	MDL(ug/L)
2,4-D	U		2.0
2,4,5-TP (Silvex)	U		2.0

MDL = METHOD DETECTION LIMIT
U =UNDETECTED BELOW THE MDL
B = PRESENT IN THE ASSOCIATED BLANK
E = EXCEEDED CALIBRATION RANGE, DILUTION TO FOLLOW
D = DILUTION
....

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Tabulat d Analytical R port
PESTICIDES

Project Name: O B D A
MATRIX: LEACHATE
Client: FOSTER WHEELER ENVIRONMENTAL
Date extracted: 10/31/00
Client ID: OBDA-NE-WC-C
Batch: PB 102600-03
Lab ID: 1947-01 TP
Date Analyzed: 11/1/00
Filename: 1PS6365.D
Dilution: 1
Lab Project No: L1947RQ
Analyst: AA

CAS #	COMPOUNDS	RESULTS(ug/L) PRIMARY	RESULTS(ug/L) CONFIRMATION	Q	MDL MDL(ug/L)
58-89-9	gamma-BHC (Lindane)	U	U		1.0
76-44-8	Heptachlor	U	U		1.0
1024-57-3	Heptachlor epoxide	U	U		1.0
72-20-8	Endrin	U	U		1.0
72-43-5	Methoxychlor	U	U		1.0
8001-35-2	Toxaphene	U	U		10
57-74-9	Chlordane	U	U		10

MDL = METHOD DETECTION LIMIT
U =UNDETECTED BELOW THE MDL
B = PRESENT IN THE ASSOCIATED BLANK
E = EXCEEDED CALIBRATION RANGE, DILUTION TO FOLLOW
D = DILUTION