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# EPA Superfund
# Record of Decision:

**NEW LONDON SUBMARINE BASE**
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**NEW LONDON, CT**
**03/31/1998**

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**RECORD OF DECISION**
**FOR**
**SOIL AND SEDIMENT**
**AREA A DOWNSTREAM WATER**
**COURSES/OVERBANK DISPOSAL AREA**

**NAVAL SUBMARINE BASE NEW LONDON**
**GROTON, CONNECTICUT**

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Northern Division
Environmental Branch Code 18
Naval Facilities Engineering Command
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# GLOSSARY

ARARs - Applicable or relevant and appropriate requirements of all state and federal laws for particular conditions or cleanup options at a site.

Bench-scale Treatability Study - A scientific and engineering experiment that is conducted in a laboratory with samples of contaminated media from the site to find out: (1) how to remove the contaminants and (2) how to improve the physical nature of the material (such as removal of excess water) for implementing the remedy.

CERCLA - The Comprehensive Environmental Response, Compensation, and Liability Act is a federal law passed in 1980 and amended by Congress by the Superfund Amendments and Reauthorization Act of 1986. The law established a national trust fund (known as Superfund) to investigate and remediate abandoned or uncontrolled hazardous waste sites.

Contaminant - Any physical, chemical, biological, or radiological substance or matter that, at certain levels, could have an adverse effect on human health or the environment.

FS - The Feasibility Study (FS) is the development and analysis of potential remedial alternatives that address all operable units, or environmental media at a site. The technologies evaluated for development of remedial alternatives are not limited to those that are commercially available and proven.

FFS - The Focused Feasibility Study (FFS) is the development and analysis of potential remedial a alternatives for only one operable unit (such as soils or sediment) and normally includes a few selected remedial alternatives that use commercially available, proven technologies.

FETAX Test - A frog embryo toxicity test that measures the effects of contaminants on growth and occurrence of abnormalities.

Free Water - Naturally occurring groundwater/surface water physically trapped in the interstitial space of soil/sediment particles.

Installation Restoration Program (IRP) - The program established by the Department of Defense in 1975 to investigate, identify, and clean up hazardous waste contamination at federal facilities.

# DECLARATION FOR THE RECORD OF DECISION

## SITE NAME AND LOCATION

Area A Downstream Water Courses/Overbank Disposal Area (Area A Downstream/OBDA) is located on the Naval Submarine Base New London (NSB-NLON), Groton, Connecticut. This Record of Decision (ROD) addresses the contaminated soil and sediment at this site. This Record of Decision does not address contaminated groundwater, which will be addressed as a separate operable unit at a later time.

## STATEMENT OF BASIS AND PURPOSE

This ROD presents the following final remedy for soil and sediment at Area A Downstream/OBDA:

- Removal of surface water followed by treatment and discharge to Thames River.
- Excavation of contaminated soil and sediment, followed by onsite dewatering and disposal at an offsite landfill.

The selected remedial action was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for Area A Downstream/OBDA which was developed in accordance with Section 113(k) of CERCLA, and is available for public review. By excavation and removal of the contaminated soil and sediment, the U.S. Navy plans to remedy the potential threat to human health and ecological receptors.

The Connecticut Department of Environmental Protection (CTDEP), concurs with the selected remedy for Area A Downstream/OBDA.

## ASSESSMENT OF AREA A DOWNSTREAM/OBDA

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present a current or potential threat to public health, welfare, or the environment.

The U.S. Navy has determined that remedial action is necessary for this site because the potential human health risks associated with the soil and sediment at this site exceed the U.S. EPA limit of cumulative noncarcinogenic Hazard Index (HI) of 1.0. Also the risks for these potential receptors exceed Connecticut Department of Environmental Protection's (CTDEP) Remediation Standards limit of $1 \times 10^{-6}$ Incremental Cancer Risk (ICR) for individual contaminants with a cumulative ICR exceeding $1 \times 10^{-5}$ and cumulative HI exceeding 1.0. Although there are currently minimal human health risks posed by the site, this ROD selects the remedy to address potential future risks to humans.

The ecological risk assessment concluded that exposure to surface water and sediment concentrations of DDT and its metabolites DDD and DDE, and to a lesser extent, dieldrin, were responsible for adverse ecological effects to aquatic biota, in particular sediment-dwelling organisms. Terrestrial vertebrates are also at risk from exposure to DDT and its metabolites in soil as a result of indirect exposure through consumption to contaminated prey.

## DESCRIPTION OF THE SELECTED REMEDY

This remedial action addresses the soil and sediment at the Area A Downstream/OBDA. The groundwater at this site will be addressed as a separate operable unit at a later time.

The U.S. Navy has determined that excavation and off site landfill disposal is appropriate for the contaminated soil and sediment at this site. Potential exposure to these media is the principal threat posed by the site. This remedy involves removal, treatment, and discharge of surface water; excavation of contaminated soil and sediment; onsite dewatering to remove free water in the soil and sediment; treatment and discharge of removed water; and offsite disposal of the dewatered media at approved landfills.

**STATUTORY DETERMINATIONS**

The remedy selected by the U.S. Navy for Area A Downstream/OBDA is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate requirements to this remedial action, and is cost-effective. Because this remedy will not result in contaminants remaining in soil and sediment on site above healthy- or ecologically-based levels, the 5-year review process will not apply to this action. This remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. The selected remedy does not satisfy the statutory preference for remedies that employ treatment as a principal element to reduce toxicity, mobility, or volume of contaminants. However, the selected remedy is deemed to be cost effective.

**DECLARATION**

This ROD represents the selection of a remedial action under CERCLA for Area A Downstream/OBDA. The foregoing represents the selection of a remedial action by the Department of the Navy and the United States Environmental Protection Agency Region I with the concurrence of the Connecticut Department of Environmental Protection.

Concur and recommend for immediate implementation:

<IMG SRC 98003D>

# 1.0 SITE NAME, LOCATION AND DESCRIPTION

NSB-NLON covers approximately 550 acres of land in the southeast of Connecticut in the towns of Ledyard and Groton, on the east bank of the Thames River, approximately 6 miles north of Long Island Sound. For almost 100 years, the Naval Submarine Base New London (NSB-NLON) has served as a major support center for the U.S. Atlantic fleet. The location of NSB-NLON is shown as the U.S. Naval Reservation Figure 1-1.

**STREAMS AND PONDS**

The Area A Downstream/OBDA drains the Area A Landfill and Area A Wetland through water bodies and streams that ultimately flow into the Thames River. The Area A Downstream/OBDA includes three small ponds (Upper Pond, Lower Pond, and OBDA Pond) plus six interconnected streams (Streams 1 through 6). The location of the Area A Downstream/OBDA is shown on Figure 1-2. The site layout and topography of the Area A Downstream/OBDA is shown on Figure 1-3. The zone designations (Zone 1 through Zone 6) shown on Figure 1-3 were the subdivisions of the site that were used during sampling of media in the Phase II RI.

The primary discharge point from the Area A Wetland is from four large culverts through a dike that separates the wetland from the Area A Downstream/OBDA. This discharge forms a small stream (Stream 4), which flows west for approximately 200 feet into Upper Pond. Upper Pond discharges to Stream 3, which flows north and then west toward Triton Road (past the OBDANE site) to the entrance of the Torpedo Shops. Stream 3 then meets the drainage channel from the Torpedo Shops and forms Stream 5. Stream 5 flows west along Triton Avenue through the Small Arms Range and under Shark Boulevard and eventually discharges to the Thames River at the DRMO outfall. Upper Pond also has a discharge structure on the south side. During periods of high flow and high water at the pond, water also flows out through this structure to Stream 1, which flows west from OBDA Pond. A second pond (Lower Pond), northwest of Upper Pond, is formed by groundwater inflow and discharges to Stream 2, which enters a storm sewer and flows to the west around North Lake.

Groundwater also seeps from the northwest slope of the adjacent Area A Landfill into a small pond (OBDA Pond) located at the base of that slope, which is the continuation of the dike which separates the Area A Wetland from the Area A Downstream/OBDA. Stream 1 flows from this OBDA Pond west toward North Lake, a recreational swimming area for Navy personnel, enters a culvert, which bypasses North Lake and discharges to a stream (Stream 6) below the outfall of that lake. Stream 6, which is formed by Stream 1, Stream 2, and the outflow of North Lake, flows west under Shark Boulevard and through the golf course to the Thames River. North Lake is filled with potable water every year and drained at the end of the season. Surface water levels in North Lake do not appear to coincide with groundwater levels in adjacent monitoring wells. Therefore, there seems to be little hydraulic connection between surface water in North Lake and the shallow groundwater.

**OVERBANK DISPOSAL AREA (OBDA)**

The OBDA is located at the base of the northwest slope of the adjacent Area A Landfill where the angle of the slope approaches 45 degrees. A small wetland exists at the very base of the slope. This area was used as a disposal site after the earthen landfill slope/dike was constructed in 1957. The Initial Assessment Study (IAS) report (Envirodyne, 1982) indicated that the disposed of material had been there for many years. The IAS report also indicated that the materials were not covered and included 30 partially covered 200-gallon metal fuel tanks and scrap lumber. Approximately 30 empty, unlabeled, 200 gallon tanks, old creosote telephone poles, several empty unlabeled 55-gallon drums, and rolls of wire were observed at that time. Orange-colored sediment were also observed in the water discharging from the base of the Area A landfill slope embankment. The above mentioned debris were removed as part of a removal action in March 1997 and some of the debris (such as acetylene tanks) were characterized as hazardous. The debris was disposed of at suitable landfills or recycling facilities offsite according to the Final Removal Action Report (Foster Wheeler, July 1997).

# 2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

This section summarizes the land use, response history, and enforcement history for the Area A Downstream/OBDA.

## 2.1 LAND USE AND SITE HISTORY

For almost 100 years, the NSB-NLON has served as a major support center for the U.S. Atlantic fleet. To protect its employees and residents, the NSB-NLON has historically used pesticides for control of mosquitoes that breed in the Area A Downstream/OBDA wetlands and water courses and affect the adjacent recreational areas of North Lake and the golf course. Also, as part of its naval operations, on occasion, the NSB-NLON has dredged the Thames River and placed the dredge spoil at the current location of the Area

A Wetland and Area A Landfill, a process during which some of that dredge spoil could have been carried over by natural forces (storm water and streams) into the adjacent Area A Downstream/OBDA.

The main cause of contamination at the Area A Downstream/OBDA was the application of pesticides. These pesticides were reportedly applied on the surface of water bodies to control mosquito proliferation adjacent to the nearby base recreational facilities (North Lake and golf course). Additional contaminants are the inorganic constituents of the over dredge spoil which have been carried over from adjacent sites.

Samples of surface soil (typically within a depth of 0 to 2 feet or less than 3 feet below the surface) and sediment showed the presence of mainly DDT, DDD, DDE, and small amounts of other pesticides such as dieldrin. Samples of sediment also contained relatively higher levels of several metals (such as arsenic, beryllium, cadmium, lead and zinc) as compared to less contaminated reference areas outside the site.

Surface water samples contained low concentrations of some of the same contaminants as those present in the soil and sediment.

### 2.2 RESPONSE AND ENFORCEMENT HISTORY

The IRP and CERCLA. In 1975, the Department of Defense developed a program to investigate and clean up problem areas involving contamination of land and water at federal facilities such as the NSB-NLON. That program, known as the Installation Restoration Program (IRP), is being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly referred to as the Superfund law. In 1986, Congress passed amendments to CERCLA that contain provisions for federal facilities (see Section 120). 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 (U.S. EPA).

Initial Assessment Study (IAS). An IAS (Envirodyne, 1982) was conducted to identify and evaluate past hazardous waste disposal practices at NSB-NLON and to assess the associated potential for environmental contamination. The IAS recommended further investigation of several areas including Area A Downstream/OBDA.

Federal Facility Agreement (FFA). The U.S. Navy entered into an FFA with the EPA and the Connecticut Department of Environmental Protection (CTDEP) January 5, 1995. The FFA established roles and responsibilities of each agency, set deadlines for the investigation and cleanup of hazardous waste sites, and established a mechanism for the resolution of disputes among agencies.

Remedial Investigations and studies conducted to date. A Phase I Remedial investigation(RI) (Atlantic, 1992), a Phase II RI (B&R Environmental, March 1997), a Focused Feasibility Study (FFS, Atlantic 1994) (including additional investigation and a bench-scale treatability study), and a Wetlands Functions and Values Assessment (Niering and Brawley, 1997) were conducted over the course of several years, ending in May 1997. A feasibility study on the soil and sediment at the site (Brown & Root Environmental, July 1997) was prepared by the Navy to support the Proposed Plan, incorporating the significant findings of all of these studies and responds to the comments made by the State of Connecticut and U.S. EPA an the prior version of FFS.

Feasibility Study (FS). The latest version of the FS for this site (B&R Environmental, July 1997) is the basis of the Proposed Plan. The scope of this FS is limited to the soil and sediment at the site. However, this FS also addresses reduction of any adverse affects that the soil and sediment may have on groundwater and surface water. This FS does not consider groundwater, which will be evaluated as part of a separate upcoming study. This FS only considers surface water to the extent necessary for the remediation of sediment.

## 3.0 COMMUNITY PARTICIPATION

Throughout the history of the contamination investigations and enforcement activities at NSB-NLON, the community has been actively involved. Community members and other interested parties have been kept abreast of site activities through informational meetings, published "fact sheets and information updates," press releases, public meetings, and Technical Review Committee (TRC) and Restoration Advisory Board (RAB) meetings.

The TRC was established in 1988 and was later (in 1994) reorganized and renamed the RAB. The RAB (formerly TRC) has been an important vehicle for community participation in the NSB-NLON IRP. The RAB consists of representatives of the U.S. Navy, EPA, CTDEP, planners and officials of neighboring towns, Navy and EPA contractors, and local residents with scientific knowledge of or interest in the sites.

The RAB meets regularly to review technical aspects of the NSB-NLON IRP and provides a mechanism for community input to the program.

To ensure that the community is well informed about NSB-NLON IRP activities, the Navy has provided and will continue to provide the public with the following sources or vehicles of information.

- Public Information Repositories. The Public Libraries in Groton and Ledyard, the Naval Submarine Base, and New London are the designated information repositories for the Subbase IRP.

- Key Contact Persons. The Navy has designated a Public Affairs Officer and an EPA Community Involvement Coordinator as information contacts for the Subbase. Their addresses and phone numbers are included in all information material distributed to the public, including any fact sheets and press releases. The Public Affairs Officer will maintain the site mailing list to ensure that all interested individuals receive more pertinent information on the IRP activities.

- Mailing List. To ensure that information materials reach the individuals who are interested in or affected by the IRP activities at the Subbase, the Navy maintains and will regularly update a mailing list of interested persons. Anyone interested in being placed on the list can do so by contacting the Subbase Public Affairs Officer.

- Regular Contact with Local Officials. The Navy has managed and will continue to arrange regular meetings to discuss the status of the IRP with the RAB, which includes representatives from neighboring towns. The Navy contacts other town officials on an as-needed basis.

- Press Releases and Public Notice. The Navy has issued and will continue to issue press releases to local media sources to announce public meetings and comment periods, the availability of the IRP reports and plans, and to provide general information updates as and when the Public Affairs Officer sees fit.

- Public Meetings. The Navy has held and will continue to hold informal public meetings as needed to keep residents and town officials informed about IRP activities at the Subbase, and of significant milestones in the IRP. The meetings include presentations by Navy technical staff, EPA personnel, and/or support contractors for both agencies. The meetings also include a question-and-answer period. Minutes of meetings during public comment periods are included in the Administrative Record for public reference.

- Fact Sheets and Information Update. The Navy has been developing a series of fact sheets which are mailed to public officials and other interested individuals and/or used as handouts at the public meetings. Each fact sheet includes a schedule of upcoming meetings and other site activities. The fact sheets may explain why the Navy is conducting certain activities or studies, update readers on potential health risks, or provide general information on the IRP process.

A detailed formal NSB-NLON Community Relations plan was published in February of 1994. The plan identifies issues of community interest and concern regarding the NSB-NLON. The plan also describes a program of community relations activities that the Navy will conduct during the IRP.

The activities of the community relations program outlined in this plan have the following specific objectives: (1) to keep local officials, citizens, military personnel, and the media informed of site activities; (2) to increase community awareness of the goals and procedures of the IRP; and (3) to provide opportunities for public involvement in the cleanup process.

The information in the Community Relations Plan is based upon:

- interviews with area residents and local officials conducted in Groton and Ledyard on October 2-3, 1991,

- interviews with area residents and local officials conducted by phone in September and October of 1991;

- input of the TRC or RAB which had regularly met to discuss progress at the Subbase;

- public comments and questions at public information meetings held in 1990 and 1991;

* review of Navy site files; and

* discussions held with Navy, EPA, contractors, and technical and public affairs staff.

The U.S. Navy published a notice and brief analysis of the Area A Downstream/OBDA Proposed Plan in the New London Day on August 1, 1997, and made the Proposed Plan available to the public at the Groton Public Library, Groton, Connecticut, and the Bill Library, Ledyard, Connecticut.

From August 1, 1997 through September 1, 1997, the U.S. Navy held a 30-day public comment period to accept public input on the alternatives presented in the FS and the Proposed Plan, as well as other documents previously released to the public. On August 6, 1997, NSB-NLON personnel and regulatory representatives held a public meeting to discuss the Proposed Plan, answer questions and concerns regarding the site and the remedial alternative under consideration, and accept any oral comments. The Navy did not receive any written comments from the public during the 30-day public comment period. The U.S. Navy received a letter dated August 18, 1997 from the CTDEP expressing their support of the Proposed Plan as presented. A transcript of this meeting is included as Appendix A, a copy of CTDEP's letter is included as Appendix B, a Responsiveness Summary is included as Appendix C, and the Declaration of Concurrence is included as Appendix D.

## 4.0 SCOPE AND ROLE OF RESPONSE ACTION

The U.S. Navy has placed 25 sites at this base under the purview of the Installation Restoration Program.

Depending on the characteristics of the sites, the media of concern at these sites are: soil and sediment, groundwater, surface water, and air. Records of Decision have been issued for some of these sites, and of these sites remedial action has been completed at a few. The remaining sites are under various stages of remedial investigation and feasibility study preparation.

The scope of the remedial action at the Area A Downstream/OBDA is limited to the soil and sediment at the site. As identified in the Phase II RI (B&R Environmental, March 1997), samples of media collected in stream beds, pond bottoms, and associated wetlands in the vicinity of these water bodies are assumed to be sediments and the solid media outside of the sediments are assumed to be soil. The remedial action was selected among a total of four alternatives retained for detailed screening in the FS for this site, including No Action. Although groundwater will not be remediated at that time, the cross-media impact from contaminated soil and sediment would be minimized by the alternative selected in this ROD.

Groundwater will be addressed as a separate operable unit at a later time.

The selected alternative is excavation of the contaminated soil and sediment followed by disposal at an offsite landfill. All of the groundwater and surface water seepage into the site from the adjacent Area A Wetland and Area A Landfill will be diverted to bypass the areas of proposed excavation and discharged into downstream culverts. Stream diversion details will be decided during remedial design. Erosion and sediment controls will also be addressed during remedial design. From the downstream culverts, the combined groundwater/surface water will be allowed to discharge to Thames River as before. Standing water in the ponds and streams on site will be pumped, treated, and discharged to Thames River.

Following groundwater and surface water management, the stream beds, pond beds, adjacent wetland areas, and soils 1hat have been determined to be contaminated at levels exceeding remediation goals will be excavated. The excavated material is expected to contain significant levels of free water that will need to be removed to improve handling and reduce disposal costs. Removal of free water to the extent practicable will be accomplished by stockpiling the excavated material on dewatering pads at a nearby location. The wastewater (drainage) from the dewatering operation will be collected in a sump, treated, and discharged to Thames River.

The dewatered soil and sediment will be transported offsite for disposal at suitable landfills. A portion of the material containing relatively higher concentrations of contaminants that may not be accepted in a nonhazardous waste landfill, will be disposed of at a hazardous waste landfill.

Following excavation and disposal of contaminated sediments and soils, the excavated areas will be backfilled with clean fill with comparable organic content to the excavated sediments and soil. During remedial design, alternative methods of erosion control (e.g. placement of hay bales or vegetative matting) will be considered for stream beds and pond banks. For areas outside the stream and pond beds, erosion control will consist of mainly top soil and revegetation of species of plants similar to those existing and those favorable to wetland recovery.

The diversions to the surface water and groundwater inflow to the area will be discontinued, and flow will be routed through the restored waterways. The functions and values of the wetland communities associated with the site will be replaced in accordance with state and federal standards, as determined during remedial design.

## 5.0 SUMMARY OF SITE CHARACTERISTICS AND ECOLOGY

Section 1.0 of the FS (B&R Environmental, July 1997) contains an overview of the Area A Downstream/OBDA, including discussions on the geology, hydrogeology, ecological habitat, and nature and extent of contamination. The RI Report (B&R Environmental, March 1997) contains the detailed results of the investigations at this site. The significant findings of the RI are summarized below.

### 5.1 PHYSICAL FEATURES AND ECOLOGICAL HABITAT

Area A Down stream/OBDA is contained in a small, narrow, steep-sided valley located in the northern portion of the NSB-NLON. The upper end of this valley was dammed to provide a disposal area for dredge spoil, eventually forming what is now known as the Area A Wetland.

The soil at the site consists of natural overburden deposits (silt, sand and gravel) overlying metamorphic bedrock. Groundwater is present in the overburden and bedrock, and flows towards the Thames River.

The site primarily consists of scrub-shrub and forested wetlands characterized by a canopy dominated by hardwoods (primarily oaks) and a secondary mixed hardwood forest dominates the wetland edge. Understory vegetation present in the area includes laurel, dogwood, cherry, tupelo, sassafras and other tree saplings, catbriar, and grape vine.

Three small ponds (Upper Pond, Lower Pond, and OBDA Pond) and six small streams (Streams 1 through 6) are present at the site. The marine sediment contained in the Area A Wetland influences water quality in these waterbodies; as elevated salinity was routinely recorded during surface water measurements taken at the site. The ephemeral nature of the streams and the shallowness of the ponds makes them unsuitable habitat for fish. No rare or endangered species of flora or fauna have been recorded in previous investigations such as the Phase II RI (B&R Environmental, 1997a) and the Functions and Values Assessment (Niering and Brawley, 1997).

#### 5.1.1 Upper Pond

Upper Pond and its associated wetland (0.48 acre) are located approximately 300 ft downstream of the Area A Wetland. Upper Pond is a palustrine open water (shallow) wetland surrounded by a palustrine emergent, nonpersistent, narrow-leaved wetland with an artificial water regime (Atlantic, July 1994).

Water depth has been reported to range from approximately 1.5 to 4 feet. Upper Pond is characterized by poorly to very poorly drained fine-textured marine sediment that were naturally transported into this pond from the upgradient Area A Wetland. The sediment are very fine and are generally unconsolidated. A layer of decomposing leaves and two submerged aquatic plants, duckweed and water starwort cover most of the pond's sediment. The emergent, persistent, narrow-leaved vegetation is dominated by the common reed (Phragmites australis). While frogs and turtles have occasionally been observed in the pond, the results of surveys have demonstrated that the Upper Pond does not contain fish.

#### 5.1.2 OBDA Pond

OBDA Pond and it associated wetland habitat (1.29 acre) are located below the northwest slope of the adjacent Area A Wetland which extends to the dike that forms the Area A Wetland. OBDA Pond is approximately 150 ft west of the Area A Wetland and 50 to 250 ft south of Upper Pond and Lower Pond.

This pond is classified as a palustrine emergent, nonpersistent, narrow-leaved wetland surrounded by scrub/shrub and forested broad-leaved deciduous wetland with a nontidal seasonal water regime (Atlantic, July 1994). The emergent, nonpersistent, narrow-leaved vegetation is dominated by a monotypic stand of the common reed (P. austrafis). Sweet pepperbush, highbush blueberry, and red maple are some of the prevalent shrub and tree vegetation species surrounding the pond. The sediment in OBDA Pond and the surrounding wetland area are classified as native Ridgebury fine sandy loam which are poorly drained, moderately coarse textured, glacial till soil developed over compact till. The pond's primary source of water is groundwater, and the sediment are generally covered by an iron floc. Water is generally 1 to 1.5 feet deep. No fish are present in OBDA Pond, but amphibians such as frogs have occasionally been observed along the pond's shoreline.

#### 5.1.3 Lower Pond

Lower Pond (0.50 acre) is located approximately 50 ft downstream of Upper Pond. Lower Pond is classified as a palustrine open water (shallow) wetland surrounded by a palustrine scrub/shrub and wooded broad-leaved, deciduous wetland (Atlantic, July 1994). This pond has a seasonal water regime; standing water is generally present in the pond only during the winter and spring. Sweet pepperbush, highbush blueberry, and red maple dominate the vegetation of this area. The soils associated with Lower Pond and its surrounding wetland are classified as native Ridgebury fine sandy loam which are poorly drained, moderately coarse textured, glacial till soil developed over compact till. A thick layer of decomposing and partially decomposed leaves covers the pond's sediment. Upper Pond and its associated wetland are adjacent to a smaller disturbed wetland (0.027 acre) with similar characteristics and dominant vegetation. Neither fish nor amphibians have been observed in Lower Pond. The Lower Pond is considered to be the least disturbed area at this site, and is currently serving the greatest number of positive wetland functions and values (Niering and Brawley, 1997).

#### 5.1.4 Stream 1

Stream 1 is located on the southern side of the valley containing the site. Stream 1 drains OBDA Pond, travels along the length of the site, and exits into Stream 6 on the western side of North Lake. Stream 1, like the other streams in the site, can be categorized as a low energy, first order stream. During the spring of 1995, the stream ranged from 1.5 to approximately 3 feet wide and 4 to 8 inches deep. The southern portion of the site is heavily canopied and the stream's bottom is covered by a thick, mat of decomposing leaf litter and detritus. No hard substrate (e.g., gravel or cobble) was observed in this stream. No riffle habitat and few leaf packs were observed. Thirty-nine vegetative species were recorded in the upper portion of the stream (Niering and Brawley, 1997).

#### 5.1.5 Stream 2

Stream 2 is located in the center of the site and serves as the outlet for Lower Pond. Like Stream 1, this stream is also a small, low energy, first order stream. The substrates are highly organic and are composed of partially decomposed leaves and detritus. Stream 2 is approximately 2 feet wide and 4 to 8 inches deep. The stream was characterized by small pools and a few areas that could be categorized as riffles. No hard substrate (e.g., gravel or cobble) was observed. Stream 2 enters into a storm sewer and discharges into Stream 6. Stream 2 is noted to be the least disturbed of streams at this site and traverses a relatively mature wooded area consisting of red maple, white ash, black gum, high bush blueberry, and sweet pepperbush (Niering and Brawley, 1997).

#### 5.1.6 Stream 3

Stream 3 is located along the northern boundary of the site and serves as the outlet stream for Upper Pond. Stream 3 is an artificially constructed water course characterized by relatively hard-packed substrates and a relatively deep, steep-sided channel that cuts through marine sediment apparently washed into the site from the Area A Wetland. The substrates consist of a combination of fine clay and sand. During the spring of 1995, Stream 3 was approximately 3 feet wide and 8 to 12 inches deep. Little organic matter was present in this small stream, and no riffle or pool habitats were observed. Stream 3 feeds into Stream 5 which flows along Triton Avenue. Stream 3 exhibits a high overall species richness (40 vegetative species recorded) that are typical of disturbed non-wetland sites (Niering and Brawley, 1997).

#### 5.1.7 Stream 4

Stream 4 is located at the eastern end of the site and serves as the outlet for the Area A Wetland. Water drains from the Area A wetland through a standpipe and into Stream 4. Stream 4 is also an artificially constructed water course like Stream 3, and the substrates are characterized by a hard-packed clay with little coarse (e.g., sand or gravel) material present. Portions of the stream's bed are covered with iron floc.

No organic matter (e.g., leaf packs) was observed in this stream nor is Stream 4 characterized by a riffle or pool habitat. In the spring of 1995, Stream 4 was approximately 6 to 8 inches deep and 3 to 4 feet wide. Stream 4 drains into Upper Pond. Stream 4 also exhibits a high overall special richness like Stream 3, that are typical of disturbed non-wetland sites (Niering and Brawley, 1997).

#### 5.1.8 Stream 5

Stream 5 is located along Triton Avenue which is on the northern side of the valley containing the site.

Stream 5 begins at the confluence of Stream 3 and the drainage channel from the Torpedo Shops. Stream 5 flows through a series of unlined channels and culverts and discharges directly into the Thames River near the DRMO. Stream 5 has not been comprehensively studied like Streams 1 through 4, and little flow, substrate, and habitat information is known about the stream.

5.1.9 Stream 6

Stream 6 is located in the southwestern corner of the site. Stream 6 begins at the confluence, of Stream 1, Stream 2, and the outlet of North Lake; travels through the golf course in a series of concrete-lined channels and culverts; and discharges into the Thames River just north of Site 22 (Pier 33). Stream 6, like Stream 5, has not been comprehensively studied like Streams 1 through 4, and therefore little flow, substrate, and habitat information is known about the stream. However, because the stream is primarily a man-made series of concrete-lined channels and culverts, it offers little ecological habitat.

## 5.2 NATURE AND EXTENT OF CONTAMINATION

Soil, sediment, and surface water samples were taken and analyzed for organic and inorganic contaminants. The soil data is limited to a few surface (i.e., sample depth of 0 to 2 feet below surface) and subsurface (i.e., sample depths to 5 feet below the surface) samples. The most significant contaminants in soil were noted to be pesticides and certain metals. The pesticides consisted mainly of 4,4'-DDD, 4,4'-DDE and 4,4'-DDT, i.e. DDT and metabolites or DDT residuals (DDTR). DDTR were detected in all surface soil samples. The highest concentrations of DDTR were detected in Zone 1 (the vicinity of the OBDA Pond and Upper Pond) at the following levels 4,4'-DDT (1,400,000 Ig/kg), 4,4'-DDD (240,000 Ig/kg), and 4,4'-DDE (24,000 Ig/kg). In surface soil, aluminum, cadmium, chromium, cobalt, manganese, nickel, and zinc were detected sporadically at concentrations that exceeded their respective maximum background concentrations, but, within the order of magnitude of their respective maximum background concentrations. No pattern of metal contamination that may be indicative of a source was apparent for any of the metals, except for manganese. However, manganese is noted to be a naturally occurring mineral constituent in the geology of the Subbase NLON (Phase II RI, pp 4-8). Although certain volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) were also detected, the detections were few, and the levels were relatively insignificant.

The most significant contaminants in sediment were DDTR and to a lesser extent, inorganics. The following are the salient features of the contamination in the sediment:

- Zone 1 (OBDA Pond, Stream 1 and Associated Wetlands): DDTR were detected in a majority of sediment samples. Maximum concentrations of 4,4'-DDD at 300,000 Ig/kg and 4,4'-DDE at 15,000 Ig/kg, respectively, were detected in an OBDA Pond sediment sample. The maximum concentration of DDT of 94,000 Ig/kg was detected in a Stream 1 sediment sample. Five other pesticides were also detected at lower concentrations, including a maximum of 370 Ig/kg of dieldrin in a Stream 1 sediment sample. Inorganics were detected in a majority of sediment samples at the following maximum concentrations: arsenic (39.9 mg/kg), lead (223 mg/kg), cadmium (30.1 mg/kg), manganese (2,850 mg/kg), and zinc (2,720 mg/kg). Arsenic, in particular, is noted to have been detected at concentrations significantly exceeding an offsite reference sample concentration of 4.4 mg/kg.

- Zone 2 (Lower Pond, Stream 2, and Associated Wetlands): DDTR were detected in a majority of sediment samples. Maximum concentrations of 4A-DDD and 4,4'-DDE in sediment were 850,000 Ig/kg and 59,000 Ig/kg, respectively. The maximum concentration of 4,4'-DDT in sediment was 24,000 Ig/kg. Four other pesticides were detected at lower concentrations, including a maximum of 860 Ig/kg for dieldrin.

- Zone 3 (Upper Pond, Stream 3, Stream 4, and Associated Wetlands): DDTR were detected in all sediment samples. Maximum concentrations of 4,4-DDD and 4,4'-DDE were 120,000 Ig/kg and 9,000 Ig/kg, respectively. The maximum concentration of 4,4'-DDT was 14,000 Ig/kg. Five other pesticides were detected at lower concentrations, including a maximum of 900 Ig/kg for dieldrin. The only notable inorganic detected was lead, at a maximum concentration of 661 mg/kg in a Stream 3 sediment sample.

- Zone 4 (North Lake): No DDTR were detected. Certain SVOCs and VOCs were sporadically detected at low levels. Mercury was detected in one sample.

- Zone 5 (Stream 5): DDTR were detected in all samples. Maximum concentrations of 4A-DDD and 4,4'-DDE were 12,000 Ig/kg and 350 Ig/kg, respectively. The maximum concentration of 4,4'-DDT was 7,000 Ig/kg. Arochlor-1260 was detected in one sample at a concentration of 280 Ig/kg.

Inorganic concentrations were within an order of magnitude higher than offsite reference sample concentrations, thereby indicating that the level of contamination was not significant compared to those of sediment in the streams described previously.

- Zone 6 (Stream 6): DDTR were detected in one sample out of two that were analyzed for pesticides.

  Among pesticides, 4,4'-DDE and 4,4'-DDT were each detected at 120 Ig/kg, and 4,4'-DDD was not detected. Inorganic concentrations were within an order of magnitude higher than offsite reference sample concentrations, with maximum levels at the outfall of Stream 6. As in Stream 5 sediment, level of inorganic contaminants were not significant compared to those of sediment in other streams onsite.

Table 5-1 presents a summary of the soil contamination. Table 5-2 presents a summary of the sediment contamination. Table 5-3 presents a summary of offsite reference sediment samples for comparison to site-related sediment contamination.

| | ZONE 1 | | | | | | ZONE 2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SURFACE (<2 FEET)(1) | | | SUBSURFACE (>2 FEET)(2) | | | SURFACE (<2 FEET)(3) | | | SUBSURFACE (>2 FEET)(4) | | |
| Analyte | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection |
| VOLATILE ORGANICS (ug/kg) | | | | | | | | | | | | |
| 1,1-Dichloroethene | 0/1 | - | ND (7) | 0/2 | - | ND | - | - | NA (8) | 1/1 | 16 | 2DMW15S |
| 2-Butanone | 1/1 | 32 | 3MW12S | 0/2 | - | ND | - | - | NA | 0/1 | - | ND |
| Acetone | 0/1 | - | ND | 0/2 | - | ND | - | - | NA | 1/1 | 79 | 2DMW15S |
| Carbon disulfide | 0/1 | - | ND | 0/2 | - | ND | - | - | NA | 1/1 | 7 | 2DMW15S |
| Tetrachloroethene | 0/1 | - | ND | 0/2 | - | ND | - | - | NA | 1/1 | 58 | 2DMW15S |
| Toluene | 0/1 | - | ND | 0/2 | - | ND | - | - | NA | 1/1 | 100 | 2DMW15S |
| Trichloroethene | 0/1 | - | ND | 0/2 | - | ND | - | - | NA | 1/1 | 24 | 2DMW15S |
| SEMIVOLATILE ORGANICS (ug/kg) | | | | | | | | | | | | |
| Benzo(k)fluoranthene | 1/1 | 50 | 3MW12S | 0/2 | - | ND | - | - | NA | 0/1 | - | ND |
| Benzoic acid | 1/1 | 82 | 3MW12S | 0/2 | - | ND | - | - | NA | 0/1 | - | ND |
| Bis(2-Ethylhexyl)phthalate | 1/1 | 160 | 3MW12S | ½ | 140 | 2DMW11S | - | - | NA | 0/1 | - | ND |
| Fluoranthene | 1/1 | 67 | 3MW12S | 0/2 | - | ND | - | - | NA | 0/1 | - | ND |
| Pyrene | 1/1 | 54 | 3MW12S | 0/2 | - | ND | - | - | NA | 0/1 | - | ND |
| PESTICIDES/PCBs (ug/kg) | | | | | | | | | | | | |
| 4,4'-DDD | 3/3 | 17-240000 | MCLL1 | 0/2 | - | ND | 3/3 | 110-1600 | 2DSS6 | 0/1 | - | ND |
| 4,4'-DDE | 3/3 | 27-24000 | MCLL1 | ½ | 28 | 2DMW16S | 3/3 | 970-3100 | 2DSS6 | 0/1 | - | ND |
| 4,4'-DDT | 3/3 | 24-1400000 | MCLL1 | ½ | 74 | 2DMW16S | 3/3 | 1600-57000 | 2DSS6 | 0/1 | - | ND |
| Alpha-Chlordane | 1/3 | 1.2 | 2DSS11 | 0/2 | - | ND | 1/3 | 1.3 | 2DSS13 | 0/1 | - | ND |
| Dieldrin | 1/3 | 2 | 2DSS11 | 0/2 | - | ND | 1/3 | 6.6 | 2DSS13 | 0/1 | - | ND |
| Heptachlor epoxide | 0/3 | - | ND | 0/2 | - | ND | 1/3 | 0.57 | 2DSS13 | 0/1 | - | ND |
| INORGANICS (Background Maximum Concentration) mg/kg | | | | | | | | | | | | |
| Aluminum (17,600) | 1/1 | 14000 | 3MW12S | 2/2 | 4080-17000 | 2DMW11S | - | - | NA | 1/1 | 26200 | 2DMW15S |
| Arsenic (3.6) | 1/1 | 2.6 | 3MW12S | 2/2 | 0.58-2.2 | 2DMW11S | - | - | NA | 1/1 | 3.1 | 2DMW15S |
| Barium (39) | 1/1 | 70.6 | 3MW12S | 2/2 | 23.1-31.4 | 2DMW11S | - | - | NA | 1/1 | 56 | 2DMW15S |
| Beryllium (0.72) | 1/1 | 0.52 | 3MW12S | ½ | 0.75 | 2DMW11S | - | - | NA | 1/1 | 0.72 | 2DMW15S |
| Cadmium (0.24) | 1/1 | 5.1 | 3MW12S | ½ | 5 | 2DMW11S | - | - | NA | 1/1 | 2.4 | 2DMW15S |
| Calcium (499) | 1/1 | 2590 | 3MW12S | 2/2 | 534-865 | 2DMW11S | - | - | NA | 1/1 | 706 | 2DMW15S |
| Chromium (19.3) | 1/1 | 27.9 | 3MW12S | 2/2 | 6.5-21.9 | 2DMW11S | - | - | NA | 1/1 | 28.6 | 2DMW15S |
| Cobalt (7) | 0/1 | - | ND(8) | ½ | 6.1 | 2DMW11S | - | - | NA | 1/1 | 13.4 | 2DMW15S |
| Copper (17.9) | 1/1 | 11.8 | 3MW12S | 2/2 | 11.9-12.2 | 2DMW11S | - | - | NA | 1/1 | 14.3 | 2DMW15S |

**TABLE 5-1**
**SUMMARY OF SOIL ANALYTICAL RESULTS**
**AREA A DOWNSTREAM/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT**


| Analyte | ZONE 1 | | | | | | ZONE 2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SURFACE (<2 FEET)(1) | | | SUBSURFACE (>2 FEET)(2) | | | SURFACE (<2 FEET)(3) | | | SUBSURFACE (>2 FEET)(4) | | |
| | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection |
| INORGANICS (Background Maximum Concentration) mg/kg (continued) | | | | | | | | | | | | |
| Iron (16,800) | 1/1 | 12000 | 3MW12S | 2/2 | 7220-16100 | 2DMW11S | - | - | NA | 1/1 | 22600 | 2DMW15S |
| Lead (17.5) | 1/1 | 17.8 | 3MW12S | 2/2 | 15.1-28.1 | 2DMW16S | - | - | NA | 1/1 | 7.5 | 2DMW15S |
| Magnesium (2,460) | 1/1 | 3510 | 3MW12S | 2/2 | 1300-2880 | 2DMW11S | - | - | NA | 1/1 | 3920 | 2DMW15S |
| Manganese (172) | 1/1 | 255 | 3MW12S | 2/2 | 94.6-105 | 2DMW16S | - | - | NA | 1/1 | 232 | 2DMW15S |
| Nickel (10) | 1/1 | 16.4 | 3MW12S | 2/2 | 4.4-14.3 | 2DMW11S | - | - | NA | 1/1 | 13.4 | 2DMW15S |
| Potassium (669) | 1/1 | 884 | 3MW12S | 2/2 | 323-1010 | 2DMW16S | - | - | NA | 1/1 | 724 | 2DMW15S |
| Sodium (33) | 1/1 | 630 | 3MW12S | 2/2 | 92.2-318 | 2DMW11S | - | - | NA | 1/1 | 102 | 2DMW15S |
| Vanadium (33.3) | 1/1 | 31.3 | 3MW12S | 2/2 | 15.3-31.5 | 2DMW11S | - | - | NA | 1/1 | 49.1 | 2DMW15S |
| Zinc (25.6) | 1/1 | 83.8 | 3MW12S | 2/2 | 27.2-82.1 | 2DMW11S | - | - | NA | 1/1 | 39 | 2DMW15S |
| TCLP (mg/L)(9) | | | | | | | | | | | | |
| Arsenic (5.0) | 1/1 | 0.19 | 3MW12S | ½ | 0.21 | 2DMW11S | - | - | NA | 0/1 | - | ND |
| Barium (100.0) | 1/1 | 0.25 | 3MW12S | 2/2 | 0.19-0.35 | 2DMW11S | - | - | NA | 1/1 | 0.34 | 2DMW15S |
| Lead (5.0) | 0/1 | - | ND | ½ | 0.1 | 2DMW16S | - | - | NA | 0/1 | - | ND |
| Selenium (1.0) | 1/1 | 0.13 | 3MW12S | ½ | 0.13 | 2DMW11S | - | - | NA | 0/1 | - | ND |
| MISCELLANEOUS PARAMETERS (mg/kg) | | | | | | | | | | | | |
| Total organic carbon | 2/2 | 78000-160000 | MCLL1 | - | - | NA | 1/1 | 43000 | 2DSS13 | | - | NA |

**TABLE 5-1**
**SUMMARY OF SOIL ANALYTICAL RESULTS**
**AREA A DOWNSTREAM/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT**


ZONE 3

| | SURFACE (<2 FEET)(5) | | | SUBSURFACE (>2 FEET) | | |
|---|---|---|---|---|---|---|
| Analyte | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection |
| PESTICIDES/PCBs (ug/kg) | | | | | | |
| 4,4'-DDD | 3/3 | 25-3300 | 2DSS16 | 0/1 | - | ND |
| 4,4'-DDE | 3/3 | 50-2800 | 2DSS16 | 0/1 | - | ND |
| 4,4'-DDT | 3/3 | 230-29000 | 2DSS16 | 0/1 | - | ND |
| Alpha-Chlordane | 1/3 | 1.2 | 2DSS2 | 0/1 | - | ND |
| Aroclor-1254 | 1/3 | 35 | 2DSS2 | 0/1 | - | ND |
| Dieldrin | 1/3 | 2.4 | 2DSS2 | 0/1 | - | ND |
| Endosulfan sulfate | 1/3 | 3.9 | 2DSS2 | 0/1 | - | ND |
| Heptachlor epoxide | 1/3 | 1.4 | 2DSS2 | 0/1 | - | ND |
| INORGANICS (mg/kg) | | | | | | |
| Aluminum (17,600) | - | - | NA | 1/1 | 15500 | 2DMW10S |
| Arsenic (3.6) | - | - | NA | 1/1 | 2.5 | 2DMW10S |
| Barium (39) | - | - | NA | 1/1 | 58.7 | 2DMW10S |
| Beryllium (0.72) | - | - | NA | 1/1 | 0.42 | 2DMW10S |
| Cadmium (0.24) | - | - | NA | 1/1 | 1.8 | 2DMW10S |
| Calcium (499) | - | - | NA | 1/1 | 978 | 2DMW10S |
| Chromium (19.3) | - | - | NA | 1/1 | 23.6 | 2DMW10S |
| Cobalt (7) | - | - | NA | 1/1 | 8.3 | 2DMW10S |
| Copper (17.9) | - | - | NA | 1/1 | 22.6 | 2DMW10S |
| Iron (16,800) | - | - | NA | 1/1 | 19800 | 2DMW10S |
| Lead (17.5) | - | - | NA | 1/1 | 5.1 | 2DMW10S |
| Magnesium (2,460) | - | - | NA | 1/1 | 4420 | 2DMW10S |
| Manganese (172) | - | - | NA | 1/1 | 283 | 2DMW10S |
| Nickel (10) | - | - | NA | 1/1 | 11.3 | 2DMW10S |
| Potassium (669) | - | - | NA | 1/1 | 2340 | 2DMW10S |
| Sodium (33) | - | - | NA | 1/1 | 141 | 2DMW10S |
| Vanadium (33.3) | - | - | NA | 1/1 | 38.1 | 2DMW10S |
| Zinc (25.6) | - | - | NA | 1/1 | 47.2 | 2DMW10S |
| TCLP (mg/L)(9) | | | | | | |
| Barium (100.0) | - | - | NA | 1/1 | 0.21 | 2DMW10S |
| Silver (5.0) | - | - | NA | 1/1 | 0.0084 | 2DMW10S |

**TABLE 5-1**
**SUMMARY OF SOIL ANALYTICAL RESULTS**
**AREA A DOWNSTREAM/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT**


| | ZONE 3 | | | | | |
|---|---|---|---|---|---|---|
| | SURFACE (<2 FEET)(5) | | | SUBSURFACE (>2 FEET) | | |
| Analyte | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection |
| MISCELLANEOUS PARAMETERS | | | | | | |
| Total Organic Carbon (TOC) | 3/3 | 13000-57000 | 2DSS2 | - | - | NA |

Notes:
1 Includes samples 2DSS11, 3MW12S, and MCLL1.
2 Includes samples 2DMW11S and 2DMW16.
3 Includes samples 2DSS13, 2DSS19 (field duplicate of 2DSS13), 2DSS5, and 2DSS6. Maximum values are used for evaluation of duplicate soil sample results and are counted as one sample.
4 Includes sample 2DMW15.
5 Includes samples 2DSS1, 2DSS16, and 2DSS2.
6 Includes sample 2DMW10S.
7 ND - Not Detected.
8 NA - Not Analyzed.
9 Values in parentheses represent Federal Toxicity Characteristic Regulatory Level (58 FR 46049)
Background maximum concentrations in surface soils were obtained from Table 3-3, Phase II RI (B&R Environmental, March 1997).
"-"implies not applicable if the analyte was not analyzed for or if it was analyzed for but not detected.

**TABLE 5-2**
**SUMMARY OF SEDIMENT ANALYTICAL RESULTS - ZONES 1 THROUGH 4**
**AREA A DOWNSTREAM/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT**
**PAGE 1 OF 4**

| Analyte | ZONE 1(1) | | | ZONE 2(2) | | | ZONE 3(3) | | | ZONE 4(4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection |
| VOLATILE ORGANICS (ug/kg) | | | | | | | | | | | | |
| 2-Butanone | 10/14 | 4-120 | EC-SDS102 | 2/6 | 76-280 | EC-SDLP11 | 0/5 | - | ND | 0/4 | - | ND(5) |
| Acetone | 7/15 | 54-320 | EC-SDOP05 | 1/6 | 900 | EC-SDLP11 | 0/5 | - | ND | 0/4 | - | ND |
| Carbon disulfide | 6/15 | 2-11 | 3SD5 | 0/4 | - | ND | 1/5 | 4 | 2DSD2 | 0/4 | - | ND |
| Ethylbenzene | 1/14 | 2 | 3SD3 | 0/4 | - | ND | 0/5 | - | ND | 0/6 | - | ND |
| Methylene chloride | 3/15 | 2-45 | EC-SDOP05 | 0/5 | - | ND | 3/7 | 3-70 | EC-SDUP18 | 3/6 | 8-14 | 2DSD30 |
| Tetrachloroethene | 1/14 | 4 | 3SD5 | 0/4 | - | ND | 0/5 | - | ND | 0/6 | - | ND |
| Toluene | 1/14 | 4 | 3SD4 | 0/4 | - | ND | 0/5 | - | ND | 0/6 | - | ND |
| Trichloroethene | 0/14 | - | ND | 0/4 | - | ND | 1/5 | 3 | 2DSD2 | 0/6 | - | ND |
| Xylenes, total | 1/14 | 3 | 3SD3 | 0/4 | - | ND | 0/5 | - | ND | 0/5 | - | ND |
| SEMIVOLATILE ORGANICS (ug/kg) | | | | | | | | | | | | |
| 2-Nitroaniline | 0/14 | - | ND | 0/4 | - | ND | 1/5 | 3100 | 2DSD2 | 0/4 | - | ND |
| 4,6-Dinitro-2-methylphenol | 0/14 | - | ND | 0/4 | - | ND | 1/5 | 6200 | 2DSD2 | 0/4 | - | ND |
| 4-Chloro-3-methylphenol | 0/14 | - | ND | 1/5 | 420 | EC-SDLP11 | 0/5 | - | ND | 0/6 | - | ND |
| 4-Methylphenol | 2/15 | 120-230 | EC-SDOP05 | 2/6 | 600-1100 | EC-SDLP11 | 0/5 | - | ND | 0/4 | - | ND |
| Acenaphthene | 2/15 | 100-140 | 3SD1 | 1/5 | 210 | EC-SDLP11 | 0/5 | - | ND | 0/6 | - | ND |
| Anthracene | 2/14 | 330-390 | 3SD5 | 0/4 | - | ND | 0/5 | - | ND | 0/6 | - | ND |
| Benzo(a)anthracene | 6/15 | 45-850 | 3SD1 | 1/5 | 340 | EC-SDLP11 | 0/5 | - | ND | 0/6 | - | ND |
| Benzo(a)pyrene | 4/15 | 98-590 | 3SD5 | 2/6 | 140-280 | EC-SDLP11 | 0/5 | - | ND | 0/6 | - | ND |
| Benzo(b)fluoranthene | 4/15 | 86-750 | 3SD1 | 2/6 | 150-460 | EC-SDLP11 | 1/6 | 160 | EC-SDUP18 | 1/6 | 47 | 2DSD10 |
| Benzo(g,h,i)perylene | 3/15 | 81-260 | 3SD1 | 2/6 | 140-290 | EC-SDLP11 | 0/5 | - | ND | 0/6 | - | ND |
| Benzo(k)fluoranthene | 4/15 | 100-290 | 3SD1 | 2/6 | 170-290 | EC-SDLP11 | 0/5 | - | ND | 0/6 | - | ND |
| Benzoic acid | 0/12 | - | ND | 2/3 | 160-3200 | EC-SDLP11 | 0/5 | - | ND | 0/4 | - | ND |
| Chrysene | 6/15 | 75-720 | 3SD5 | 2/6 | 220-630 | EC-SDLP11 | 0/5 | - | ND | 0/6 | - | ND |
| Di-n-butyl phthalate | 1/14 | 53 | EC-SDS102 | 1/5 | 180 | EC-SDS209 | 0/5 | - | ND | 1/6 | 3289 | NAV90119 |
| Di-n-octyl phthalate | 1/15 | 81 | EC-SDOP05 | 0/4 | - | ND | 0/5 | - | ND | 0/6 | - | ND |
| Dibenzofuran | 1/14 | 100 | 3SD1 | 0/4 | - | ND | 0/5 | - | ND | 0/4 | - | ND |
| Fluoranthene | 9/15 | 73-1500 | 3SD5 | 3/6 | 97-1000 | EC-SDLP11 | 1/6 | 60 | EC-SDS313 | 1/6 | 68 | 2DSD10 |
| Fluorene | 2/14 | 180-200 | 3SD5 | 0/4 | - | ND | 0/5 | - | ND | 0/6 | - | ND |
| Indeno(1,2,3-cd)pyrene | 3/15 | 62-360 | 3SD1 | 1/5 | 240 | EC-SDLP11 | 0/5 | - | ND | 0/6 | - | ND |

**TABLE 5-2**
**SUMMARY OF SEDIMENT ANALYTICAL RESULTS - ZONES 1 THROUGH 4**
**AREA A DOWNSTREAM/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT**


| | ZONE 1(1) | | | ZONE 2(2) | | | ZONE 3(3) | | | ZONE 4(4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analyte | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection |
| Naphthalene | 1/14 | 80 | 3SD1 | 0/4 | - | ND | 0/5 | - | ND | 0/6 | - | ND |
| Pentachlorophenol | 0/14 | - | ND | 1/5 | 310 | EC-SDLP11 | 0/5 | - | ND | 0/6 | - | ND |
| Phenanthrene | 5/15 | 77-1600 | 3SD5 | 3/6 | 130-620 | EC-SDLP11 | 0/5 | - | ND | 0/6 | - | ND |
| Pyrene | 9/15 | 140-1900 | 2DSD5 | 3/6 | 190-1000 | EC-SDLP11 | 2/7 | 63-140 | EC-SDUP18 | 1/6 | 64 | 2D5D10 |
| PESTICIDES/PCBs (ug/kg) | | | | | | | | | | | | |
| 4,4'-DDD | 21/21 | 59-300000 | 3SD3 | 7/10 | 11000-850000 | EC-SDLP12 | 13/13 | 1500-120000 | EC-SDS421 | 0/6 | - | ND |
| 4,4'-DDE | 20/22 | 17-15000 | 3SD3 | 10/11 | 5.3-24000 | EC-SDLP12 | 15/15 | 68-9000 | 2DSD21 | 0/6 | - | ND |
| 4,4'-DDT | 18/22 | 25-94000 | EC-SDS103 | 7/11 | 440-59000 | EC-SDLP10 | 10/15 | 33-14000 | EC-SDS421 | 0/6 | - | ND |
| Alpha-Chlordane | 3/18 | 28-290 | EC-SDOP06 | 0/5 | - | ND | 9/15 | 12-490 | EC-SDS421 | 0/4 | - | ND |
| Dieldrin | 2/17 | 33.5-370 | EC-SDS103 | 3/8 | 100-860 | EC-SOS209 | 4/9 | 14-900 | EC-SDS421 | 0/6 | - | ND |
| Endosulfan-I | 1/16 | 3.7 | 3DSD4A | 0/5 | - | ND | 0/11 | - | ND | 0/6 | - | ND |
| Endrin | 0/15 | - | ND | 0/5 | - | ND | 1/10 | 84 | EC-SDUP16 | 0/6 | - | ND |
| Endrin aldehyde | 0/5 | - | ND | 1/5 | 240 | EC-SDS207 | 0/8 | - | ND | 0/5 | - | ND |
| Endrin ketone | 0/16 | - | ND | 1/6 | 280 | EC-SDLP10 | 0/11 | - | ND | 0/4 | - | ND |
| Gamma-Chlordane | 1/17 | 81 | EC-SDOP06 | 1/6 | 23 | EC-SDS208 | 1/11 | 180 | EC-SDUP17 | 0/4 | - | ND |
| Heptachlor | 1/16 | 16 | EC-SDOP06 | 0/5 | - | ND | 1/12 | 46 | EC-SDUP17 | 0/6 | - | ND |
| DIOXINS/FURANS (ug/kg) | | | | | | | | | | | | |
| 1,2,3,4,6,7,8-HPCDD | ½ | 0.494 | 3SD6 | | - | NA (6) | | - | NA | | - | NA |
| OCDD | ½ | 5.366 | 3SD6 | | - | NA | | - | NA | | - | NA |
| OCDF | ½ | 0.552 | 3SD6 | | - | NA | | - | NA | | - | NA |
| INORGANICS (mg/kg) | | | | | | | | | | | | |
| Aluminum | 15/15 | 4190-18800 | 3SD3 | 6/6 | 5050-12000 | 2DSD25 | 7/7 | 3270-33100 | 2DSD2 | 4/4 | 2060-8830 | 2DSD10 |
| Antimony | 0/2 | - | ND | 1/4 | 11.4 | EC-SDS209 | 1/3 | 6.1 | EC-SDUP18 | 0/5 | - | ND |
| Arsenic | 15/15 | 1.9-39.9 | 3SD4 | 3/5 | 0.58-9.5 | EC-SDS209 | 7/7 | 3.9-17.7 | EC-SDUP18 | 6/6 | 1.1-30 | DN-88118 |
| Barium | 15/15 | 27.2-154 | 3SD4 | 6/6 | 15.4-111 | EC-SDS209 | 7/7 | 28-635 | EC-SDUP18 | 4/4 | 10.1-41.9 | 2DSD10 |
| Beryllium | 15/15 | 0.37-1.8 | 3SD4 | 3/4 | 0.28-0.37 | 2DSD25 | 7/7 | 0.51-5.6 | EC-SDUP18 | 1/6 | 0.36 | 2DSD10 |
| Boron | 2/4 | 13-26.3 | EC-SDOP05 | 1/5 | 19.1 | EC-SDS209 | 3/4 | 4-23.8 | EC-SDUP18 | 0/3 | - | ND |
| Cadmium | 12/13 | 1.1-30.1 | 3SD4 | 1/4 | 4 | 2DSD4 | 3/5 | 4.2-13.8 | 2DSD1 | 2/6 | 1.6-1.7 | 2DSD10 |
| Calcium | 15/15 | 1390-5720 | 3SD4 | 6/6 | 521-11300 | EC-SDS209 | 7/7 | 1290-92200 | EC-SDS420 | 4/4 | 527-1150 | 2DSD10 |
| Chromium | 15/15 | 9.4-43.4 | 3SD5 | 6/6 | 6.7-14.5 | 2DSD25 | 7/7 | 9.5-48.9 | 2DSD1 | 6/6 | 4.2-12.5 | 2DSD10 |

**TABLE 5-2**
**SUMMARY OF SEDIMENT ANALYTICAL RESULTS - ZONES 1 THROUGH 4**
**AREA A DOWNSTREAM/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT**


| Analyte | ZONE 1(1) Frequency of Detection | ZONE 1(1) Concentration Range | ZONE 1(1) Location of Maximum Detection | ZONE 2(2) Frequency of Detection | ZONE 2(2) Concentration Range | ZONE 2(2) Location of Maximum Detection | ZONE 3(3) Frequency of Detection | ZONE 3(3) Concentration Range | ZONE 3(3) Location of Maximum Detection | ZONE 4(4) Frequency of Detection | ZONE 4(4) Concentration Range | ZONE 4(4) Location of Maximum Detection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cobalt | 15/15 | 3.7-26.6 | 3SD2 | 4/6 | 2.2-4.1 | EC-SDS209 | 7/7 | 5.6-26.7 | EC-SDUP18 | 1/4 | 5.5 | 2DSD10 |
| Copper | 15/15 | 10.6-118 | 3SD2 | 3/6 | 21.7-45.5 | EC-SDS209 | 7/7 | 18.1-94.3 | 2DSD1 | 6/6 | 3.1-36.5 | 2DSD10 |
| Cyanide | 2/13 | 0.23-3.4 | 3SD2 | 1/4 | 0.2 | 2DSD27 | 4/7 | 0.12-21.4 | EC-SDUP18 | 0/2 | - | ND |
| Iron | 15/15 | 8430-195000 | 3SD4 | 6/6 | 1350-23200 | EC-SDS209 | 7/7 | 18900-639000 | EC-SDUP18 | 4/4 | 3510-9930 | 2DSD10 |
| Lead | 15/15 | 5-223 | 3SD2 | 6/6 | 4-661 | EC-SDS209 | 7/7 | 18.7-82 | EC-SDUP18 | 6/6 | 4-15 | NAV90119 |
| Magnesium | 15/15 | 2170-9640 | 3SD2 | 6/6 | 353-2090 | 2DSD25 | 7/7 | 1320-2980 | 2DSD1 | 4/4 | 811-2350 | 2DSD10 |
| Manganese | 15/15 | 104-2850 | EC-SDS102 | 6/6 | 53.3-399 | EC-SDS209 | 7/7 | 129-1300 | EC-SDUP18 | 4/4 | 52.9-177 | 2DSD10 |
| Mercury | 1/13 | 0.33 | 3SD1 | 0/4 | - | ND | 0/5 | - | ND | 2/6 | 0.15-7 | 2DSD31 |
| Nickel | 15/15 | 6.8-44.6 | 3SD2 | 5/6 | 3-25.2 | 2DSD4 | 7/7 | 10.1-46.7 | EC-SDUP18 | 4/6 | 3.1-8.6 | 2DSD10 |
| Potassium | 13/15 | 534-3620 | 3SD5 | 4/5 | 121-412 | 2DSD25 | 6/7 | 910-2390 | EC-SDS313 | 4/4 | 406-1310 | 2DSD10 |
| Selenium | 10/13 | 0.33-3.2 | 3SD4 | 1/4 | 3 | 2DSD4 | 1/6 | 17.8 | EC-SDUP18 | 0/6 | - | ND |
| Silver | 1/13 | 4.3 | 3SD1 | 0/4 | - | ND | 0/6 | - | ND | 0/6 | - | ND |
| Sodium | 14/14 | 200-2070 | 3SD3 | 5/6 | 141-2220 | 2DSD4 | 7/7 | 208-1930 | EC-SDUP18 | 1/4 | 375 | 2DSD10 |
| Thallium | 0/13 | - | ND | 0/5 | - | ND | 0/5 | - | ND | 1/6 | 0.56 | DN-88118 |
| Vanadium | 15/15 | 15-64.9 | 3SD4 | 6/6 | 4.6-86.9 | EC-SDS209 | 7/7 | 11.6-56.7 | EC-SDUP18 | 4/4 | 5.2-21.4 | 2DSD10 |
| Zinc | 15/15 | 18.2-2720 | 3SD2 | 5/6 | 12.2-111 | EC-SDS209 | 7/7 | 48.4-617 | 2DSD1 | 6/6 | 6.3-37.7 | 2DSD10 |
| TCLP (mg/L)(7) | | | | | | | | | | | | |
| Arsenic (5.0) | 2/12 | 0.13-0.16 | 3SD1 | 0/1 | - | ND | 0/3 | - | ND | 0/1 | - | ND |
| Barium (100.0) | 12/12 | 0.041-0.38 | 3SD4 | 1/1 | 0.091 | 2DSD4 | 3/3 | 0.17-0.47 | 2DSD3 | 1/1 | 0.16 | 2DSD10 |
| Cadmium (1.0) | 10/12 | 0.0023-0.045 | 3SD4 | 0/1 | - | ND | 3/3 | 0.009-0.036 | 2DSD1 | 0/1 | - | ND |
| Chromium (5.0) | 1/12 | 0.05 | 3SD3 | 0/1 | - | ND | 0/3 | - | ND | 0/1 | - | ND |
| Lead (5.0) | 0/12 | - | ND | 0/1 | - | ND | 1/3 | 0.11 | 2DSD2 | 1/1 | 0.1 | 2DSD10 |
| Mercury (0.2) | 1/12 | 0.0023 | 3SD5 | 0/1 | - | ND | 0/3 | - | ND | 0/1 | - | ND |
| Selenium (1.0) | 6/12 | 0.0026-0.0296 | 3SD7 | 0/1 | - | ND | 0/3 | - | ND | 0/1 | - | ND |
| Silver (5.0) | 1/3 | 0.0083 | 3SD5 | 0/1 | - | ND | 0/3 | - | ND | 1/1 | 0.0078 | 2DSD10 |

**TABLE 5-2**
**SUMMARY OF SEDIMENT ANALYTICAL RESULTS - ZONES 1 THROUGH 4**
**AREA A DOWNSTREAM/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT**


| Analyte | ZONE 1(1) | | | ZONE 2(2) | | | ZONE 3(3) | | | ZONE 4(4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection | Frequency of Detection | Concentration Range | Location of Maximum Detection |
| MISCELLANEOUS | | | | | | | | | | | | |
| Ash (%) | 2/2 | 26.1-55.2 | 2DSD28 | 1/1 | 72.9 | 2DSD26 | 1/1 | 73.2 | 2DSD21 | | - | NA |
| CEC (meq/100 g)(8) | 2/2 | 15-56 | 2DSD29 | 1/1 | 17 | 2DSD26 | 1/1 | 7 | 2DSD21 | | - | NA |
| pH | 2/2 | 7.16-7.63 | 2DSD28 | 1/1 | 5.08 | 2DSD26 | 1/1 | 7.05 | 2DSD21 | | - | NA |
| Specific gravity (g/cm3) | 2/2 | 1.2-1.7 | 2DSD28 | 1/1 | 1.9 | 2DSD26 | 1/1 | 1.9 | 2DSD21 | | - | NA |
| Total organic carbon (mg/kg) | 11/11 | 1400-53000 | 3DSD4A | 9/9 | 3557-52000 | 20SD33 | 12/12 | 804-30000 | 2DSD18 | | - | NA |

1 Includes samples 112990-3SD1 (0-0.5), 112990-3SD6 (0-0.5) (field duplicate of 112990-3SD1 (0-0.5)), 11299D-3DS1 (1-1.5), 112990-3SD2 (0-0.5), 112990-3SD2 (1-1.5), 112990-3SD3 (0-0.5), 112990-3SD3 (1-1.5), 112990-3SD4 (0-0.5), 112990-3SD4 (1-1.5), 112990-3SD5 (0-0.5), 112990-3SD5 (1-1.5), 120390-2DSD5, 120390-2DSD6 (field duplicate of 120390-2DSD5), 2DSD28, 2DSD29, 3DSD4A, 3SD6, 3SD6 (0-1), 3SD7, EC-SDOP04-02, EC-SDOP05-02 (4/11/95), EC-SDOP05-02 (7/19/95), EC-SDOP06-02, DUP-06 (field duplicate of EC-SDOP06-02), EC-SDS101-02, EC-SD101-02, and EC-SDS103-02. Maximum values are used for evaluation of sediment sample results and are counted as one sample.
2 Includes samples 120390-2DSD4, 2DSD24, 2DSD25, 2DSD26, 2DS027, 2DSD33 (field duplicate of 2DSD27), EC-SDLP10-2, EC-SDLP11-2, EC-SDLP12-2, EC-SDS207-02, EC-SDS208-02, EC-SDS209-02, and DUP-05 (field duplicate of EC-SDS209-02). Maximum values are used for evaluation of duplicate sediment sample results and are counted as one sample.
3 Includes samples 120390-2DSD1, 120390-2DSD2, 120390-2DSD3, 2DSD18, 2DSD19, 2DSD21, EC-SDS313-02, EC-SDS314-02, EC-SDS315-02, EC-SDS419-02, EC-SDS420-02, EC-SDS421-02, EC-SDUP16-02, EC-SDUP17-02, and EC-SDUP18-02.
4 Includes samples 120390-2DSD10, 2DSD30, 2DSD31, 2DSD32, DN-88118, and NAV90119.
5 ND - Not Detected.
6 NA - Not Analyzed.
7 Values in parentheses represent Federal Toxicity Characteristic Regulatory Level (58 FR 46049).
8 Cation exchange capacity.
"-" Implies not applicable if the analyte was not analyzed for or if it was analyzed for but not detected.

**TABLE 5-3**
**SUMMARY OF SEDIMENT ANALYTICAL RESULTS**
**OFFSITE REFERENCE AREAS FOR AREA A DOWNSTREAM/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT**


| Sample Number: | EC-SDF828-02 | EC-SDF829-02 | EC-SDNP22-2 | DUP-04 | EC-SDNP23-2 | EC-SDNP24-2 | EC-SDPP25-02 | EC-SDPP26-02 | EC-SDPP27-02 |
|---|---|---|---|---|---|---|---|---|---|
| Location: | EC-SDFB28 | EC-SDFB29 | EC-SDNP22 | EC-SDNP23 | EC-SDNP23 | EC-SDNP24 | EC-SDPP25 | EC-SDPP26 | EC-SDPP27 |
| Sample Date: | 04/08/95 | 04/08/95 | 04/08/95 | 04/08/95 | 04/08/95 | 04/08/95 | 04/11/95 | 04/10/95 | 04/11/95 |
| Ecological Area: | Fishtown Brook | Fishtown Brook | Niantic Pond | Niantic Pond | Niantic Pond | Niantic Pond | Pequot Woods | Pequot Woods | Pequot Woods |
| Investigation: | ECO-2 | ECO-2 | ECO-2 | ECO-2 | ECO-2 | ECO-2 | ECO-2 | ECO-2 | ECO-2 |
| Sample Type: | GRAB | GRAB | GRAB | GRAB | GRAB | GRAB | GRAB | GRAB | GRAB |
| Status: | | | | | | | | | |
| VOLATILES (ug/kg) | | | | | | | | | |
| 2-Butanone | 13 U | 100 J | | 80 J | 83 UR | | | 83 UR | |
| Ethylbenzene | 13 U | 26 J | | 91 UR | 83 UR | | | 83 UR | |
| Toluene | 13 U | 20 J | | 22 J | 83 UR | | | 83 UR | |
| Xyelenes, Total | 13 U | 9 J | | 91 UR | 83 UR | | | 83 UR | |
| SEMIVOLATILES (ug/kg) | | | | | | | | | |
| 4-Methylphenol | 430 U | 410 J | | 820 J | 230 J | | | 600 J | |
| 4-Nitrophenol | 1000 U | 6700 UR | | 7300 UR | 6700 UR | | | 340 J | |
| Benzo(a)anthracene | 430 U | 2800 UR | | 190 J | 2800 UR | | | 480 J | |
| Benzo(a)pyrene | 29 J | 170 J | | 260 J | 2800 UR | | | 500 J | |
| Benzo(b)fluoranthene | 430 U | 2800 UR | | 260 J | 190 J | | | 510 J | |
| Benzo(g,h,i)perylene | 430 U | 2800 UR | | 170 J | 2800 UR | | | 430 J | |
| Benzo(k)fluoranthene | 430 U | 2800 UR | | 280 J | 160 J | | | 480 J | |
| Benzoic acid | 1000 U | 6700 U | | 6600 J | 4000 J | | | 14000 UR | |
| Chrysene | 430 U | 2800 UR | | 310 J | 190 J | | | 750 J | |
| Dibenzo(a,h)anthracene | 430 U | 2800 UR | | 3000 UR | 2800 UR | | | 160 J | |
| Fluoranthene | 25 J | 2800 UR | | 630 J | 380 J | | | 1100 J | |
| Indeno(1,2,3-cd)pyrene | 430 U | 2800 UR | | 190 J | 2800 UR | | | 320 J | |
| Pentachlorophenol | 1000 U | 6700 UR | | 320 J | 6700 UR | | | 150 J | |
| Phenanthrene | 430 U | 2800 UR | | 380 J | 220 J | | | 490 J | |
| Pyrene | 23 J | 2800 UR | | 530 J | 290 J | | | 1200 J | |
| PESTICIDES/PCBs (ug/kg) | | | | | | | | | |
| 4,4'-DDD | 4.6 J | 3200 J | 22 UR | 30 UR | 440 J | 180 J | 4.7 UJ | 28 UR | 25 UR |
| 4,4'-DDE | 4.3 U | 240 J | 22 UR | 30 UR | 28 UR | 21 UR | 4.7 UJ | 28 UR | 25 UR |
| 4,4'-DDT | 4.3 U | 530 J | 22 UR | 30 UR | 60 J | 35 R | 4.7 UJ | 28 UR | 25 UR |
| Alpha-chlordane | 2.2 U | 31 J | 11 UR | 15 UR | 14 UR | 11 UR | 2.4 UJ | 14 UR | 13 UR |
| Dieldrin | 4.3 U | 28 J | 22 UR | 30 UR | 28 UR | 21 UR | 4.7 UJ | 28 UR | 25 UR |
| Endrin | 4.3 U | 28 UR | 22 J | 30 UR | 28 UR | 26 J | 4.7 UJ | 28 UR | 25 UR |
| Heptachlor | 2.2 U | 14 UR | 13 J | 15 UR | 14 UR | 11 UR | 2.4 UJ | 14 UR | 13 UR |
| INORGANICS (mg/kg) | | | | | | | | | |
| Aluminum | 1160 | 8730 | | 3100 J | 4970 J | | | 19500 J | |
| Arsenic | 0.54 U | 4.4 | | 6.9 UR | 10.2 UR | | | 5.5 U | |
| Barium | 13.7 | 139 | | 51.2 J | 86.4 J | | | 242 J | |
| Beryllium | 0.27 U | 2.2 | | 1.4 UR | 2.0 UR | | | 3.2 J | |
| Boron | 0.54 U | 6.4 | | 0.6 U | 15.5 U | | | 8.9 J | |
| Cadmium | 0.27 U | 1.6 UR | | 1.4 UR | 2.0 UR | | | 1.4 J | |

**TABLE 5-3**
**SUMMARY OF SEDIMENT ANALYTICAL RESULTS**
**OFFSITE REFERENCE AREAS FOR AREA A DOWNSTREAM/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT**


| Sample Number: | EC-SDF828-02 | EC-SDFB29-02 | EC-SDNP22-2 | DUP-04 | EC-SDNP23-2 | EC-SDNP24-2 | EC-SDPP25-02 | EC-SDPP26-02 | EC-SDPP27-02 |
|---|---|---|---|---|---|---|---|---|---|
| Location: | EC-SDFB28 | EC-SDFB29 | EC-SDNP22 | EC-SDNP23 | EC-SDNP23 | EC-SDNP24 | EC-SDPP25 | EC-SDPP26 | EC-SDPP27 |
| Sample Date: | 04/08/95 | 04/08/95 | 04/08/95 | 04/08/95 | 04/08/95 | 04/08/95 | 04/11/95 | 04/10/95 | 04/11/95 |
| Ecological Area: | Fishtown Brook | Fishtown Brook | Niantic Pond | Niantic Pond | Niantic Pond | Niantic Pond | Pequot Woods | Pequot Woods | Pequot Woods |
| Investigation: | ECO-2 | ECO-2 | ECO-2 | ECO-2 | ECO-2 | ECO-2 | ECO-2 | ECO-2 | ECO-2 |
| Sample Type: | GRAB | GRAB | GRAB | GRAB | GRAB | GRAB | GRAB | GRAB | GRAB |
| Status: | | | | | | | | | |
| Calcium | 215 | 11900 | | 3220 J | 6610 J | | | 5180 J | |
| Chromium | 3.1 | 13.6 | | 3.1 J | 3.7 J | | | 36.1 J | |
| Cobalt | 0.88 | 9.6 | | 1.4 UR | 3.5 J | | | 14.6 J | |
| Copper | 0.98 | 23.8 | | 34.8 J | 55.7 J | | | 31.0 J | |
| Iron | 1750 | 10900 | | 909 J | 1520 J | | | 33900 J | |
| Lead | 3.2 J | 53.6 J | | 309 J | 703 J | | | 122 J | |
| Magnesium | 417 | 1290 | | 468 J | 708 J | | | 3410 J | |
| Manganese | 27.1 J | 1240 J | | 63.7 J | 118 J | | | 529 J | |
| Nickel | 1.8 | 11.4 | | 4.7 J | 6.9 J | | | 27.3 J | |
| Potassium | 330 U | 1910 UR | | 953 J | 1740 J | | | 2530 U | |
| Selenium | 1.4 U | 7.8 ur | | 5.5 UR | 8.2 UR | | | 9.1 J | |
| Sodium | 51.4 U | 297 UR | | 440 J | 664 J | | | 270 UR | |
| Vanadium | 4.0 | 20.2 | | 5.5 J | 9.0 J | | | 60.4 J | |
| Zinc | 7.7 U | 97.5 | | 35.7 J | 47.0 J | | | 219 J | |
| MISCELLANEOUS PARAMETERS (mg/kg) | | | | | | | | | |
| Total Organic Carbon (mg/kg) | 430 | 5973 | 2342 | 9257 | 6896 | 6068 | 1087 | 3478 | 4273 |

Notes:
1 Blank indicates that the analyte was not analyzed
2 U - Not detected
3 R - Rejected
4 J - Estimated value

## 6.0 SUMMARY OF SITE RISKS

A baseline risk assessment provides the basis for taking action and indicates the exposure pathways that need to be addressed by the remedial action. It serves as the baseline indicating what risks could exist if no action were taken at the site. This section of the ROD reports the results of the baseline risk assessment conducted for the site.

A Risk Assessment (RA) was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants in various media at the Area A Downstream/OBDA. The human health risk assessment procedure followed the most recent guidance from the U.S. EPA (U.S. EPA, December 1989 and March 25, 1991) and regional guidance (U.S. EPA Region I, August 1995, August 1996, and June 1989). The ecological risk assessment procedure followed U.S. EPA (1992) guidance to establish the goals, breadth and focus of the assessment. Several widely used sources in literature were used for the more detailed stages of the ecological risk assessment, as quoted in Section 3.4 of the Phase II RI (B&R Environmental, March 1997).

The human health and ecological risk assessment followed a four step process: (1) contaminant identification, which identified those chemicals which, given the specifics of the site, were of significant concern; (2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure; (3) toxicity assessment, which evaluated the type and magnitude of adverse health and ecological effects due to exposure to the contaminants; and (4) risk characterization, which integrated the two earlier steps to summarize the potential and actual non-carcinogenic (toxic) and carcinogenic (cancer causing) risks posed by contaminants at the site and uncertainties inherent in the risk assessment process.

### 6.1 CONTAMINANT IDENTIFICATION

The Area A Downstream/OBDA is one of a number of sites under evaluation at NSB-NLON. Because of the potential for cumulative risks associated with this site, a single base-wide list of chemicals of concern was developed. This ensured that chemicals were consistently evaluated from location to location even though some of the chemicals included on the list may not have been detected at a particular location. The chemicals evaluated for this area and other sites at NSB-NLON in general are listed below.

<IMG SRC 98003F>

| | | |
|---|---|---|
| Non-carcinogenic PAHs | Carcinogenic PAHs | PCBs<br>(Aroclors 1260 and 1254) |
| Other SVOCs<br>(12 compounds: primarily phthalates and phenols | Pesticides<br>(7 compounds: DDTR, endrin, dieldrin, methoxychlor) | Metals<br>(14 elements: Al, Sb, As, Be, B, Cd, Cu, Fe, Pb, Mn, Hg, Ni, Se, Zn) |
| BTEX compounds<br>(All BTEX compounds) | Chlorinated VOCs<br>(13 compounds) | Other VOCs<br>(4 compounds) |

Notes:
- PAHs: Polynuclear Aromatic Hydrocarbons
- PCBs: Polychlorinated Biphenyls
- BTEX: Benzene, Toluene, Ethylbenzenes and Xylenes
- VOCs: Volatile Organic Compounds
- SVOCs: Semi-volatile Organic Compounds

### 6.2 EXPOSURE ASSESSMENT

Based on information obtained through site visits, inspections, and discussions with personnel at the Area A Downstream/OBDA or involved in future plans for the area, the following potential receptors were identified:

- Older child trespassers and recreational users exposed to surface soil up to a depth of 2.0 feet below surface, surface water, and sediment.

- Construction workers exposed to all soil to a depth of 10 feet below surface, sediment and groundwater.

- Aquatic organisms, terrestrial vegetation, soil invertebrates and terrestrial vertebrates exposed to surface soil, surface water and sediment.

## 6.3 TOXICITY ASSESSMENT

The toxicity assessment for the contaminants of concern (COCs) examines information concerning the potential human health and ecological effects of exposure to COCs. The goal of the toxicity assessment is to provide, for each COC, a quantitative estimate of the relationship between the magnitude and type of exposure and the severity and probability of human health and ecological effects. Toxicity values are integrated with the exposure assessment to characterize the potential for the occurrence of adverse health effects. The toxicological evaluation involves a critical review and interpretation of toxicity data from epidemiological, clinical, animal, and in vitro studies. This review of the data ideally determines both the nature of the health effects associated with a particular chemical, and the probability that a given quantity of a chemical could result in the referenced effect. This analysis defines the relationship between the dose received and the incidence of an adverse effect for the chemicals of concern. The entire toxicological data base is used to guide the derivation of cancer slope factors (CSFs) for carcinogenic effects and Reference Doses (RfDs) for noncarcinogenic effects. These data may include epidemiological studies, long-term animal bioassays, short-term tests, and comparisons of molecular structure. Data from these sources are reviewed to determine if a chemical is likely to be toxic to humans.

The chemicals of concern for ecological receptors are selected based on the finding of chemicals detected in surface soils, surface water, or sediment or predicted body burdens, in concentrations greater than regulation-based criteria (such as ambient water quality criteria), ecological guidance provided by agencies (U.S. EPA, the Ontario Ministry of the Environment, Oakridge National laboratories, National Oceanic and Atmospheric Administration, etc.), and supplemental ecological investigations such as benthic community analyses and sediment toxicity tests. At the Area A Downstream, all of the sources listed above were used, as quoted in Section 3.4 of the Phase II RI (B&R Environmental, March 1997). As appropriate, the guidance provided by one or more of these sources was used in developing chemical specific criteria for the feasibility study.

## 6.4 RISK CHARACTERIZATION

This section on risk characterization presents the results of the risk assessment from the Phase II RI. The first part presents a summary of the human health risk characterization. The second part presents a summary of the ecological risk characterization.

### 6.4.1 Summary of Human Health Risk Characterization

In order to determine if potentially significant risks exist for human receptors, quantitative estimates of risk were compared to "acceptable" levels of risk. Estimated HIs were compared to unity (1.0). Estimated ICRs were compared to the U.S. EPA target risk range of 1E-4 to 1E-6 and the Connecticut target cancer risk of 1E-5.

For Zones 4 through 6, no significant potential human health risks are associated with exposure to soil/sediment. All estimated HIs for incidental ingestion of and dermal contact with soil/sediment are less than 1.0. All estimated ICRs for these exposure routes are within the U.S. EPA target risk range and less than the Connecticut target risk of 1E-5.

For Zones 1 through 3, potentially significant human health risks (noncarcinogenic and/or carcinogenic) were calculated for exposure to soil/sediment. For Zone 1, estimated HIs for the older child trespasser and construction worker exceeded 1.0 under the Reasonable Maximum Exposure (RME) scenario, where receptors are assumed to be exposed to maximum detected contaminant concentrations. Elevated risks for these receptors are primarily attributable to 4.4'-DDT. Estimated HIs were less than 1.0 for exposure to soil/sediment at Zones 2 and 3. Although estimated ICRs for all potential human receptors at Zones 1 through 3 are within the U.S. EPA target risk range, estimated ICRs for exposure to soil/sediment under the RM E scenario exceeded 1E-5 for the construction worker at Zone 1 and the older child trespasser for Zones 1 through 3. In general, elevated carcinogenic risks for these receptors are associated with exposure to pesticides (4,4'-DDD, 4,4'-DDT, and dieldrin) and inorganics, (arsenic and beryllium). Table 6-1 presents a summary of the human health risk characterization for Zones 1 through 3. Risks to the adult recreational user are noted to be at acceptable levels.

A conservative approach to determining the significance of the estimated risks was used by emphasizing the risks associated with the RME scenario. All estimated HIs and ICRs for the Central Tendency Exposure (CTE) scenario, where receptors are assumed to be exposed to average contaminant concentrations, were less than the target risk levels for noncarcinogenic and carcinogenic effects.

Although the human health risks associated with surface water and groundwater are not addressed in this ROD, no potential human health risks were calculated for exposure to surface water (i.e., for incidental ingestion of and dermal contact with surface water, HIs were less than 1.0 and ICRs were within the U.S. EPA target risk range or less than the CTDEP limit of 1E-5). However, HIs associated with dermal exposure to groundwater exceeded 1.0 for the construction worker. Elevated potential hazards for this medium are attributable to antimony and manganese.

Soil and sediment at the site are not considered to be sources of the observed antimony and manganese contamination in groundwater. Although manganese was detected frequently in the soil/sediment at the site, the presence of this metal in the groundwater at the Area A Downstream/OBDA site is considered to be attributable to naturally occurring conditions. Manganese has been widely detected in the groundwater at concentrations of concern at various sites throughout the Base.

In summary, as shown in Table 6-2, potential human health risks associated with exposure to soil/sediment at the Area A Downstrearn/OBDA site are attributable to pesticides and inorganics. The older child trespasser faces a potential health risk exceeding the acceptable limit for cumulative Hazard Index of 1.0. The construction worker faces potential health risks exceeding the acceptable limits of cumulative Hazard Index of 1.0 and Cumulative Incremental Cancer Risk of 1E-5. Remediation Goals for these chemicals are presented in Table 6-3. These Remediation Goals are contaminant concentrations that would reduce the potential health risks to the receptors of concern (i.e., the older child trespasser and construction workers) to acceptable levels.

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### 6.4.2 Summary of Ecological Risk Characterization

An ecological risk assessment was conducted for the Area A Downstream/OBDA as part of the Phase II RI, based on samples of surface sails (0-2'), surface water, and sediment. Aquatic organisms (including benthic organisms), terrestrial vegetation, soil invertebrates, and terrestrial vertebrates were selected as indicator groups to assess potential impacts to ecological receptors at the Area A Downstream/OBDA. The following species were used to assess potential risk to terrestrial vertebrates inhabiting this portion of NSB-NLON:

- Short-tailed shrew
- Barred owl
- Raccoon
- Mallard duck

Table 6-4 summarizes the potential risks to these receptors. Pesticides and to a lesser extent inorganics pose an unacceptable level of risk to these receptors. Potential risks to ecological receptors can be estimated using a Hazard Quotient (HQ) or Hazard Index (HI). HQ values provide a measure of the exceedance of contaminant concentrations compared to thresholds levels for toxicity to organism. An HI value is a sum of MCI values for each organism considering various contaminants or pathways of exposure.

#### 6.4.2.1 Terrestrial Plants and Invertebrates

DDTR and heptachlor epoxide were identified as likely to cause harm to terrestrial receptors. These pesticides, being organochlorine in nature, are not known to have herbicidal (i.e., terrestrial plant) effects. Risks to soil invertebrates exposed to pesticide-contaminated soil were evaluated by estimating the concentration of each pesticide present in soil moisture and comparing this concentration to toxicological endpoints protective of these receptors. The results of these comparisons indicated that DDTR and helotachlor epoxide did not represent a risk to soil invertebrates. Although a soil invertebrate survey and several earthworm toxicity studies were performed to assess the potential impact of contaminated soils on soil invertebrates at the Area A Downstream/OBDA, the results of these efforts were difficult to interpret.

## TABLE 6-2

**SUMMARY OF HUMAN HEALTH CHEMICALS OF CONCERNS (COCs)**
**AREA A DOWNSTREAM/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT**

| Zone | COCs (1) | | Potential Human Receptor |
|---|---|---|---|
| | Noncarcinogenic Effects | Carcinogenic Effects | |
| 1 | 4,4'-DDT | 4,4'-DDD, 4,4'-DDT | Construction Worker |
| | 4,4'-DDT | 4,4'-DDD, 4,4'-DDT, arsenic | Older Child Trespasser |
| 2 | None (2) | 4,4'-DDD, 4,4'-DDT, dieldrin, arsenic | Older Child Trespasser |
| 3 | None | 4,4'-DDD, dieldrin, arsenic, beryllium | Older Child Trespasser |

1 Chemicals associated with a Hazard Index of 1.0 and/or an incremental cancer risk of 1E-6.
2 Cumulative Hazard Indices are less than 1.0.

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## TABLE 6-4

**SUMMARY OF POTENTIAL CHEMICAL-SPECIFIC RISKS TO ECOLOGICAL RECEPTORS OF CONCERN**
**AREA A DOWNSTREAM/OBDA**
**NAVAL SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT**

| Contaminant | Aquatics HQ | Benthos HQ | Mallard HI | Raccoon HI | Shrew HI | Owl HI |
|---|---|---|---|---|---|---|
| DDD | 704 | 9765.0 | 29700.0 | 2.8 | 31.0 | 1500.0 |
| DDE | 110 | 4410.0 | 17503.0 | | 3.7 | 180.0 |
| DDT | 360 | 610.1 | 1326.7 | | 180.0 | 9000.0 |
| Heptachlor epoxide | | | | | 170.0 | 3.2 |
| Dieldrin | | 1808.0 | | | | |
| Aluminum | 3.9 | 1.1 | 1.2 | 5.4 | | |
| Antimony | | | | 45.0 | | |
| Arsenic | | 1.7 | | | | |
| Barium | 10.6 | 7.7 | | 1.0 | | |
| Cadmium | 1.4 | 11.8 | | | | |
| Chromium | | 1.7 | | | | |
| Cobalt | 1.1 | | | | | |
| Copper | 1.1 | 3.0 | | | | |
| Cyanide | | 24.3 | | | | |
| Iron | 3.7 | | | | | |
| Lead | 1.2 | 11.0 | | | | |
| Manganese | 9.1 | 1.4 | | | | |
| Nickel | | 1.9 | | | | |
| Selenium | | 11.6 | | | | |
| Vanadium | | | | 2.5 | | |
| Zinc | 2.2 | 3.0 | | | | |

Notes:
1 Hazard Quotient (HQ) or Hazard Index (HI) based on average concentrations (not maxima). Only contaminants with an HQ or HI values > 1 are listed. Only HQs or HIs > 1.0 listed in text tables were used to calculate means; if HQs or HIs for an area were not high enough to be included in tables, zero values were not included in the calculation of the mean.

#### 6.4.2.2 Aquatic Organisms

Risks to aquatic organisms were evaluated by taking the ratios (hazard quotients, or HQs) of exposure concentrations to ambient water quality criteria. Table 6-4 shows that average (across areas) exposure levels for DDTR and dieldrin result in high potential for ecological risk (as noted by the Hazard Quotients or HQs and Hazard Indices or HIs), while common metals have moderate potential ecological risk and metals like cadmium, lead, and copper have low potential for posing ecological risks.

Macroinvertebrate sediment toxicity tests were conducted for the Phase II RI to determine if sediment collected from the Area A Downstream/OBDA were toxic. Mortality of test organisms exposed to some sediment samples collected from Area A Downstrearn/OBDA which is composed of Upper Pond, Lower Pond, OBDA Pond, and Stream 1-4 was statistically significantly greater than that recorded for organisms exposed to sediment collected from the reference locations. Survival of two benthic macroinvertebrate species, Chironomus tentans and Hyalella azteca was extremely low in most sediments and 100% mortality occurred in Lower Pond sediments. Other physical and chemical characteristics of the sediment (e.g. high concentrations of organic matter, low dissolved oxygen content and possibly hydrogen sulfide) collected from these streams and ponds could have contributed to the observed adverse effect. However, these sediment toxicity test results show that some sediments in the Area A Downstream/OBDA adversely impact benthic macroinvertebrates.

A triad score method (that used measures of three critical components of ecological effects) was used to assess the ecological risk. The sediment triad scores were used to compare Area A Downstream/OBDA water bodies to reference locations in terms of sediment chemistry, toxicity, and macroinvertebrate (e.g., aquatic insects, snails, worms) characteristics. Differences between reference and site locations in toxicity scores are apparent from the sediment triad ranks in Table 6-5.

Chemical data used for a scoring of one of the three components of the triad utilized sediment concentrations of 18 inorganic (including toxic metals) and 36 organic (including DDTR) analytes. For each analyte, the concentrations from each water body were scaled so that the values ranged from 1 to 100. The scaling retained proportional relationships of the original data, while providing a standard scale for all measurements. The standard scale gave each measurement (i.e., concentration for chemicals) the same weight as other measurements in the final triad summation. The scaled scores were summed to give the values listed as "Sum Rank Inorganic" and "Sum Rank Organic" for each water body (Table 6-5). These two values were added together for each water body to yield the "Total Chemical Sum." The "Total Chemical Sums" for each water body were then scaled from 1 to 100 in the same manner as described above, and the result listed as "Total Chemical Rank."

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The other two components of the triad concerned sediment toxicity and macroinvertebrate community analysis. Results of sediment toxicity testing and macroinvertebrate community analysis were treated similarly. However, some date were inverted before scaling in order to make sure that higher values on every scale indicated worse biological conditions. For example, growth measurements in the FETOX test were inverted before scaling, so that lower growth rates would come out higher (indicating more toxic conditions) on the final scale. Scaled responses of test organisms in toxicity experiments (e.g., mortality, growth) were summed to yield a "Tox Test Sum" for each water body. Likewise, scaled measurements of macroinvertebrate community structure (e.g., density, number of species) were summed to yield a "Taxonomic Sum" for each water body. As with the chemical data, the sums for toxicity and taxonomy were scaled from 1 to 100, resulting in "Tox Test Rank," and "Taxonomic Rank" scores. The final step in the triad process was the summing of the "Total Chemical Rank," "Tox Test Rank," and "Taxonomic Rank" scores for each water body, giving the "Overall Rank." The "Overall Rank" had a potential value of 3 to 300, with higher scares indicating worse biological conditions.

Samples were also collected to characterize the benthic macroinvertebrate community present at the Area A Downstream/0BDA water bodies. Although macroinvertebrates were present, community parameters (e.g. population density, community diversity) were generally lower than those calculated for samples collected from reference locations. Differences between reference and site locations in taxonomic scores are apparent from the sediment triad ranks in Table 6-5. When coupled with the results of sediment toxicity tests conducted on samples collected from these same locations, the results of the characterization lend support to the conclusion that sediments within the Area A Downstream/0BDA represent a significant risk to benthic macroinvertebrates.

#### 6.4.2.3 Terrestrial Vertebrates

The amount of DDTR to which terrestrial vertebrates may be exposed was determined by calculating the total dose to these receptors received from ingestion of contaminated prey, incidental ingestion of soil/sediment, and from drinking water. In the models used to assess risks, barred owls were assumed to be exposed to contaminants through the consumption of prey (short-tailed shrews), ingestion of contaminated water, and through the incidental ingestion of contaminated soil. Short-tailed shrews were assumed to be exposed through the consumption of contaminated prey (earthworms), consumption of contaminated water, and the incidental ingestion of soil. Earthworms were assumed to bioaccumulate directly from contaminated soil. Mallards and raccoons were assumed to be exposed through the ingestion of contaminated prey (oligochaete worms and frogs, respectively), contaminated water, and the incidental consumption of sediment. Oligochaetes (benthic macroinvertebrates) were assumed to bioaccumulate contaminants present in sediment in the same manner as earthworms.

Several conservative assumptions such as assuming home range consisted of the entire site were made on the input parameters to the food-chain modeling. However, more realistic exposure parameters were incorporated into the food-chain modeling modified in the Feasibility Study (B&R Environmental, July 1997). The risk assessment did determine that exposure to contaminated soils represent a potential risk to terrestrial vertebrates such as the short-tailed shrew, barred owl, mallards, and raccoons. Based on the modeling results, the potential risks to the terrestrial vertebrates of concern are presented in Table 6-4.

### 6.4.2.4 Remediation Goals for Protection of Ecological Receptors

Remediation goals consisting of concentration limits of pesticides and inorganics for protection of ecological receptors of concern are presented in the following discussion and in Table 6-6. Because of the differences in the biochemical properties of pesticides and inorganics, the following discussion presents separate discussions for the derivations of their respective remediation goals.

Pesticides Remediation Goals

Pesticides Remediation Goals for contaminated soil were estimated for food-chain protection (i.e., acceptable ERA levels) of terrestrial vertebrates, the selected terrestrial vertebrate species consisted of the barred owl, the short-tailed shrew, the raccoon and the mallard duck. Allowable soil concentrations of pesticides for the four selected terrestrial vertebrate species were calculated by comparing the predicted doses of pesticides from food chain models to species-specific Lowest Observable Adverse Effects Level (LOAEL) values obtained from literature.

In addition, Pesticide Remediation Goals for sediment were estimated for protection of benthic macroinvertebrates. Allowable sediment concentration of pesticides for the benthic macroinvertebrates were evaluated in two ways: 1) by comparing water quality guidelines for DDTR against the potential for the DDTR present in the sediment to partition into the pore water using equilibrium partitioning and 2) by evaluating the relationship between macroinvertebrates community characteristics, sediment toxicity results and sediment DDTR concentration.

This approach yielded remediation goals of 5.6 mg/kg DDTR for soils and 2 mg/kg DDTR for sediment. These were selected as the most appropriate remediation goals for all receptors and both media, irrespective of location on site. Remediation goals for dieldrin were estimated to be in the range of 0.045 mg/kg to 0.195 mg/kg in the sediment. A final remediation goal for dieldrin in sediment will be selected at the time of remedial design.

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Inorganics Remediation Goals

Inorganics, Remediation Goals were selected as National Oceanographic and Atmospheric Administration (NOAA) Effects Range Median (ER-M) values for the inorganic COCs. Inorganics were identified as contaminants of concern in sediment and not in soil. By setting ER-M values as remedial goals, the mean residual concentrations following remediation will be within the range where "occasional" adverse effects may be expected, which is assumed to be acceptable. ER-Ms are presented in Table 6-6 along with a range/maximum concentrations for the inorganic contaminants of concern.

Based on the average concentrations exceeding ER-M values, the following COCs are being assigned corresponding ER-M values as remediation goals:

- Cadmium = 9.6 mg/kg
- Lead = 218 mg/kg
- Zinc = 410 mg/kg

### 6.4.3 Discussion of Uncertainty Factors

Uncertainties in human health risk assessment arise from:

- Selection of COCs
- Exposure assessment
- Toxicological evaluation
- Risk characterization.

Uncertainty in the selection of COCs is associated with the current status of the predictive data bases and the procedures used to include or exclude constituents as chemicals of concern.

Uncertainty associated with the exposure assessment is associated with the values used as input variables for a given intake route, the methods used and the assumptions made to determine exposure point concentrations, and the predictions regarding future land use and population characteristics.

Uncertainty in the toxicity assessment is associated with the quality of the existing data to support dose response relationships, and the weight-of-evidence used for determining the carcinogenicity of chemicals of concern.

Uncertainty in risk characterization is associated with exposure to multiple chemicals and the cumulative uncertainty from combining conservative assumptions made in earlier activities.

While the procedures for human health risk assessment are somewhat standardized and consequently the uncertainty factors are controlled, the procedures for ecological risk assessment are less standardized. The following discussion summarizes these uncertainty factors and states the salient assumptions for ecological risk assessment (ERA).

In order to understand how useful or appropriate the results of the ERA are, the uncertainties associated with the assessment need to be considered. Uncertainties from fairly well-known sources, like errors in sampling and measurement, will affect the assessment. More serious uncertainties may stem from lesser known sources, such as how available environmental contaminants are for uptake by exposed plants and animals, and how well toxicological studies on laboratory subjects relate to organisms in nature. A brief outline of the uncertainties in the ERA includes:

Sources of error or variability:

- Sampling and measurement
- Data handling and analysis

Incomplete knowledge of the relationship between measured contaminant concentrations and actual exposure to contaminants:

- Spatial and temporal factors (e.g., lack of feeding in areas of highest or lowest contaminant concentrations)
- Availability of contaminants for uptake by organisms
- Transfer of contaminants in food chains

Incomplete knowledge of toxicology:

- Use of non-native organisms and unnatural situations in experiments
- Applicability of length of the experiment and the effects measured
- Effects of toxicant mixtures

For the most part, assumptions are made corresponding to uncertainties in the ERA. The following list of assumptions may help clarify the nature of the uncertainties:

Sampling and Data Handling

Errors in the design of the sampling program, performance of sampling, analytical measurement, data handling, and data analysis do not have a significant affect on the results of the ERA. Therefore, assumptions are not relevant to this aspect of the input.

Exposure

- Proportion of site size to individual's home range is an adequate exposure factor
- Animals are exposed throughout the year
- No degradation or loss of contaminants from system
- 100 percent of each contaminant is available for uptake by organisms
- Contaminant transfer from one level of a food chain to the next is adequately described by a single factor

Toxicology

- Experimental conditions apply adequately to those at Area A Downstream
- Toxicants do not affect each others' actions via synergistic or antagonistic effects

Uncertainties were reduced and some assumptions avoided through the use of biological data collected in Area A Downstream. A factor for the transfer of DDTR from soil to soil invertebrates (earthworms) was based on field measurements rather than literature values. Also, the sediment RAO for DDTR was based on an analysis of biological field data, results of sediment toxicity testing, and sediment concentrations of DDTR. Use of measured responses of native and laboratory animals to site sediment eliminated uncertainty due to application of toxicity data from literature sources and reduced the uncertainty associated with exposure assumptions.

## 6.5 CONCLUSION

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present a current or potential threat to public health, welfare, or the environment.

# 7.0 REMEDIAL ACTION OBJECTIVES AND DEVELOPMENT OF ALTERNATIVES

This section describes the remedial action objectives and the development of alternatives. Alternatives are developed for contaminated soil and sediment to meet remedial action objectives for these media.

## 7.1 STATUTORY REQUIREMENTS/RESPONSE OBJECTIVES

Under its legal authorities, the U.S. Navy's primary responsibility at NPL sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that the U.S. Navy's remedial action, when complete, must comply with all federal and more stringent state environmental standards, requirements, criteria or limitations, under an environmental or facility siting law unless a waiver is granted; a requirement that the U.S. Navy select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment that permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Remedial alternatives were developed to be consistent with these Congressional mandates.

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, RAOs were developed to aid in the development of alternatives. These remedial action objectives were developed to mitigate existing and future potential threats to public health and the environment. These remedial action objectives are as follows:

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

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

- Protection of ecological receptors by preventing contaminated soil (containing DDTR concentrations exceeding 5.6 mg/kg rounded down to 5.0 mg/kg, to be conservative) and contaminated sediment (containing DDTR concentrations exceeding 2.0 mg/kg and dieldrin concentrations exceeding 0.045 mg/kg to 0.195 mg/kg) from entering the food chain.

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

**ESTIMATED VOLUMES OF CONTAMINATED MEDIA**

The most prevalent COC present at concentrations exceeding remediation goals is DDTR. The contaminated media are the soil and sediment that contain DDTR at concentrations exceeding their respective remediation goals of 5.0 mg/kg and 2.0 mg/kg of DDTR. These remediation goals are more stringent than those for protection of human receptors and, therefore, would be protective of both ecological and human receptors.

Figures 7-1 and 7-2 show the areas of soil and sediment, respectively, that are assumed to contain DDTR at concentrations exceeding remediation goals. The area of contaminated soil exceeding remediation goals is estimated to be 2.7 acres, and the area of contaminated sediment exceeding remediation goals is estimated to be 1.9 acres. Assuming an average depth of contamination of 2.5 feet in soil and ranging from 2.0 to 2.5 feet (average of 2.3 feet) in sediment, the total volume of contaminated media is estimated at approximately 18,000 cubic yards, including 11,000 cubic yards of soil and 6,800 cubic yards of sediment. The estimated volume of sediment containing the inorganic COCs exceeding remediation goals (i.e., cadmium, lead and zinc) is approximately 5,460 cubic yards within the overall DDTR-contaminated sediment volume. Because of the relatively low occurrence of dieldrin in the sediment, all of the dieldrin contaminated sediment containing dieldrin at concentrations exceeding remediation goals are expected to be within the DDTR and inorganic-contaminated sediment volumes. The definition of the extent of contamination is very approximate and must be confirmed with additional sampling prior to remedial action.

## 7.2 TECHNOLOGY SCREENING AND ALTERNATIVE DEVELOPMENT

CERCLA and the NCP have set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a list of potential technologies were screened for effectiveness, implementability, and cost in attaining the remedial action objectives for contaminated soil and sediment. A range of alternatives were developed from the technologies that were retained from screening.

The FS developed a range of alternatives considering the CERCLA statutory preference for a treatment that reduces the toxicity, mobility, or volume of the hazardous substances. This range included an alternative that removes or destroys hazardous substances to the maximum extent feasible, eliminating or minimizing to the degree possible the need for long-term management. This range also included an alternative that removes the threat posed by the contaminated media at the site with little or no treatment onsite but disposes of the material at an offsite facility where the material would be managed in a manner that would minimize any risk of threat to human health or release to the environment. The range also includes an alternative that involves little or no treatment onsite but provides protection through engineering or institutional controls, and a no action alternative.

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# 8.0 DESCRIPTION OF ALTERNATIVES

This section provides a narrative summary of the alternatives that were evaluated in the FS. The alternatives were as follows: (1) No Action, (2) Capping with Institutional Controls, (3) Excavation/Dredging of Soil/Sediment, Dewatering, Offsite Disposal, and (4) Excavation/Dredging of Soil/Sediment, Dewatering, Onsite Thermal Desorption of Soils/Sediment, Onbase Reuse of Treated Soil, and Offsite Disposal of Sediment.

## 8.1 ALTERNATIVE 1: NO ACTION

No Action, as the name indicates, is a status-quo alternative. No Action is an alternative that is required to be evaluated under Superfund Law to provide the baseline for comparing the benefits of other alternatives. This alternative is typically not selected unless the risks of doing nothing are acceptable to human health and environment.

This alternative would not comply with the following key Applicable or Relevant and Appropriate Requirements (ARARs):

- CTDEP Remediation Standard Regulation (criteria developed for direct exposure to potential receptors would be applicable).
- Executive Order for Protection of Wetlands (applicable because of the presence of wetlands at the site).
- Coastal Zone Management Act (applicable because the site is present in a coastal area).

Furthermore, this alternative would not comply with the remediation goals. At this site the No Action alternative would result in contamination being left in place which would be a continued threat to human health and environment.

**8.2 ALTERNATIVE 2: CAPPING, RESTORATION OF WETLANDS AND WATERWAYS, AND INSTITUTIONAL CONTROLS**

Capping would consist of the placement of a clean soil cover and a biotic barrier over the contaminated soils and sediment. All of the groundwater seepage and surface water run on into the, site from the adjacent Area A wetland and Area A Landfill will be diverted to bypass the areas of proposed capping and be discharged into downstream culverts. Under this alternative, the standing water in the streams and ponds (remaining after the groundwater and surface water inflow to the site have been diverted around the site) would first be pumped, treated by filtration and granular activated carbon (GAC) adsorption at a wastewater treatment facility to be constructed at a nearby location, and discharged. A permeable layer of clean soil would be placed over the sediment areas that exceed remediation goals. A layer of gravel would be placed on top of the clean soil to control erosion of the soil cover. The soil outside of the ponds and streams would be cleared of vegetation to the extent necessary to provide access to the underlying contaminated surface soil. The surface soil would then be covered with a layer of clean soil and a layer of topsoil and revegetated with the native wetland vegetation species of flora. A stainless steel wire mesh will be placed approximately mid-depth in the cover material to serve as a biotic barrier. The diversion of surface water and groundwater inflows to the remediated area will be discontinued and the flow will be re-established through the reconstructed waterways. The function and value of the wetlands will be replaced according to state and federal standards, as determined during remedial design. Residues from wastewater treatment (spent filter elements and 10 tons of GAC) would be disposed of off site.

Institutional controls (fencing and security) would ensure that the soil cover is not disturbed by trespassers. Monitoring of contaminated media would be conducted to assess any migration or need for future action. Moreover, in the event of future transfer of property, the deed would carry records of the contamination and restrict potential land development.

This alternative would comply with the following main location-specific ARARs:

- Executive Order for Protection of Wetlands (applicable because of the presence of wetlands at the site).
- Federal Clean Water Act, Section 404 (applicable to filling of wetlands).
- Coastal Zone Management Act (applicable because the site is present in a coastal area).
- State of Connecticut Inland Wetlands and Watercourses (applicable to work in wetlands and watercourses).

The alternative would comply with chemical-specific ARARs and TBCs particularly the State of Connecticut Remediation Standards for soil.

This alternative would also comply with all action-specific ARARs, key among which are:

- State of Connecticut Water Pollution Control and Water Quality Standards (applicable to discharge of treated surface water).
- Hazardous Waste Management: Listing and Identification (applicable for testing hazardous characteristics of DW/WWT residues).
- Hazardous Waste Management: Generator Standards (potentially applicable for handling of DW/WWT residues).

| | |
|---|---|
| Estimated Time for Construction: | 6 months |
| Capital Cost: | $2,561,000 |
| Operating and Maintenance Cost: | $20,000 per year with site review every 5 years ($20,000 per event) + $50,000 (wetland restoration total cost for years 0 through 5) |
| Total Cost (as present worth): | $2,968,000 |

## 8.3 ALTERNATIVE 3: EXCAVATION/DREDGING, ONSITE DEWATERING, AND OFFSITE DISPOSAL OF SOIL/SEDIMENT; RESTORATION OF WETLANDS AND WATERWAYS; AND MONITORING

Under this alternative, all of the groundwater seepage and surface water run on into the site from the adjacent Area A Wetland and Area A Landfill will be diverted to bypass the areas of the proposed excavation and be discharged into downstream culverts. Then, the standing water in the streams and ponds (remaining after the groundwater and surface water inflow to the site have been diverted around the site) would be pumped, treated on site by filtration and GAC adsorption at a Dewatering/Wastewater Treatment (DW/WWT) facility to be constructed at a nearby location and discharged. The contaminated sediment would then be excavated. The contaminated soil outside of the ponds and streams would be cleared of all vegetation and excavated. The excavated soil and sediment would be staged separately and transported to the DW/WWT dewatering facility where these materials would be dewatered in a stockpile. Approximately 23,000 tons of dewatered soil and sediment would be transported off site for disposal. The excavated areas will be backfilled with clean material and wetlands and waterways reconstructed. The wetlands functions and values will be restored according to state and federal standards, as determined during remedial design.

The drainage wastewater from the stockpile would be treated by filtration and GAC adsorption for removal of TSS and DDTR. The residues from dewatering and wastewater treatment (600 tons of clogged filter sand, spent filter elements, and 10 tons GAC) would be disposed of off site. Depending on the concentration of DDTR and hazardous characteristics, the dewatered material and wastewater treatment residues would be disposed of at a nonhazardous waste landfill or a RCRA hazardous waste landfill.

This alternative would comply with the following main location-specific ARARs:

- Executive Order for the Protection of Wetlands (applicable because of the presence of wetlands at the site).
- Federal Clean Water Act, Section 404 (applicable to filling of wetlands).
- Coastal Zone Management (applicable because the site is present in a coastal area).
- State of Connecticut Inland Wetlands and Water courses (applicable to work in wetlands and water courses).

The removal of contaminated material from the site by excavation and offsite disposal, followed by site restoration of wetland and waterway functions and values would achieve compliance with the above ARARs. Furthermore, this alternative would comply with chemical-specific ARARs and TBCs, particularly the State of Connecticut Remediation Standards for Soil.

This alternative would also comply with all action-specific ARARs, key among which are:

- State of Connecticut Water Pollution Control and Water Quality Standards (applicable to discharge of treated wastewater).

Hazardous Waste Management Listing and Identification (applicable for testing hazardous characteristics of excavated soil/sediment and DW/WWT residues).

- Hazardous Waste Management: Generator Standards (potentially applicable for excavated soil/sediment and DW/WWT residues).
- Hazardous Waste Management: Treatment/Storage/Disposal Facility Standards (potentially applicable to the dewatering treatment of soil/sediment and storage of excavated soil/sediment and DW/WWT residues).

Estimated Time for Remedial Action: 12 months
Estimated Cost: $8,125,000 (including wetland restoration total cost for years 0 to 5)

## 8.4 ALTERNATIVE 4: EXCAVATION/DREDGING, ONSITE DEWATERING AND THERMAL DESORPTION OF SOIL/SEDIMENT; ONBASE REUSE OF TREATED SOIL; OFFSITE DISPOSAL OF SEDIMENT; RESTORATION OF WETLANDS; AND MONITORING

Under this alternative, all of the groundwater seepage and surface water run on into the site from the adjacent Area A Wetland and Area A Landfill will be diverted to bypass the areas of the proposed excavation and be discharged into downstream culverts. Then, the standing water in the streams and ponds (remaining after the groundwater and surface water inflow to site have been diverted around the site) would first be pumped, treated on site by filtration and GAC adsorption, at a DW/WWT facility to be constructed at a nearby location, and discharged. The contaminated sediment would then be excavated. The contaminated soil outside of the ponds and streams would be cleared of all vegetation and excavated. The excavated soil and sediment would be staged separately and transported to the DW/WWT facility where they would be dewatered in separate stockpiles to produce a total of approximately 23,000 tons of dewatered material. The excavated areas will be backfilled with clean material and wetlands and waterways reconstructed. The wetlands functions and values will be restored according to state and federal standards, as determined during remedial design.

The wastewater would be treated by filtration and GAC adsorption, and discharged. Approximately 11,000 tons of dewatered soil would be treated by thermal desorption for removal of DDTR to meet the soil PRG of 5 mg/kg. The off-gas would be treated and vented to the atmosphere. All of the dewatered sediment would be disposed of off site at a nonhazardous waste landfill. If a portion of the sediment contain DDTR in excess of limits deemed acceptable by the nonhazardous waste landfill, it would first be treated onsite by thermal desorption. None of the sediment can be treated and backfilled on site because inorganic COCs in the sediment would remain untreated. The treated soil would be reused at a suitable location onbase above the seasonal high water table elevation. Appropriate reuse locations onbase would be determined during remedial design. Although the soil would be treated to meet remediation goals for pesticides, it cannot be backfilled on site. This is because the State's remediation standards require attainment of background levels for organics and inorganic COCs to allow backfilling on site in areas (such as most of contaminated areas of Area A Downstream/OBDA) that are below the seasonal high water table elevation. The drainage wastewater from the dewatering stockpiles would be treated by filtration and GAC adsorption for removal of DDTR. The residues from dewatering, and wastewater treatment (600 tons of clogged filter sand, spent filter elements, and 20 tons of spent GAC), and offgas treatment (16 tons of spent activated carbon) would be disposed of off site at a suitable nonhazardous or hazardous waste landfill depending on their DDTR levels and hazardous characteristics.

This alternative would comply with the following main location-specific ARARs:

- Executive Order for the Protection of Wetlands (applicable because of the presence of wetlands at the site).
- Federal Clean Water Act, Section 404 (applicable to filling of wetlands).
- Coastal Zone Management (applicable because the site is present in a coastal area).
- State of Connecticut Inland Wetlands and Water courses (applicable to work in wetlands and water courses).

The removal of contaminated soil and sediment from the site by excavation, treatment with offsite disposal of sediment and treatment with onbase reuse of soil, followed by restoration of the site's wetland functions and values would achieve compliance with the above ARARs. Furthermore, this alternative would comply with chemical-specific ARARs and TBCs, particularly the State of Connecticut Remediation Standards for soil. This alternative would also comply with all action-specific ARARs, key among which are:

- State of Connecticut Water Pollution Control and Water Quality Standards (applicable to discharge of treated DW/WW).
- Hazardous Waste Management: Listing and Identification (applicable for testing hazardous characteristics of excavated soil/sediment, DW/WWT residues and thermal desorption residues).
- Hazardous Waste Management: Generator Standards (potentially applicable to excavated soil/sediment, DW/WWT residues and thermal desorption residues).
- Hazardous Waste Management: Treatment/Storage/Disposal Facility Standards (potentially applicable to the dewatering treatment of soil/sediment and storage of excavated soil/sediment and DW/WWT residues).
- Resource Conservation and Recovery Act, Treatment Standards for Hazardous Debris-Thermal Desorption (applicable for treatment of contaminated soil and sediment onsite although they are not expected to be hazardous wastes).
- Federal and State of Connecticut Air Pollution Control (applicable to emissions from the thermal desorber).

Estimated Time for Remedial Action: 24 months
Capital Cost: $9,505,000 (including wetland restoration total cost for years 0 to 5)

## 9.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that, at a minimum, the U.S. Navy is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

### 9.1 EVALUATION CRITERIA USED FOR DETAILED ANALYSIS

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select an interim site remedy. Section 9.2 contains a summary of the comparison of each alternative's strengths and weaknesses with respect to the nine evaluation criteria. These criteria are summarized in Subsection 9.1.1 through 9.1.3.

#### 9.1.1 Threshold Criteria

The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP.

- Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection to human health and the environment, in both the short- and long-term, from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site by eliminating, reducing or controlling exposure.

- Compliance with ARARs addresses whether or not a remedy attains applicable or relevant and appropriate requirements under federal environmental laws and state environmental and facility siting laws or provide grounds for invoking a waiver.

#### 9.1.2 Primary Balancing Criteria

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria.

- Long-term effectiveness and permanence addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

- Reduction of toxicity, mobility, or volume through treatment addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site.

- Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

- Implementability addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

- Cost includes estimated capital costs (indirect and direct) and annual O&M costs, as well as present worth costs.

#### 9.1.3 Modifying Criteria

The modifying criteria are used on the final evaluation of remedial alternatives generally after the U.S. NAVY has received public comment on the RI/FS and Proposed Plan.

- State acceptance addresses the state's position and key concerns related to the preferred alternative and other alternatives, and the state's comments on ARARs and to be considered (TBC) criteria or the proposed use of waivers.

- Community acceptance addresses the public's general response to the alternatives described in the Proposed Plan and RI/FS report.

## 9.2 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section presents a comparison of the remedial alternatives for soil and sediment for Area A Downstream/OBDA for relative advantages and disadvantages. The criteria for comparison are the same that were used for the detailed analysis of alternatives. The alternatives being evaluated are as follows:

- Alternative 1: No Action.
- Alternative 2: Capping, Restoration of Wetlands and Waterways, and Institutional Controls.
- Alternative 3: Excavation/Dredging, Onsite Dewatering, and Offsite Disposal of Soil/Sediment; Restoration of Wetlands and Waterways; and Monitoring.
- Alternative 4: Excavation/Dredging, Onsite Dewatering and Thermal Desorption of Soil/Sediment; Onbase Reuse of Treated Soil; Offsite Disposal of Sediment; Restoration of Wetlands; and Monitoring

### 9.2.1 Overall Protection Of Human Health And Environment

Alternative 1 would not be protective of human health or the environment. Contaminants would remain in the soil and sediment at concentrations that would exceed remediation goals for both potential human receptors under the Reasonable Maximum Exposure (RME) scenario and ecological receptors of concern.

Alternative 2 would be protective of human health and environment. The use of a soil cover and institutional controls would be effective in preventing human trespassers from intrusion into the cover and for minimizing potential exposure to contaminants. The soil cover and biotic barrier would minimize the risk of exposure of ecological receptors to the underlying contaminated soil and sediment. The soil cover over sediment would minimize migration of contaminants to surface water. Restoration of the wetland and waterways could be more difficult in Alternative 2 than in Alternative 3 and Alternative 4, because Alternative 2 involves filling the wetlands and waterways above the current wetland elevation.

Alternative 3 would be protective of human health and the environment. The contaminated media would be removed from the site, followed by disposal by offsite landfilling. Removal of contaminated sediment would protect surface water from sediment-related contaminants. Clean media would replace the excavated/dredged soil and sediment, followed by restoration of the wetlands and waterways. The wetland functions and values will be replaced according to state and federal standards as determined during remedial design.

Alternative 4 would be protective of human health and the environment. The contaminated soil/sediment would be removed from the site. Removal of contaminated sediment would protect surface water from sediment-related contaminants. The soil would be treated by thermal desorption to achieve the remediation goal of 5 mg/kg DDTR that would reduce the risk of potential receptors to acceptable levels for reuse at a suitable non-residential location on base. The sediment containing DDTR and inorganic COCs would be disposed of offsite at a non-hazardous waste landfill with thermal desorption of portions that contain DDTR exceeding the landfill's limits. Clean media (soil, sand and gravel) would replace the excavated/dredged soil and sediment, followed by restoration of wetlands and waterways. The wetland functions and values will be replaced according to state and federal standards as determined during remedial design.

Alternative 2 is less likely to be protective of the environment than Alternative 3 and Alternative 4 because the contaminated media would be left on site without treatment and long-term maintenance of the cover would be required in the former alternative. Alternative 4 would be the most protective because the contaminated media are treated prior to disposal/reuse.

### 9.2.2 Compliance With ARARs And TBCs

Alternative 1 would not comply with the chemical-specific ARARs and TBCs, particularly State of Connecticut Remediation Standards for Soil. This alternative would not comply with federal/state water quality criteria. This alternative would not address the Protection of Wetlands as required by Executive Order. Moreover, this alternative would not address the protection of an area within a coastal zone as required by the Coastal Zone Management Act. No action-specific ARARs and TBCs apply to this alternative.

Alternative 2 would comply with chemical-specific ARARs and TBCs, particularly State of Connecticut Remediation Standards for Soil by minimizing access to the contaminated media if the cap is properly maintained. This alternative would also comply with federal state water quality criteria and must be confirmed via monitoring. This alternative would comply with the location specific ARARs associated with federal and state wetlands protection statutes and Coastal Zone Management if altered wetland functions and values can be restored. This alternative would comply with ARARs associated with the discharge of treated water to surface water at the site, mitigation of wetlands and other location-specific ARARs and

TBCs associated with flood plains and water courses on site.

Alternative 3 would comply with the chemical-specific ARARs and TBCs, particularly State of Connecticut Remediation Standards for Soil. This alternative would comply with all location-specific ARARs, particularly regarding wetlands and coastal zone issues. The proposed excavation and removal will also comply with all action-specific ARARs and TBCs, including protection of waterways, hazardous waste management, erosion control.

Alternative 4 would also comply with the chemical-specific ARARs and TBCs, particularly State of Connecticut Remediation Standards for Soil. This alternative would comply with all location-specific ARARs, particularly regarding wetlands and coastal zone issues. The proposed excavation/treatment/disposal will also comply with all action-specific ARARs and TBCs, including protection of waterways, hazardous waste management, erosion control and air pollution control.

### 9.2.3 Long-Term Effectiveness and Permanence

Alternative 1 would not be effective in the long-term. Residual risks would exceed an HI of 1.0 for non-carcinogens for the receptors of concern.

Alternative 2 would be effective in the long-term for protection of receptors of concern. Although contaminants would remain in the soil and sediment, by minimizing access to the contaminants, the risks would be reduced to HIs of less than 1.0 for non-carcinogens. However, because long-term monitoring and maintenance of the cover would be required, this alternative is less effective and less likely to be a permanent solution than Alternatives 3 and 4.

Alternative 3 would be more effective than Alternative 2 in the long-term for protection of receptors of concern. The contaminated media would be removed from the site and disposed off site by landfilling. Although the CERCLA preference for treatment would not be satisfied, disposal in a secure landfill would be permanent. The risks due to residual contaminants in the soil and sediment on site would be permanently reduced to HIs of less than 1.0 for non carcinogens.

Alternative 4 would be the most effective in the long term and would be a permanent remedy. Contaminated media would be either treated and reused on base or disposed of off site. The risks due to residual contaminants in the treated soil and remaining soil and sediment on site would be permanently reduced to HIs of less than 1.0 for non carcinogens.

### 9.2.4 Reduction of Toxicity, Mobility, and Volume Through Treatment

Alternative 1 would offer no reduction of toxicity, mobility or volume. There is no treatment of contaminated media.

Alternative 2 would offer minimal reduction of toxicity, mobility, and volume through the treatment of the ponds and streams water prior to placement of the cover.

Alternative 3 would offer minimal reduction of toxicity, mobility through treatment of the ponds and stream standing water, and dewatering drainage water during remedial action. There would also be some reduction in volume as a result of soil and sediment dewatering. The contaminated media would merely be removed from the site and deposited at a more secure offsite location.

Alternative 4 would offer the greatest reduction of toxicity, mobility, and volume through thermal desorption. Approximately 11,000 cubic yards of soil and portions of highly contaminated sediment containing a total of 2.8 tons of DDTR, plus a minor amount of dieldrin would be treated to achieve a minimum of 99 percent removal of DDTR and dieldrin. This would be followed by safe disposal/destruction of these contaminants captured in approximately 26 tons of solid waste, consisting primarily of spent GAC. Inorganic COCs in sediment would be deposited off site without treatment. Degree of treatment of pesticides through thermal desorption would be 100 percent irreversible. Some reduction in volume would also be achieved through dewatering and minimal toxicity reduction would also result from treatment of the ponds and stream standing water and dewatering drainage water.

### 9.2.6 Short-Term Effectiveness

Alternative 1 would have no relevant concerns. There would be no remedial activities under this alternative.

Alternative 2 would pose significant short-term ecological concerns. Placement of a cover would require significant disruption of the ecological habitat, because removal of vegetation would be necessary to access the surface of the contaminated soils. Attainment of remedial action objectives would be expected once the remedial action is complete within 4 to 6 months and the disturbed wetland and aquatic habitats are restored.

Alternative 3 would pose severe short-term ecological concerns. There would be a greater disruption of the ecological habitat under Alternative 3 than under Alternative 2 because of the excavation/dredging of all contaminated soil/sediment. Attainment of remedial action objectives would be expected once the remedial action is complete within 10 to 12 months and the disturbed wetland and aquatic habitats are restored.

Alternative 4 would also pose the same severe short-term ecological concerns as Alternative 3. The disruption of habitat under Alternative 4 would be similar to that under Alternative 3. In addition, the onsite thermal processing of soil/sediment creates a short-term human health concern as a result of potential worker exposure to contaminants (i.e., soil and offgas emission), although this concern could be adequately controlled with use of appropriate personal protection equipment (PPE) and offgas treatment. Attainment of remedial action objectives would be expected once the remedial action is complete within 16 to 24 months and the disturbed wetland and aquatic habitats are restored.

### 9.2.6 Implementability

Alternative 1 would be readily implementable. No remedial actions would be involved.

Alternative 2 would be somewhat less easily implementable than Alternative 3, but more easily implementable than Alternative 4. The remedial activity would involve the use of relatively simple technologies and would be the least dependent on the availability of offsite disposal facilities. There are potential difficulties in restoring lost wetland functions and values within the filled, capped wetlands. The difficulties in restoring the wetland functions and values can be adequately addressed by proper choice of soil cover material that would be suitable for wetland plant growth.

Alternative 3 would be more easily implementable than Alternative 4. Alternative 3 and Alternative 4 would involve a potentially more site restoration (because of excavation/dredging and backfilling) and greater use of offsite disposal of wastes than Alternative 2. Any additional remediation could be more easily implemented under Alternatives 1, 3 or 4 than under Alternative 2.

Alternative 4 would be the least easily implementable alternative. Alternative 4 would involve the onsite mobilization and operation of a treatment unit, that requires specialized personnel and trained operators. This technology is offered by a relatively few number of contractors. Moreover, Alternative 4 would require coordination with state agencies to negotiate discharge limits for not only treated wastewater discharge to onsite surface waters, but also for treated off gas discharge. However, Alternative 4 would involve less dependence on the availability of offsite disposal facilities because the treated soil would be reused at the base.

Any additional remedial action could be more readily undertaken under Alternatives 3 and 4 than under Alternative 2 because of the presence of a cap under Alternative 2. However, additional remedial actions would be implementable following any of these alternatives.

### 9.2.7 Cost

Capital, annual operation/maintenance and net present worth costs of alternatives are compared here. Present worth costs are estimated only if the duration of the remedial action is prolonged such as the long-term monitoring and maintenance involved in Alternative 2.

Alternative 1:

- Capital Cost: $ 0
- Operation/Maintenance Cost: $ 0
- Net Present Worth: $ 0

Alternative 2:

- Capital Cost: $2,561,000
- Operation/Maintenance Cost: $ 20,000/yr + $ 20,000/5 yr + $50,000 (wetland restoration total cost for years 0 to 5)
- Net Present Worth: $2,968,000

Alternative 3:

- Capital Cost: $8,080,000
- Operation/Maintenance Cost: $50,000 (wetland restoration total cost for years 0 to 5)
- Net Present Worth: $8,125,000

Alternative 4:

- Capital Cost: $9,460,000
- Operation/Maintenance Cost: $50,000 (wetland restoration total cost for years 0 to 5)
- Net Present Worth: $9,505,000

### 9.2.8 State Acceptance

The CTDEP, as a party of the FFA, has provided comments on the FS and Proposed Plan, and has documented its concurrence with the remedial action, as stated in Section 13 of this ROD. A copy of the CTDEP's letter of concurrence is presented in Appendix C of this ROD.

### 9.2.9 Community Acceptance

The Proposed Plan presents the preferred alternative for Area A Downstream/OBDA. From August 1, 1997 through September 1, 1997, the U.S. Navy held a public comment period to accept public input. A public meeting was held on August 6, 1997 to discuss the Proposed Plan and to accept any oral comments.

Community acceptance of the Proposed Plan was evaluated based on comments received at the public meeting as documented in the transcript of the Public Meeting in Appendix A. No comments were received from the public during the public comment period.

## 10.0 THE SELECTED REMEDY

Based upon consideration of requirements of CERCLA, the NCP, the detailed analysis of alternatives, and U.S. EPA, state, and public comments, the Navy has selected Alternative 3 (Excavation/Dredging, Onsite Dewatering, and Offsite Disposal of Soil/Sediment; Restoration of Wetlands and Waterways; and Monitoring) as the most appropriate remedy for soil and sediment at Area A Downstream/OBDA at NSB-NLON. At the completion of this remedy, the risk associated with soil and sediment at this site will be protective of human health and the environment.

The selected remedy consists of excavation of the contaminated soil and sediment, followed by onsite dewatering and offsite disposal. The sequence of actions envisioned at a conceptual state is as follows: (1) removal, onsite treatment, and discharge of standing water from ponds and streams with appropriate stream flow diversions; (2) clearing/grubbing of contaminated soil areas; (3) dredging, onsite dewatering and offsite disposal of contaminated sediment; (4) excavation, onsite dewatering and offsite disposal of contaminated soil; (5) placement of clean soil backfill over the excavated soil areas with top soil cover and revegetation to replace altered wetland functions and values; and (6) placement of suitable borrow material over the dredged sediment areas (such as sand in ponds and gravel in streams) and restoration of aquatic habitats. Fencing and security measures are assumed to be present and will continue to be instituted during the remedial action. Figure 10-1 presents the conceptual remediation plan for Alternative 3.

Approximately 1.0 million gallons of standing water will be treated on site at the Dewatering/Wastewater Treatment (DW/WWT) facility and discharged downstream of the site at a suitable location in a storm sewer that will ultimately discharge to Thames River. Approximately 7,000 cubic yards of contaminated sediment (an estimated area of 1.9 acres down to an average depth of 2.3 feet) will be excavated. The estimated depths of excavation are expected to vary between 0.5 feet to 3.0 feet depending on the depth to clean sediment. The excavated sediment will be transported to the DW/WWT facility. This facility is expected to be constructed at a suitable location at or near the neighboring Area A Landfill. Furthermore, approximately 11,000 cubic yards of contaminated soil (within an estimated area of 2.7 acres, down to an assumed depth of 2.5 feet) will be excavated and transported to the DW/WWT facility. The areas, depths and volumes of excavation are likely to change when the extent of contamination is clearly defined at the time of remedial design.

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Prior to excavation at the OBDA, during the remedial design phase, the stability of the northwest side slope of the adjacent Area A Landfill will be evaluated. At that time, appropriate measures will be taken, if necessary, to minimize any adverse effects that could result from excavation.

The DW/WWT facility will consist of separate dewatering pads for sediment and soil, a bag filtration unit and a GAC adsorption unit. The dewatering pad will be a layered structure consisting of sand, gravel, and an impermeable base. The sand layer will be sandwiched between geotextile/geonet layers. The pad will be bermed and provided with an underdrain and sump. Each pad will provide a total of approximately 1,620 square feet of stockpiling area and will be designed to accommodate approximately 300 cubic yards of soil/sediment assuming an average stockpile height of 5 feet. The soil/sediment will be stockpiled on the top geotextile layer and covered with an impervious synthetic liner to prevent potential rainfall infiltration. A suitable weight (such as concrete slabs) will be placed on top of the pile to promote dewatering. The top liner is also expected to prevent the weight from becoming embedded in the pile. The cross section of the dewatering pads will consist of the following components in descending order as depicted in Figure 10-2:

- A graded sand layer:  1.0 foot in thickness, sandwiched between two geotextile/geonet membranes.

- A gravel layer:  1.0 foot in thickness.

- A High Density Poly Ethylene (HDPE) liner on compacted and sloped soil base.

- A slotted PVC pipe:  4 inches in diameter, placed within the gravel layer, along the entire deep end of the base.

The sand and geotextile/geonet layers in the base of the pad are expected to function as a preliminary filter to retain gross TSS and most of the soil particles, while allowing relatively solids-free drainage water into the gravel underdrain layer. The slotted PVC pipe in the gravel layer will collect drainage water and transfer it to an adjacent sump. Drainage water will then be pumped into a bag filtration unit for secondary TSS removal, followed by GAC adsorption for removal of dissolved DDTR. The treated drainage water will then be discharged using a pump via a pipeline leading to a suitable storm sewer downstream of Area A Downstream/OBDA that will eventually discharge to the Thames River.

Standing water that will be pumped from the ponds and streams prior to dredging as well as drainage from the dewatering stockpile will undergo preliminary filtration in the dewatering pad drainage layers followed by bag filtration and GAC adsorption. It is anticipated that the standing water will contain, on average, less than 30 mg/L of TSS and less than 1 Ig/L of DDTR which would meet the anticipated discharge limits. Therefore, treatment is a conservative measure prior to discharge to the Thames River. However, the drainage water from the dewatering stockpile is expected to be significantly more contaminated, containing up to 2.2 mg/L of DDTR (in particulates of 0.45 Im size and larger) and up to 2,000 mg/L of TSS, based on information obtained during a bench-scale dewatering study on sediment (Atlantic, May 1994). The preliminary filtration in the dewatering bed is assumed to reduce the TSS from approximately 2,000 mg/L to approximately 100 mg/L. Bag filtration will reduce the TSS further to 5 mg/L as pretreatment for GAC adsorption. GAC adsorption will remove the DDTR to achieve less than detection limits (1 Ig/L) in the treated effluent. The effluent will be periodically monitored in accordance with substantive requirements of Connecticut State's discharge permit.

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Each dewatering bed will be capable of accommodating a flow of 200 gpm from the discharge of standing water from the water bodies. The hydraulic flux corresponding to this flow rate will be less than 0.5 gpm/ft 2 and, therefore, will be easily accommodated. However, this flow rate of 200 gpm must be distributed uniformly over, the surface of the dewatering bed to prevent any channeling effect that could disrupt the bed and reduce filtration efficiency. If analysis of the standing water shows minimal TSS levels (i.e., less than 15 mg/L), then it will be discharged directly into the dewatering bed sump for treatment by bag filtration and GAC adsorption.

Drainage water from the stockpile will be treated at a rate of less than 10 gpm in the dewatering bed. The sand filtration layer is assumed to require replacement when the solids accumulated within it reaches a limit of 1.0 lb/ft 2 (dry basis). At that time, the sand and geotextile layers will be removed, tested to determine if hazardous; disposed of off site and replaced with clean layers. The sand/geotextile media is estimated to require replacement approximately 7 times, based on an estimated wastewater volume 720,000 gallons, conservatively assumed to contain 2,000 mg/L of TSS, If a portion of the sand/geotextile media contains concentrations of COCs at levels not acceptable at a nonhazardous waste landfill, it will be disposed of at a RCRA hazardous waste landfill.

Prior to excavation, the existing vegetation in the contaminated soil areas will be cleared and the roots grubbed. The extent of clearing, grubbing, and excavation will be limited strictly to the areas of contaminated soil in order to minimize habitat destruction. Approximately 11,000 cubic yards of soil and 6,800 cubic yards of sediment will be excavated; dewatered on site to yield a total waste mass of 20,300 tons; and disposed of at a nonhazardous waste landfill. If a portion of the sediment contain concentrations of DDTR or other COCs at levels not acceptable at a nonhazardous waste landfill, it will be disposed of at a RCRA hazardous waste landfill. The contaminated sediment that will be disposed of offsite will also contain minor amounts of dieldrin. Within the total excavated sediment volume of 6,800 cubic yards, approximately 5,680 cubic yards will also contain inorganic COCs (Cd, Zn, and Pb) in excess of remediation goals which will require offsite disposal regardless of DDTR concentrations.

Following excavation of contaminated soil, approximately 11,000 cubic yards of clean borrow fill material including 2,200 cubic yards of top soil will be spread and revegetated with suitable wetland species of flora. In wetland areas where canopy loss would be inevitable, trees of the same species, i.e., Red Maple (Acer rubrum) or Black Gum (Nyssa sylvatica) will be replanted. The wetland functions and values will be replaced according to state and federal standards, as determined during remedial design. Following excavation of contaminated sediment, approximately 4,900 cubic yards of suitable borrow material will be backfilled in the streams and ponds to maintain the original contour of the water bodies. Suitable borrow materials for ponds and streams are assumed to be sand and gravel, respectively. Sand is expected to be similar to the existing sediment in the ponds. Moreover, the streams are man-made with hard substrate. Gravel, as opposed to sand is expected to be more suitable in streams where the flow of water (and hence the potential for erosion) is greater than the ponds. The volume of clean material used to backfill the excavated areas of ponds and streams will be equivalent to the excavated sediment; and the excavated sediment and wetland functions and values of the waterways will be replaced according to state and federal standards, as determined during remedial design. At the time of remedial design, alternative methods of erosion control such as placement of hay bales or high velocity matting might be considered if determined to be more compatible with the natural habitat.

Table 10-1 presents a summary of the remediation goals for each contaminant of concern in soil and sediment that would be protective of both human and ecological receptors of concern. These remediation goals were derived for protection of ecological receptors of concern and are sufficiently low to be protective of human receptors of concern. Additional sampling and analysis for DDTR, dieldrin, and inorganic COCs would be required at the time of remedial design to verify the area and depth of contamination exceeding these remediation goals. At that time, the volumes of contaminated media, the process details, and logistics would be more accurately estimated.

The cost associated with this selected remedy is estimated to be $8,125,000 with an accuracy of +50 to -30 percent. The cost includes a component of $1,263,000 associated with contingency, equivalent to 20 percent of the total field cost.

**TABLE 10-1**
**SUMMARY OF REMEDIATION GOALS PROTECTIVE OF HUMAN AND ECOLOGICAL RECEPTORS OF CONCERN**
**AREA A DOWNSTREAM/OBDA**
**NSB-NLON GROTON, CONNECTICUT**

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

## 11.0 STATUTORY DETERMINATIONS

The remedial action selected for Area A Downstream/OBDA is consistent with CERCLA and the NCP, to the extent practicable. The remedial action is protective of human health and the environment, complies with ARARs, and is cost effective. The remedial action does not satisfy the statutory preference for remedies that reduce contaminant toxicity, mobility and volume through treatment as a principal element. However, the remedial action removes the significant potential threat of the contaminants at the site, followed by safe management at an offsite disposal facility.

### 11.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedial action will be protective of human health and the environment at the site by removing the contaminated material, thereby significantly reducing the health risks to potential human and ecological receptors. The soil and sediment that contain contaminants of concern at levels higher than the acceptable limits corresponding to a cumulative ICR of 1E-05 and cumulative non-carcinogenic HI of 1.0 will be removed from the site. Although significant destruction of habitat will occur because of the removal of vegetation and excavation, the benefits of contaminant removal will outweigh the short-term effects following restoration of the site and recovery of the functions and values of the wetlands in the long term. The contaminated media will be disposed of in approved and permitted nonhazardous and hazardous waste landfills where they will be managed appropriately to minimize exposures to human health and the environment off site.

## 11.2 COMPLIANCE WITH ARARs

The selected remedial action will comply with federal and State of Connecticut ARARs. The ARARs and TBCs that have been analyzed for this remedial action and the methods that will be employed to achieve compliance with the ARARs and TBCs are summarized in Table 11-1, 11-2, and 11-3.

## 11.3 COST-EFFECTIVENESS

In the U.S. Navy's judgment, the selected remedy is cost effective, i.e., its overall protectiveness justifies the cost. In selecting this alternative, the Navy analyzed the overall effectiveness of all alternatives that were protective of human health and environment and complied with ARARs. The overall effectiveness of the alternatives were assessed by considering a combination of three relevant criteria; (1) long-term effectiveness and permanence, (2) reduction of toxicity, mobility and volume through treatment as a principal element, and (3) short-term effectiveness.

The No Action alternative is the least expensive (zero cost) alternative, but it would not be protective of human health and the environment. Therefore, only three other alternatives were analyzed further for overall effectiveness with respect to cost. Capping is the least expensive among the three alternatives, but it is questionable in its long-term effectiveness and permanence because it would allow the contaminants to remain on site and potentially migrate if the cover is not maintained, and would not employ treatment as a principal element. Therefore, although capping would be the most short-term effective alternative, it is not favored. Excavation and onsite treatment by thermal desorption is the only alternative that would be effective in the long-term and permanent and that would also reduce contaminant toxicity using treatment as the principal element. This alternative is the most expensive, and, there would be considerable short-term effectiveness concerns because of temporary ecological habitat destruction. Moreover, thermal desorption treatment on site would also pose potential hazards to worker health and the nearby community. Excavation with off site landfill disposal is less expensive than the onsite treatment alternative, and it will be effective in the long term because the contaminants will be removed from the site for safe management offsite. Although there will be considerable short-term effectiveness concerns also associated with this alternative because of temporary ecological habitat destruction, the costs using offsite landfill disposal rather than onsite thermal desorption are considered more justified for the long term benefits of removing contaminants from the site.

Estimated Cost of selected remedial alternative: $8,125,000

**TABLE 11-1**

**CHEMICAL-SPECIFIC ARARs AND TBCs**
**ALTERNATIVE 3 - EXCAVATION/DREDGING, ONSITE DEWATERING, AND OFFSITE DISPOSAL OF SOIL/SEDIMENT; RESTORATION OF WETLANDS AND WATERWAYS; AND MONITORING**
**AREA A DOWNSTREAM/OBDA**
**NSB-NLON GROTON, CONNECTICUT**


FEDERAL

| Requirement | Citation | Status | Synopsis of Requirement | Action to Be Taken to Attain ARAR |
|---|---|---|---|---|
| Water Quality Criteria for DDT and Metabolite (EPA 440-80-038), 1980 | | TBC | Provides criteria for assessing toxicity of DDT and metabolics to aquatic organisms. | DDTR contaminated soil/sediment would be excavated, removed, and replaced with uncontaminated material. Remaining soil/sediment would provide no source of contamination to surface waters and would pose no hazard to potential aquatic receptors. |
| Technical Basis for deriving Sediment Quality Criteria for Non-Ionic Organic Contaminants for Protection of Benthic organisms by Using Equilibrium Partitioning (EPA-822-R-93-011).1993 | | TBC | Guidance for estimating cleanup goals for sediment contamination. | Contaminated sediment would be excavated, removed, and replaced with uncontaminated material. Remaining sediment would pose no hazard to potential receptors. Removal of contaminated sediment would achieve protection of receptors of concern. |
| National Oceanographic and Atmospheric Administration (NOAA) Incidence of Adverse Biological Effects within Ranges of Chemical Concentration in Marine and Estuarine Sediments (Long et. al., 1995) | | TBC | Guidance on concentration ranges of contaminants in sediment that would rarely or more likely to have adverse effects. Findings comparable with fresh-water sediments. | Contaminated sediment would be excavated, removed, and replaced with uncontaminated material. Remaining sediment would pose no hazard to potential receptors. Removal of contaminated sediment would achieve protection of receptors of concern. |
| Cancer Slope Factors (CSF). | | TBC | These are guidance values used to evaluate the potential carcinogenic or non-carcinogenic hazard caused by exposure to contaminants. | Contaminated soil/sediment would be excavated, removed, and replaced with uncontaminated material. Remaining soil/sediment would pose no hazard to potential receptors. |
| Reference Dose (RfD) | | TBC | These are guidance values used to evaluate the potential carcinogenic or non-carcinogenic hazard caused by exposure to contaminants. | Contaminated soil/sediment would be excavated, removed, and replaced with uncontaminated material. Remaining soil/sediment would pose no hazard to potential receptors. |

**TABLE 11-1**

**CHEMICAL-SPECIFIC ARARs AND TBCs**
**ALTERNATIVE 3 - EXCAVATION/DREDGING, ONSITE DEWATERING, AND OFFSITE DISPOSAL OF SOIL/SEDIMENT; RESTORATION OF WETLANDS AND WATERWAYS; AND MONITORING**
**AREA A DOWNSTREAM/OBDA**
**NSB-NLON GROTON, CONNECTICUT**


STATE OF CONNECTICUT

| Requirement | Citation | Status | Synopsis of Requirement | Action to Be Taken to Attain ARAR |
|---|---|---|---|---|
| Soil Remediation Standards | RCSA º 22a-133k-1 thru 2 | Applicable | Regulations specify remediation standards for direct exposure to soil and sediments. Regulations also specify groundwater protection standards for contaminated soil in areas with a state groundwater classification of GB. | Direct exposure would be prevented by removing the contaminated soil/sediments from the site followed by safe disposal offsite. Standards for soil remediation within a GB groundwater zone are applicable. |

**TABLE 11-2**
**LOCATION-SPECIFIC ARARs AND TBCs**
**ALTERNATIVE 3 - EXCAVATION/DREDGING, ONSITE DEWATERING, AND OFFSITE DISPOSAL OF SOIL/SEDIMENT; RESTORATION OF WETLANDS AND WATERWAYS; AND MONITORING**
**AREA A DOWNSTREAM/OBDA**
**NSB-NLON GROTON, CONNECTICUT**


FEDERAL

| Requirement | Citation | Status | Synopsis of Requirement | Action to Be Taken to Attain ARAR |
|---|---|---|---|---|
| Clean Water Act, Section 404 | 33 USC 1344; 40 CFR Part 230 and 33 CFR Parts 320-323 | Applicable | These rules regulate the discharge of dredge and fill materials in wetlands and navigable waters. Such discharges are not allowed if practicable alternatives are available. | Remedial action includes dredging of soil and sediment from the contaminated wetlands and replacement/restoration with uncontaminated material. Measures would be taken to minimize adverse effects and to replace or restore protected wetland functions and values. |
| Executive Order 11990 RE: Protection of Wetlands | Executive Order 11990, 40 CFR Part 6, Appendix A | Applicable | This Order requires Federal agencies to take action to avoid adversely impacting wetlands wherever possible, to minimize wetlands destruction and to preserve the values of wetlands, and to prescribe procedures to implement the policies and procedures of this Executive Order. | Remedial action includes dredging of soil and sediment from the contaminated wetlands and replacement/restoration with uncontaminated material. However, measures to minimize adverse effects and to replace or restore protected wetland functions and values would be considered and incorporated into any plan or action wherever feasible. |
| Fish and Wildlife Coordination Act | 16 USC Part 661 et. seq., 40 CFR 122.49 | Applicable | This order protects fish and wildlife when Federal actions result in control or structural modification of a natural stream or body of water. | Appropriate agencies would be consulted prior to implementation to find ways to minimize adverse effects to fish and wildlife from excavating and restoring the contaminated wetlands and waterways. |
| Coastal Zone Management Act | 16 USC Parts 1451 et. seq. | Applicable | Requires that any actions must be conducted in a manner consistent with state approved management programs. | Portions of the site are located in a coastal zone management area; therefore, applicable coastal zone management requirements need to be addressed. |
| Executive Order 11988 RE: Floodplain Management | Executive Order 11988 | Applicable | This order requires Federal agencies to evaluate the potential effects of actions it may take within a designated 100-year floodplain of a waterway to avoid adversely impacting floodplains whenever possible. | Although the 100-year floodplain for the Thames River only include Streams 5 and 6 for which no action is proposed, this order may be applicable to the streams on site, which may be classified as inland waters. Measures would be taken to minimize impacts during excavation and backfilling |

**TABLE 11-2**

**LOCATION-SPECIFIC ARARs AND TBCs**
**ALTERNATIVE 3 - EXCAVATION/DREDGING, ONSITE DEWATERING, AND OFFSITE DISPOSAL OF SOIL/SEDIMENT; RESTORATION OF WETLANDS AND WATERWAYS; AND MONITORING**
**AREA A DOWNSTREAM/OBDA**
**NSB-NLON GROTON, CONNECTICUT**


STATE OF CONNECTICUT

| Requirement | Citation | Status | Synopsis of Requirement | Action to Be Taken to Attain ARAR |
|---|---|---|---|---|
| Inland Wetlands and Watercourses | CGS 22a-37 thru 45, RCSA º 22a-39-1 through 15 | Applicable | These rules regulate all activities in wetlands and watercourses. | This alternative proposes to dredge soil and sediment from the contaminated wetlands and watercourses and to restore the areas using uncontaminated material. The substantive requirements of the CT standards would be met to address the alteration of wetlands and watercourses. |
| Coastal Management | CGS ºº22a-92 and 94 | Applicable | Federal facilities are required to file a coastal zone consistency determination under these rules, which includes the goal that development, preservation, or use of land and water resources of a coastal area proceed without significantly disrupting the natural environment. | This alternative proposes to dredge contaminated soil and sediment from areas within the coastal zone and to restore the areas using uncontaminated material. The substantive requirements of the CT standards would be met to address the alteration of the coastal zone. |
| CT Endangered Species Act | CGS º 26-303 thru 314 | Relevant and appropriate | Regulates activities affecting state-listed endangered or threatened species or their critical habitat. | Two state-threatened plants, Golden Alexanders and Seaside Crowfoot, have been sighted in the NSB-NLON area. In addition, three state special concern species, Creeping Bush-clover, Crooked-stem Aster, and Carex crawfordii, have been documented in the NSB-NLON area.<br>Excavation and restoration of the contaminated area would be implemented so as to address potential negative impacts to the listed plant species or any of their critical habitat which might occur within the site. |

TABLE 11-3

**ACTION-SPECIFIC ARARs AND TBCs**
**ALTERNATIVE 3 - EXCAVATION/DREDGING, ONSITE DEWATERING, AND OFFSITE DISPOSAL OF SOIL/SEDIMENT;**
**RESTORATION OF WETLANDS AND WATERWAYS; AND MONITORING**
**AREA A DOWNSTREAM/OBDA**
**NSB-NLON GROTON, CONNECTICUT**



FEDERAL

| Requirement | Citation | Status | Synopsis of Requirement | Action to Be Taken to Attain ARAR |
|---|---|---|---|---|
| Clean Water Act, Section 402, National Pollution Discharge Elimination System (NPDES) | 33 USC 1342; 40 CFR 122 through 125 | Applicable | These standards govern the discharge of water into surface waters. | Surface water removed prior to dredging, along with water from the sediment/soil dewatering process, would be treated by filtration and carbon adsorption to meet discharge criteria according to substantive requirements of NPDES. |
| STATE OF CONNECTICUT | | | | |
| Water Pollution Control | RCSA ° 22a430-1 through 8 | Applicable | These rules regulate water discharge to surface water. | Surface water removed prior to dredging, along with water from the sediment/soil dewatering process, would be treated by filtration and carbon adsorption in compliance with these regulations. |
| Water Quality Standards | CGS 22a-426 | Applicable | Connecticut's Water Quality Standards establish specific numeric criteria, designated uses, and anti-degradation policies for groundwater and surface water. | Surface water removed prior to dredging, along with water from the sediment/soil dewatering process, would be treated by filtration and carbon adsorption in a manner which is consistent with the antidegradation policy in the Water Quality Standards. |
| Hazardous Waste Management: Generator and Handler Requirements, Listing and Identification | RCSA 22a-449(c) 100-101 | Applicable | CT is delegated to administrate the federal RCRA statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference. | Hazardous waste determinations would be performed an all contaminated soils/sediments excavated to determine that levels of regulated constituents do not exceed applicable limits.<br>Also, wastes produced from surface water and dewatering treatment would be tested to determine whether levels of certain regulated constituents (lead, mercury, heptachlor, etc.) exceed TCLP limits. Any contaminated soil/sediments which exceed applicable limits would be managed in accordance with requirements of these regulations, if necessary. |

**TABLE 11-3**

**ACTION-SPECIFIC ARARs AND TBCs**
**ALTERNATIVE 3 - EXCAVATION/DREDGING, ONSITE DEWATERING, AND OFFSITE DISPOSAL OF SOIL/SEDIMENT;**
**RESTORATION OF WETLANDS AND WATERWAYS; AND MONITORING**
**AREA A DOWNSTREAM/OBDA**
**NSB-NLON GROTON, CONNECTICUT**


STATE OF CONNECTICUT (Continued)

| Requirement | Citation | Status | Synopsis of Requirement | Action to Be Taken to Attain ARAR |
|---|---|---|---|---|
| Hazardous Waste Management: Generator Standards | RCSA º 22a-449(c)-l02 | Applicable | This section establishes standards for various classes of generators. The standards of 40 CFR 262 are incorporated by reference. | Surface water treatment residues (spent filtration media and activated carbon) may contain high concentrations of certain regulated constituents such as lead, mercury, heptachlor, etc. Although the residues are not expected to fail hazardous characteristics, substantive requirements of these regulations would be met. |
| Hazardous Waste Management: TSDF Standards | RCSA º 22a-449(c) 104 | Applicable | This section establishes standards for treatment, storage, and disposal facilities. The standards of 40 CFR 264 are incorporated by reference. | Any hazardous waste which may be treated or temporarily stored on this site as part of the remedy would be managed in accordance with the requirements of this section. |
| Air Pollution Control | RCSA º 22a-174 1-20 | Applicable | These regulations require permits to construct and to operate specified types of emission sources and contain emission standards that must be met prior to issuance of a permit. Pollutant abatement controls may be required. Specific standards pertain to fugitive dust (18b), and control of odors (23). | Emission standards for fugitive dust from excavation and restoration operations would be met with dust control measures. Odors/emissions from the dewatering piles would be managed to comply with these standards. |
| Water Diversion Policy Act | RCSA º 22a-377(b) | Relevant and appropriate | These rules regulate a wide variety of water diversions. | Diversions as part of site remediation are exempt from state diversion regulations as long as 1) best management practices are employed to minimize erosion and sedimentation, to provide for necessary downstream flow in surface waters affected by the diversion, and to avoid adverse impacts to adjacent wells and to fish and wildlife, including to their spawning and nesting seasons; or 2) if such activity, structure, or facility may after the habitat of any rare, endangered or threatened species fisted or identified by any federal or state governmental agency, if present only. Surface water diversions would be conducted using best management practices. |
| Connecticut Guidelines for Soil Erosion and Sediment Control | CT Council on Soil and Water Conservation | TBC | Technical and administrative guidance for development, adoption and implementation of erosion and sediment control program. | Guidelines would be followed to protect wetlands and aquatic resources. |

### 11.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The selected remedial action (Alternative 3) offers a greater potential for permanence than allowing the contaminants to remain on site as in Alternative 2. Although landfill disposal without treatment is typically not a favorable option, the nature of the primary contaminants (pesticides) is such that owing to their minimal solubility in water, their potential for migration in the environment is minimal. The only potential of threat to human health would be in the event of long-term exposure of landfill workers through dermal contact or incidental ingestion of contaminated soil/sediment, which is not expected to be of concern because permitted landfills with an established record of worker health and safety practices will be selected.

Because of the presence of a high water table, State of Connecticut regulations do not allow onsite reuse of treated soil unless contaminant levels are reduced to less than detection limits. Therefore, the treated soil under Alternative 4 would have to be disposed of off site. Thus, the use of treatment as a principal element for reduction in toxicity in Alternative 4, albeit being a more long-term effective and permanent solution, is of questionable benefit compared to the selected remedial action.

Resource recovery is not intended to be a component of any of the alternatives because the main contaminant, DDTR, is a banned pesticide.

Among those alternatives that are protective of human health and environment and comply with ARARs, the Navy, with EPA and CTDEP concurrence, have determined that this selected remedial action provides the best balance of trade-offs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost while also considering the statutory preference for treatment as a principal element and considering state and community acceptance.

### 11.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The selected remedy does not treat the wastes for reduction of toxicity, mobility, or volume. However, dewatering of the soil and sediment to the extent possible on site would render the material amenable to easier handling and it would minimize the potential for adverse effects from releases to the environment in the event of a spill. Also, onsite treatment of the drainage water from dewatering operations does provide a minor reduction of contaminant toxicity and volume.

## 12.0 DOCUMENTATION OF NO SIGNIFICANT CHANGES

The U.S. Navy presented a Proposed Plan outlining the proposed alternative (Alternative 3) of excavation, dewatering, and offsite landfill disposal for Area A Downstream/OBDA. The Proposed Plan was presented to the public on August 6, 1997. Public comments have been considered by the Navy prior to the selection of the preferred alternative. Upon review of these comments, it was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary.

## 13.0 STATE ROLE

The CTDEP, as a part of the FFA, has reviewed the various alternatives. The CTDEP has also reviewed the Remedial Investigation and Feasibility Study to determine if the selected remedial action is in compliance with applicable or relevant and appropriate state environmental laws and regulations.

The CTDEP concurs with the selected remedial action for Area A Downstream/OBDA. A copy of the letter of concurrence is presented in Appendix B of this ROD.

# REFERENCES


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**APPENDIX A**
**PUBLIC MEETING TRANSCRIPT**

<IMG SRC 98003P>

DEPARTMENT OF THE NAVY
NORTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
10 INDUSTRIAL HIGHWAY
MAIL STOP, #82
LESTER, PA 19113-2090 IN REPLY REFER TO

MINUTES OF PUBLIC MEETING

SITE 3 - AREA A DOWNSTREAM

To: NSB-NLON Public Meeting Attendees

From: Mark Evans, Remedial Project Manager, Northern Division, Naval Facilities Engineering Command

Date: 1 October 1997

Subject: Public Meeting Minutes - August 6, 1997
Installation Restoration Program
Naval Submarine Base - New London (NSB-NLON)
Groton, Connecticut.

Attendees of the meeting

| | |
|---|---|
| Andy Stackpole | NSB-NLON |
| Mark Evans | Navy |
| Greta Deirocini | Navy |
| Kymberlee Keckler | USEPA Boston |
| Patti Lynne Tyler | USEPA Boston |
| David Peterson | USEPA Boston |
| Jennifer Hayes | Gannett Fleming |
| Mark Lewis | CTDEP |
| Corey Rich | Brown & Root |
| J. P. Pradeep | Brown & Root |
| Susan Orrill | RAB Community Co-Chair |
| Andrew Parella | RAB Member |
| Bart Pearson | Community |
| Steve Cicoria | Community |
| L. J. Chmura | Community (City of Groton Conservation Commission) |
| Dave Paskavsky | Community (City of Groton Conservation Commission) |
| Felix Prokop III | Community (Ledge Light Health District) |
| Dr. Norman Richards | Community (The Mohegan Tribe of Indians of Connecticut) |
| Noah Levine | Community |

Welcome and Introduction

Andy Stackpole opened the meeting at 6:30 p.m..

Mr. Stackpole read the public notice that appeared in the New London Day on August 1, 1997.

Mr. L. J. Chmura stated that the law in the State of Connecticut requires a 30-day legal notice, and all he ever saw was an advertisement without a legal notice number on it, and he went to the Groton Library that day, the day after, and yesterday, and there was no literature there from the Navy regarding this meeting.

Mr. Stackpole stated that he went to the library the day before this noticed was published and made sure the information was there.

Mr. Chmura asked why they weren't given a 30-day notice as required by law.

Mr. Stackpole stated that the Navy put a legal ad in the paper (New London Day) on August 1 and the Navy is having a public comment period until September 2. The Navy has a legally stamped notarized copy from the New London Day certifying that the notice was placed in the paper on August 1, 1997.

Mr. Chmura asked if there was a legal number on it.

Mr. Stackpole stated that the requirement is for the Navy to publish a notice in a major local newspaper and the Navy met that requirement.

Mr. Chmura stated that it is suppose to be a 30-day notice before the hearing.

Mr. Dave Paskavsky stated that you may be the Navy but you got to still play by the rules.

Andy Stackpole stated that the Navy follows applicable regulations.

(Mr. J. P. Pradeep gave presentation on the Proposed Plan for the Area A Downstream).

Mr. Paskavsky asked who conducted this investigation, were borings taken and were any lead batteries found.

Mr. Pradeep stated Brown & Root Environmental, the Navy consultant, conducted the investigation. No lead batteries were found and soil borings were conducted.

Mr. Paskavsky asked how deep the boring were taken.

Mr. Mark Evans stated that borings were taken up to 80 feet deep and there were no lead batteries found there. The site that we are discussing is the Area A Downstream not the Area A Landfill. This area is below a large man-made dike that was constructed back in the '40s during the dredging of the Thames River.

Ms. Patti Lynne Tyler stated that the Area "A" Downstream is almost all wetlands.

Mr. Paskavsky asked whether the area was filled in the early '40s.

Mr. Pradeep stated that dredge spoils were placed in the Area "A' wetlands, and the area we're talking about is downstream of this Area "A" wetland and landfill. It's a series of ponds and streams and wetlands.

Mr. Chmura asked if this area was used as a dump for the things that they wanted to get rid of at the base.

Mr. Evans stated that there were no dumping operations in this area. The Navy used a pesticide called DDT to control the mosquito population, and that is the contaminant that is the concern in this area.

Mr. Stackpole stated that this area is where the dike was built. This area was virtually untouched. There are a few areas in here that there was never any kind of filling or land filling going on.

Mr. Chmura asked if the scrap metal or anything like that was disposed of here.

Mr. Stackpole stated that no industrial waste was disposed of there.

(Mr. Pradeep continued the presentation on the proposed remedial action for Area "A" Downstream).

Mr. Pradeep stated that additional information can be found in the Groton Public Library.

Mr. Paskavsky stated that they don't have a copy of the report and asked to receive a copy.

Mr. Pradeep gave Mr. Paskavsky a copy of the Feasibility Study.

Mr. Noah Levine stated that he was on the Navy's mailing list, but did not get a notice in the mail. He hasn't received anything since last year. It just so happens that he caught this in the paper.

Ms. Sue Orrill stated that the Navy has been meeting with the public for over ten years. It started as a technical review committee which reviews some of these documents. This has been going on as early as the 1980s. She stated that she is a resident of Gales Ferry and a member of the technical review committee which was later renamed the Restoration Advisory Board. The board usually meets four times a year or every three months depending on when certain public meetings are being held. We can't beg enough people to come. If your interested, we'll let you know when the next meeting is.

Mr. Paskavsky stated that he was interested.

Ms. Orrill asked if he would put that on the address list that you may be interested in joining the restoration advisory board. So, if you are interested that's what we're trying to do, make sure that the information is getting examined by the public and comments get made. It was six months ago that 250 letters were sent out about the RAB meeting.

Mr. Levine stated that the last one he went to was last year.

Ms. Orrill stated that it's good that this gets publicized. The defensiveness that I hear coming from the public at large I really don't understand. That's the whole purpose of the restoration advisory board members. I'm the Co-chairman and the non-Navy person community member at large. So, I've had calls and given out the information. I usually have a personal copy of the documents. I've lent those out to make it easier than going to the library.

Mr. Bart Pearson stated that when the meetings first started the medical officer from the City use to attend the meetings, and then for some reason we haven't seen him for a long time.

(Patti Lynne Tyler from EPA gave a presentation on the development of Preliminary Remediation Goals).

Mr. Chmura asked if this area drains into the Thames River.

Mr. Paskavsky asked if any of it goes into the Groton reservoir.

Ms. Tyler stated that it does not drain into the Groton reservoir, but Stream 5 eventually comes out and drains into the Thames River and the same with Stream 6, so they do eventually drain into the Thames River.

Mr. Paskavsky asked how long does it take for DDT to break down and go away.

Ms. Tyler stated that it takes many, many years. U.S. Fish and Wildlife services continues to monitor fish from the Great Lakes area and they still see very high concentrations. What you end up seeing is you don't have as much DDT but you get the breakdown products like DDE which is a lower toxic, but was responsible for the eggshell thinning of the Bald Eagles.

(Ms. Tyler continued her presentation).

Mr. Paskavsky asked if there are problems with PCBs.

Ms. Tyler stated no.

Mr. Chmura asked if the Navy tested for dioxins.

Ms. Tyler stated that the Navy did. We're looking for pesticides. We are able to show that pesticides are driving the risks and looking at clean-up goals for inorganics.

Dr. Norman Richards asked looking back, what information do you think you would have gotten with sulfides, with the metals that you found.

Ms. Tyler stated that they wouldn't have been available. Looking at the concentrations of the pesticides by far drives the risk. There's no question about it at all, and the toxicity tests we have are 100 percent across the board. What I would like to mention is we are going into an area that is a wetland. We're going to have to excavate and destroy that area. We will restore that area in kind and in place. That area has been delineated. It will include regrading, replanting, and restoring that wetland.

Dr. Richards asked if that will be in a one-to-one ratio.

Ms. Tyler stated yes in kind and in place, same footprint.

Mr. Paskavsky asked what the Navy is going to do with the soil that is cleaned out of the ponds.

Ms. Tyler stated that it depends on what's in the sediments or the soils. If it has high concentrations of DDT, it will be brought to an outside hazardous waste landfill.

Mr. Chmura asked what caused such a concentration of DDT in that particular wetland.

Ms. Tyler stated that they used DDT for mosquito control.

Mr. Chmura asked how did the Navy get rid of that in that other area, the Area "A' wetlands.

## APPENDIX B

## CTDEP CONCURRENCE WITH PROPOSED PLAN

<IMG SRC 98003Q>

## APPENDIX C

## RESPONSIVENESS SUMMARY

The Navy published a notice and brief analysis of the Proposed Plan in the New London Day on August 1, 1997 and made the plan and the administrative record available to the public at the Groton Public Library, the Bill Library and the Naval Submarine Base Library.

On August 6, 1997, the Navy held an informational meeting to discuss and present the Proposed Plan. Also, on August 6, 1997 the Navy held a public hearing to discuss the Proposed Plan and to accept any oral comments. A transcript of this meeting is included in Appendix A. From August 1, 1997 to September 1, 1997 the Navy held a 30-day public comment period to accept public comment on the Proposed Plan.

### SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD

Oral comments received during the public hearing held on August 6, 1997 are provided in Appendix A. No written comments were received during the public comment period other than a letter dated August 18, 1997 from the Connecticut Department of Environmental Protection (CTDEP) expressing their support of the Proposed Plan as presented.

## APPENDIX D

## DECLARATION OF CONCURRENCE

The State of Connecticut has concurred with the Proposed Remedial Action Plan as shown in Appendix B. The U.S. EPA has concurred with the Proposed Plan as described in the Declaration of this Record of Decision.

<IMG SRC 98003R>