

Final
Decision Document
Site 7: Amphibious Base Landfill
Naval Amphibious Base, Little Creek
Virginia Beach, Virginia



Prepared for
Department of the Navy
Atlantic Division
Naval Facilities Engineering Command
Norfolk, Virginia

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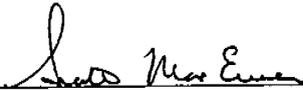
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Naval Amphibious Base Little Creek
Virginia Beach, Virginia

Contract Task Order Number 0025
Contract Number N62470-95-D-6007
LANTDIV CLEAN II Program

Prepared by
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January 12, 1998

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Acronyms and Abbreviations

ARAR	Applicable or Relevant and Appropriate Requirement
BNA	Base Neutral and Acid Extractable Organic Compound
BRA	Baseline Risk Assessment
BTAG	Biological Technical Assistance Group
CERCLA	Comprehensive Environmental Response and Liability Act of 1980
CTO	Contract Task Order
cy	cubic yards
DD	Decision Document
ECOC	Ecological Contaminants of Concern
EPA	United States Environmental Protection Agency
ERA	Ecological Risk Assessment
FS	Feasibility Study
FWES	Foster Wheeler Environmental Services
GCL	Geosynthetic Clay Liner
HDPE	High-Density Polyethylene
HI	Hazard Index
IAS	Initial Assessment Study
ICR	Incremental Cancer Risk
IR	Installation Restoration
IRI	Interim Remedial Investigation
MCL	Maximum Contaminant Level
NAB	Naval Amphibious Base
NPL	National Priorities List
OSHA	Occupational Safety and Health Administration
PCBs	Polychlorinated Biphenyls
ppb	parts per billion
ppm	parts per million
PRAP	Proposed Remedial Action Plan
QI	Quotient Index
RA	Risk Assessment
RAB	Restoration Advisory Board
RAO	Remedial Action Objective

Acronyms and Abbreviations (continued)

RCRA	Resource Conservation and Recovery Act
RGH	Rogers, Golden, and Halpern
RI	Remedial Investigation
RVS	Round 1 Verification Step
SARA	Superfund Amendments and Reauthorization Act of 1986
TBC	to be considered
VDCR	Virginia Department of Conservation and Recreation
VDEQ	Virginia Department of Environmental Quality
VOC	Volatile Organic Compound

Declaration

1.1 Statement of Basis and Purpose

This Decision Document (DD) presents the selected remedial action for Site 7: The Amphibious Base Landfill at Naval Amphibious Base, Little Creek (NAB Little Creek), in Virginia Beach, Virginia. The remedial action was chosen in accordance with the Navy's Installation Restoration (IR) Program and, to the extent practicable, with guidance provided by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan. CERCLA, as amended by SARA, sets forth the legal requirements for cleaning up hazardous waste disposal and spill sites on the National Priorities List (NPL). Although neither Site 7 nor NAB Little Creek is on the NPL, the Navy's approach to investigating and remediating this site and other non-NPL sites in the IR Program is consistent with the requirements of CERCLA and SARA to the extent practicable. This DD is based on the administrative record for this site.

1.2 Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this DD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

1.3 Description of the Selected Remedy

The principal risks at and near the site are potential exposure to inorganic contaminants in the surface soil and groundwater within the site boundary, and in the surface water and sediment in the canal bordering the site to the west. The risks associated with the canal water and sediment are not necessarily associated with Site 7 because the greatest levels of contaminants in both media in the canal are found upstream of the site.

The risks associated with the groundwater onsite are based on total rather than dissolved metal concentrations; dissolved concentrations do not present an unacceptable risk.

The remedy selected for this site consists of institutional controls. The major components of this remedy are as follows:

- Placement of cover soil and topsoil and the reestablishment of vegetative cover in the open areas of the site to prevent erosion and deter infiltration of rainwater and leaching of soil contaminants to the groundwater.
- Removal of visible debris along the north edge of the landfill.
- Installation of a chain-link fence along the eastern and southern sides of the site to prevent unauthorized access.
- Implementation of a public awareness program, including posting of warning signs.

- Implementation of groundwater-use restrictions, land-use restrictions and revisions to the Base Master Plan to restrict future uses of the site.
- Installation of protective measures in the erosion-prone areas on each side of the canal crossing on the west side of the site.
- Performance of semiannual long-term monitoring of site groundwater, surface water, and sediment.

1.4 Statutory Determinations

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy uses permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable for this site. However, because treatment of the principal threats of the site was not found to be practicable, the remedy does not satisfy the statutory preference for treatment as a principal element.

Because the remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted within 5 years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Approval by:



Leroy A. Brown
Commanding Officer
NAB Little Creek

11 Jan 1990

Date

Decision Summary

2.1 Site Description

Naval Amphibious Base Little Creek (NAB Little Creek), in Virginia Beach, Virginia, is on the southern shoreline of the Chesapeake Bay near the Virginia Beach-Norfolk border (Figure 1). Site 7, the Amphibious Base Landfill is in the south-central part of the base, adjacent to the south shore of Little Creek Cove (Figure 2).

The area of the landfill is approximately 38 acres. About one-third of the site is a flat, grassy area. The remainder of the site is thickly vegetated or covered by wetlands and tidal marshes. The northern vegetated part of the site is flat, but uneven, with evidence of the underlying debris buried in the landfill. There is a sharp drop in grade on the north side of the site between the thickly vegetated area and the tidal marsh area bordering Little Creek Cove that appears to correspond with the limits of waste placement in the landfill. Several large piles of debris, consisting primarily of lumber, plastic, and metal, are located in this area. The source of these piles of debris is not known.

Vehicle access to the landfill is controlled by two locked gates across access roads on the site's eastern and western sides. A chain-link fence runs along the site's southern boundary. Pedestrian access along the eastern and western borders is deterred by dense vegetation and canals.

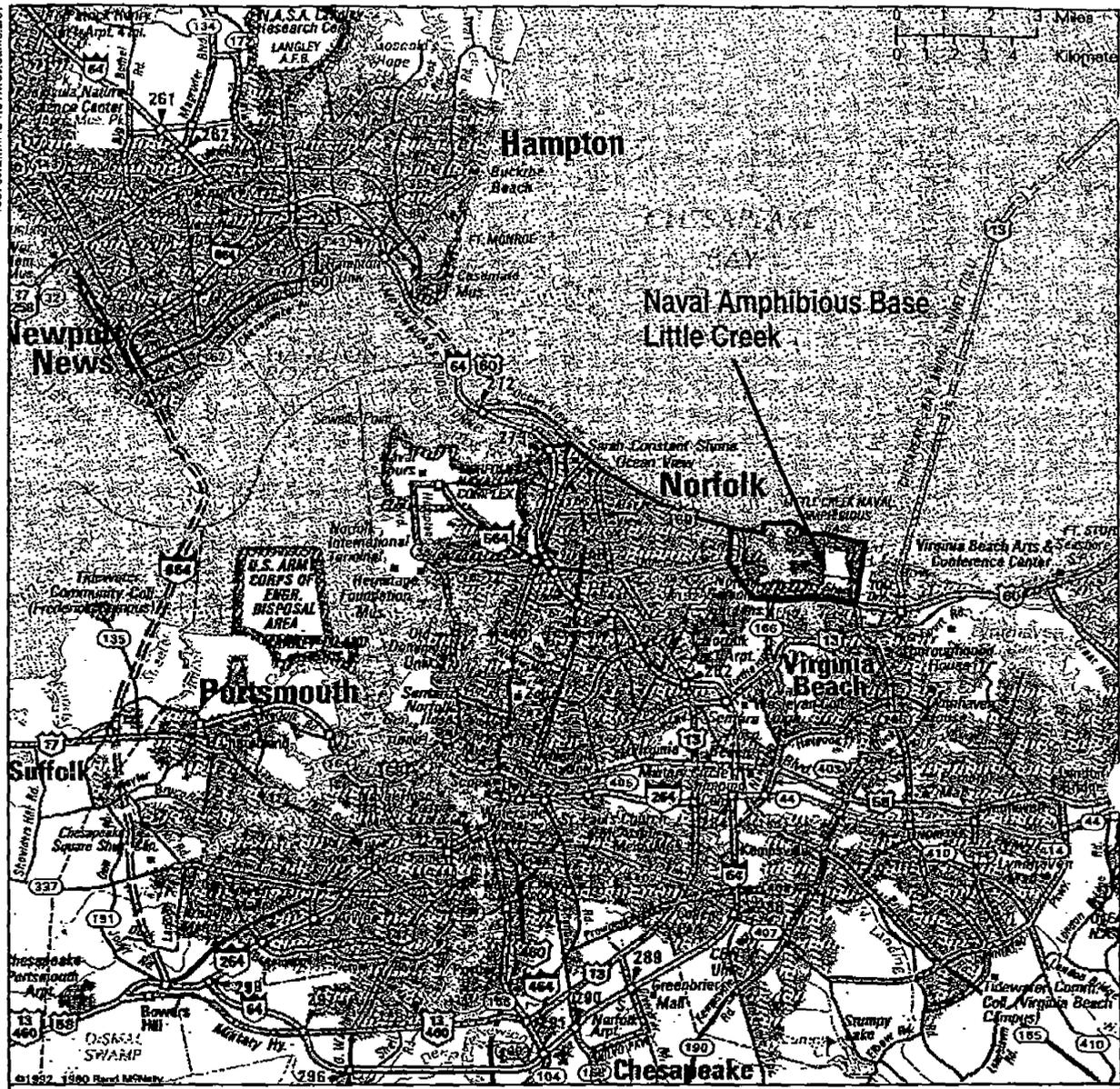
The area immediately surrounding Site 7 is primarily industrial and includes the base's former construction debris landfill to the east, a wastewater treatment plant operated by the Hampton Roads Sanitation District to the south, and the base's Duration Force Vehicle Compound and an ammunition magazine to the west. Land use surrounding the base is industrial, residential, and commercial. The nearest residents to the site are approximately 2,000 feet to the southeast. The location of the nearest water-supply well is not known; however, there are no water-supply wells downgradient (north) of Site 7, between the site and Little Creek Cove.

2.2 Site History and Enforcement Activities

Site 7, the Amphibious Base Landfill, was operated between 1962 and 1979. It initially operated as a trench-type landfill with open burning of refuse in the trenches. Trenches were excavated to a depth where groundwater filled the trench as quickly as it could be excavated. This commonly resulted in standing water in the trenches during waste disposal operations. The manner in which the landfill was operated makes it difficult to establish the degree of combustion or fate of any particular item disposed of. The landfill was later operated as an area landfill, with refuse spread over the ground and covered regularly. This aspect of the operation has resulted in the current surface topography and elevation.

Estimates of the volume of waste in the landfill vary from approximately 500,000 cubic yards (cy) to 1.2 million cy. Most of this total is presumed to be composed of nonhazardous solid waste from base housing and other residential and commercial activities at the installation.

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Source: Rand McNally



Figure
BASE LOCATION MAP
NAB Little Creek
Virginia Beach, Virginia

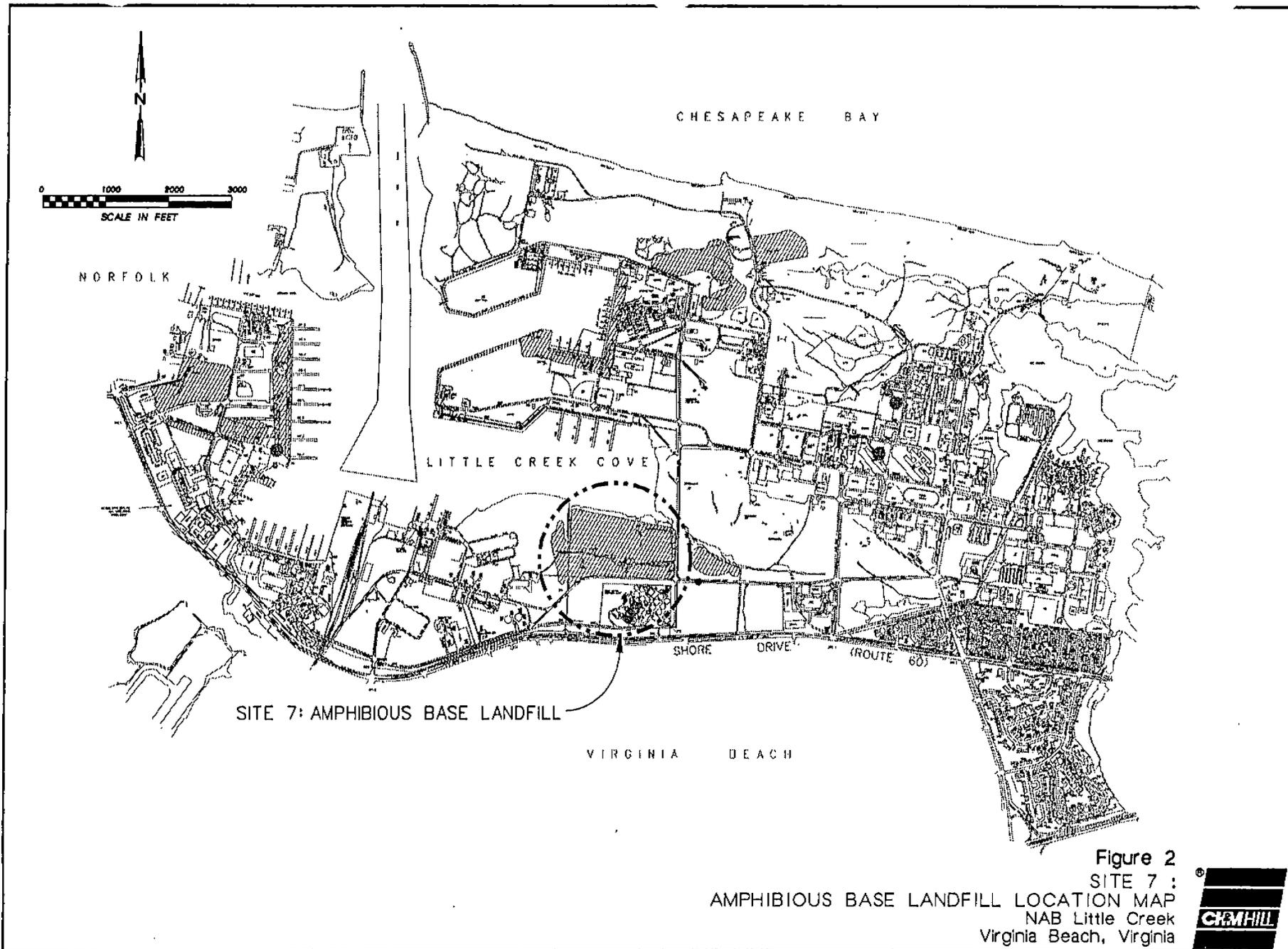


Figure 2
 SITE 7 :
 AMPHIBIOUS BASE LANDFILL LOCATION MAP
 NAB Little Creek
 Virginia Beach, Virginia



Specific records documenting the types and quantities of waste placed in the landfill are not available. Because the landfill received all waste generated by NAB Little Creek during its operation, it most likely received potentially hazardous materials.

Waste oils and metals segregated from the wastes were placed in the landfill starting in 1970. A hazardous waste management plan for the base was not implemented until 1979, the year the landfill closed. Up until 1979, the landfill was operated under a Virginia solid waste permit (No. 276). The permit was terminated in 1982 and the landfill was considered closed by the state. After closure, the landfill continued to be used as a metal collection and transfer site, temporary storage site for wastes, and burn area for scrap wood and trees. Open burning was halted in 1984 and waste storage activities at the site ceased permanently in 1994. Parts of the landfill were covered with a layer of topsoil in 1994 and a cover of vegetation was subsequently established.

Five investigations involving Site 7 have been conducted at NAB Little Creek:

- The Initial Assessment Study (IAS)
- A Round 1 Verification Step (RVS)
- An Interim Remedial Investigation (IRI)
- A Remedial Investigation/Feasibility Study (RI/FS)
- A detailed FS focusing only on Site 7

Environmental investigation activities were initiated at NAB Little Creek in 1984 with the IAS conducted by Rogers, Golden, and Halpern, Inc. (RGH). The IAS identifies and assesses sites that posed a potential threat to human health or the environment because of contamination from past handling of and operations involving hazardous materials. Potentially contaminated sites were identified on the basis of information obtained from historical records, photographs, site inspections, and personnel interviews. Each site was evaluated for type of contamination, migration pathways, and pollutant receptors. The IAS concluded that Site 7, in addition to several other sites, posed sufficient potential threats to human health or the environment to warrant further evaluation in a confirmation study.

A confirmation study subsequently was performed at Site 7 and several other sites that were recommended for further investigation in the IAS. The confirmation study was conducted in two rounds consisting of the RVS, conducted by CH2M HILL, dated October 1986, and the IRI, conducted by Ebasco, dated November 1991. The study verified the presence or absence of potential contamination at the IR sites identified in the IAS. Nine groundwater samples, five surface-water samples, and five sediment samples were collected at Site 7 during this phase of the investigation. Groundwater and surface water samples were analyzed for volatile organic compounds (VOCs), base neutral and acid extractable organic compounds (BNAs), pesticides and polychlorinated biphenyls (PCBs), and metals.

The RVS report concluded that little or no contamination was leaving the landfill at that time. However, the source of the low-level concentrations of some contaminants in surrounding surface water could not be adequately assessed, based on current data. The RVS, in turn, recommended that a second round of samples be collected from the previously sampled monitoring wells and surface water and sediment locations.

The IRI was conducted to determine whether further characterization activities or remedial action was warranted at Site 7. Additional sampling was performed, as recommended in the RVS. The results tended to confirm the findings of the RVS.

On the basis of the combined results of the RVS and IRI, the IRI report concluded that the landfill was not releasing contaminants to the groundwater. The IRI recommended that the status of the landfill, regarding Virginia regulations, be determined.

The RI/FS was conducted at six sites, including Site 7 by Foster Wheeler Environmental Services (FWES) in November 1994. Eight surface soil, five subsurface soil, nine groundwater, six surface water, and six sediment samples were collected at Site 7.

A detailed draft-final FS was completed for Site 7 by FWES in February 1997. The FS identified remedial alternatives to reduce potential human health and environmental risks associated with the various contaminants of concern identified at Site 7. The FS identified and evaluated a range of remedial alternatives and provided recommendations. The preferred alternative was identified on the basis of the evaluation provided in the FS and presented for public comment in the Draft Final Proposed Remedial Action Plan (PRAP), dated April 10, 1997.

The Navy, acting as the lead agency, is submitting this DD through the Navy's IR Program, and in accordance CERCLA, as amended by SARA. CERCLA as amended by SARA sets forth the legal requirements for cleaning up hazardous waste disposal and spill sites on the NPL. While neither Site 7 nor NAB Little Creek is on the NPL, the Navy's approach to investigating and remediating this site and other non-NPL sites in the IR Program is consistent with the requirements of CERCLA and SARA. Because the site is not a CERCLA site, there have been no CERCLA or other enforcement activities at the site.

2.3 Highlights of Community Participation

CERCLA sections 113(k)(2)(B)(i-v) and 117 require public participation in the decision process. A PRAP was prepared for Site 7 in April 1997. The PRAP describes the remedial alternative preferred by the Navy, and summarizes key information in the RI/FS and other documents pertaining to the site. The PRAP was available for public review and comment between April 13, 1997, and May 12, 1997, at several public repositories near the site. The Navy encouraged community participation during the public comment period by advertising the availability of the PRAP and the procedures for review and comment in the April 13 edition of the *Virginian Pilot* newspaper and sending copies to the Restoration Advisory Board (RAB). The Navy, with the assistance of EPA Region III and the Virginia Department of Environmental Quality (VDEQ), identified a selected remedy for Site 7 only after the public comment period ended and the information submitted during this time was reviewed and considered. The Draft Final DD was prepared based on the comments received during the public comment period for the PRAP and was submitted to EPA and VDEQ and placed in the public repositories in October 1997. Comments were received from VDEQ and were incorporated into the Final DD. Responses to comments presented by the public and the government regulatory agencies during the PRAP and DD review periods are presented in Section 3 of this DD.

2.4 Scope and Role of Response Action Within Site Strategy

The selected remedy addresses the potential threats posed by all media, including surface soil and subsurface soil, buried waste, groundwater, surface water, and sediment at Site 7.

The principal threats posed by Site 7 are related to the wastes that have been buried at the site during its operation as the base landfill. The wastes are believed to include petroleum and hazardous wastes. Potential threats posed by the presence of the waste include:

- Residual contamination in surface soil and physical hazards, such as protruding trash and depressions, caused by subsidence in the landfill which could pose threats to the health and safety of people, such as base personnel, trespassers, and others who might come in contact with the landfill surface now or in the future.
- The buried waste and contaminated subsurface soil which could pose threats to people who may come into direct contact with it if there is future excavation at the site.
- The waste and contaminated soil which may also pose a threat to the condition of the groundwater under the landfill and the surrounding surface water and sediment in Little Creek Cove and the streams and canals bordering the site. This could occur via runoff from the landfill surface, which may carry contaminants or contaminated surface soil, or through the leaching of contaminants from the soil or waste as rainwater percolates through the landfill.

The risks posed by these potential threats have been quantified in a baseline risk assessment, the results of which are summarized below in Section 2.6 of this DD.

2.5 Summary of Site Characteristics

The primary landfill materials are the municipal wastes produced at the residences and other facilities at NAB Little Creek. The materials also are assumed to include potentially hazardous materials. Waste oils and metals segregated from the wastes were placed in the landfill from 1970 to 1979. The landfill was closed in 1979. After closure, the landfill area continued to be used as a metal collection and transfer site, temporary storage for wastes, and burn area for scrap wood and trees.

During the RVS, dated October 1986, and the IRI, dated November 1991, BNAs were detected at low levels in three monitoring wells. Several metals, including cadmium, total chromium, selenium, silver, thallium, and zinc, were detected in all of the groundwater samples at concentrations slightly greater than what would be expected to occur naturally in this aquifer. Oil and grease also were detected in all nine groundwater samples at levels ranging from 3 to 47 parts per million (ppm).

Metals were detected in surface water samples at concentrations above typical levels. Low levels of BNAs also were detected in surface water samples. Sediment samples were found to contain low levels of BNAs, PCBs, and oil and grease. Several metals were detected at concentrations slightly above typical soil levels.

During the RI/FS, PCBs were identified in two surface soil samples. Low levels of arsenic, cadmium, chromium, cobalt, copper, and nickel also were detected. Metals, including beryllium, lead, aluminum, and iron, were detected in subsurface soil samples at concentrations slightly above typical soil levels for the area.

Metals were the only constituents detected in groundwater samples. These included aluminum, arsenic, beryllium, cadmium, chromium, iron, lead, manganese, and nickel. Metals also were detected in surface water samples. Aluminum, arsenic, barium, copper, iron, lead, manganese, and zinc were detected at concentrations above expected surface water

concentrations. Various metals, specifically aluminum, arsenic, barium, copper, iron, lead, manganese, and zinc, were detected in sediment samples at concentrations slightly above typical soil concentrations for the area.

The RI did not identify the extent of waste within the landfill boundary or the extent of contaminated soil; however, the preliminary FS, which is presented in Section 7 of the RI report, calculated a potential volume of 1.2 million cy of waste and soil, using an average fill height of 15 feet. The average height was estimated based on the site topography and the depth to clay layers observed in borings at the edge of the landfill.

2.6 Summary of Site Risks and Remedial Action Objectives

The human health risks associated with exposure to contaminated media at Site 7 were evaluated in the 1994 RI/FS report. A human health Baseline Risk Assessment (BRA) was conducted to assess the potential health risks that might result under both current and future land-use scenarios. The site is expected to remain industrial; however, exposure to contaminants was assumed for a future residential scenario as suggested by EPA guidance.

The assessment of risks to ecological receptors from sources related to Site 7 was addressed in two phases. The 1994 RI/FS report included an Ecological Risk Evaluation that qualified risks to aquatic wildlife receptors within the reaches of Little Creek that were adjacent to Site 7. A Supplemental Ecological Assessment (SEA) was prepared by Baker Environmental (Baker) in 1996 at the request of EPA's Biological Technical Assistance Group (BTAG) to provide a more comprehensive assessment of the risks to aquatic ecological receptors in Little Creek Harbor. The SEA includes a Phase One Ecological Risk Assessment (ERA). Both the human health and ecological risks associated with Site 7 are summarized below.

2.6.1 Summary of Human Health Risks

A BRA was conducted using the analytical data obtained during the RI in 1993. Details of the BRA can be found in the draft final FS report dated February 1997.

2.6.1.1 Exposure Pathways

Potential receptors may come in contact with site-related contaminants via:

- Ingestion and dermal contact with surface and subsurface soil
- Ingestion, dermal contact, and inhalation of groundwater
- Ingestion and dermal contact with surface water and sediments
- Ingestion of fish from the streams on or adjacent to the site

2.6.1.2 Potential Receptors

The BRA evaluated the current risks for child and adult trespassers, adult workers, and child and adult recreational receptors; and evaluated future risks for a potential residential population, including both children and adults.

2.6.1.3 Exposure Assessment

The following contaminants of concern were identified at Site 7:

- Semivolatile organic compounds—phenanthrene and benzo(a)pyrene

- PCBs–Aroclor-1260
- Metals–aluminum, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, vanadium, and zinc

2.6.1.4 Risk Characterization

2.6.1.4.1 Current Scenario

The only risk in the current scenario appears to be via surface water ingestion, where the hazard index (HI) exceeded 1.0 for both the trespasser adult (3.45) and trespasser child (16.1). EPA considers an HI of more than 1.0 to represent an unacceptable risk for systemic health effects under a given exposure scenario. For these receptors, arsenic and manganese appear to be the primary sources of risk. The incremental cancer risk (ICR) for the trespasser adult and the trespasser child are 2.12×10^{-4} and 1.98×10^{-4} , respectively, for this exposure scenario with arsenic being the dominant risk driver. EPA considers an ICR of greater than 1×10^{-4} to be an unacceptable cancer risk.

Surface water risks are associated with the tidal canal along the western border of the site. The canal appears to be impacted by other sources beside Site 7 and the risks are not necessarily related to Site 7. Concentrations exceeding risk levels have been found in this canal at locations both upstream and downstream of Site 7. The risks associated with upstream locations are similar to the risks associated with downstream locations. Likewise the concentrations of arsenic and manganese in the canal are similar upstream and downstream of the site.

2.6.1.4.2 Future Scenario

Several potentially unacceptable health risks exist under the future scenario. The HI for the resident child ingestion of both surface soil and subsurface soil exceed 1.0. The HI for surface soil ingestion is 2.56 and for subsurface soil ingestion is 1.15. The exceedances are mainly due to the presence of metals, primarily arsenic, iron, and manganese. For the groundwater ingestion pathway, the HI for the resident adult receptor exceeded 1.0 (2.85) and the ICR exceeded 1×10^{-4} (1.28×10^{-4}), where aluminum, arsenic, beryllium, cadmium, chromium, manganese, and vanadium dominate. In this same scenario, the threshold HI for resident child was also exceeded (3.33). Risk indices for groundwater ingestion were calculated using total metals; the indices were not exceeded if dissolved metal concentrations are used. Finally, in the surface water ingestion pathway, the HI for a resident child was 16.1 and the ICR was 1.98×10^{-4} and the HI for the resident adult scenario was 3.45 and the ICR was 2.12×10^{-4} . Arsenic, barium, and manganese significantly contribute to the index exceedances.

Because the site is a landfill, and will continue to be a landfill, it is unlikely that the site will ever be used for purposes where exposure will occur under a residential scenario. A majority of the Site 7 area also falls within the radius of the Explosive Safety Quantity Distance of a munitions magazine which restricts use of the site (e.g., no inhabited building may be constructed in this area).

2.6.2 Summary of Ecological Evaluation

One intent of the SEA was to conduct a Phase One ERA to characterize potential aquatic receptors and to evaluate the potential hazard or risks to these receptors associated with Site 7 and other IR sites. The SEA also attempted to qualitatively evaluate the overall ecological

condition of Little Creek Harbor by performing a compilation of existing IR and non-IR data pertaining to Little Creek Harbor and presented a perspective overview of the ecological condition of Little Creek Harbor as related to similar water bodies in the region. The ERA followed the methodologies outlined in EPA document *Region III Interim Ecological Risk Assessment Guidelines* (1994). The Phase One ERA is presented fully in the 1996 SEA and briefly summarized here.

Analytical data collected during the 1994 RI were analyzed using EPA guidance to identify ecological contaminants of concern (ECOCs) and to determine ecological quotient index (QI) ratios for the various ECOCs for each media. Data for surface water and sediment were reviewed. ECOCs were identified by comparing to Region III BTAG screening levels and using several other criteria. QI ratios greater than 1 indicate potential for risk.

A site inspection was performed at Site 7 as part of the RI to identify the types of habitats and animals present. Site 7 contains open water (ponds, canals, and the south shoreline of Little Creek Cove), wetlands, and mixed forest. Two tracts of wetlands are present within or surrounding Site 7. The first is an emergent wetland along the northern part of the site bordering Little Creek Cove. The second is east of the site, across Helicopter Road. Neither wetlands has been delineated. The aquatic systems at NAB Little Creek serve as a winter haven for waterfowl and wading birds, and the base's wetlands are considered to be a significant wildlife habitat.

No federal or state-listed threatened or endangered plant or animal species were encountered at the site or on the base during a 1990 survey conducted by the Virginia Department of Conservation and Recreation (VDCR). Three species of rare plants and suitable habitats for two species of rare animals were identified on the base, but none were found specifically in Site 7. One area of the base, along the east shore of Little Creek Channel, has been recommended by the VDCR for conservation and the establishment of a management plan because of its use as a nesting area for a state-recommended threatened species of tern. Only one area considered to be a sensitive environment, Seashore State Park, is within a 15-mile radius of the base.

2.6.2.1 Exposure Pathways

The exposure pathways considered in the ERA are ingestion and dermal contact with the surface water and sediment.

2.6.2.2 Potential Receptors

The potential receptors are considered to be species that live in or use the surface water and sediment in areas affected by Site 7.

2.6.2.3 Exposure Assessment

Exposure point concentrations of contaminants in the surface water and sediment for aquatic receptors were assumed to be equal to the contaminant concentration at the surface water and sediment sampling points.

2.6.2.4 Risk Characterization

The Phase One ERA for Site 7 indicates that several inorganic compounds potentially adversely affect the overall ecological condition of Little Creek Harbor. In surface water, manganese presented a moderate potential for risk with an average QI ratio of greater than 10

for chronic effects. Acute and chronic copper and chronic lead risks were associated with average QI ratios between 1 and 10, which indicate a slight potential for risk. Total surface water QI ratios were approximately 3 for acute risks and 28 for chronic risks. Surface water risks were associated only with inorganic compounds.

The sediment ECOCs also were limited to inorganic compounds. Arsenic, beryllium, cadmium, cobalt, copper, silver, and zinc produced QI ratios between 1 and 5 for individual sampling locations, which indicate a slight potential for risk. Total average risks associated with the sediment (for all sampling locations at Site 7) are considered slight to nonexistent and are related to cadmium, cobalt, silver, and beryllium.

2.6.2.5 Other Findings

Other findings of the SEA related to the overall condition of Little Creek Harbor are:

- Based on the comparison of Site 7 ECOC concentrations, and concentrations of ECOCs from several water quality studies conducted in Little Creek Harbor, there may be a variety of sources for the ECOCs detected in the harbor.
- The overall water quality in Little Creek Harbor, based on the study by Ewing et al. (1992), is meeting current screening levels of metals analyzed with the exception of mercury. Mercury, however, was only detected in one station, which is located in the western part of Little Creek Harbor and not near Site 7. Mercury was not detected in the surface water or sediments of Site 7. For sediment samples, many of the metals exceeding sediment benchmarks for Site 7 also exceeded these benchmarks in the Ewing study. However, it is noted that the relative range of Site 7 metal concentrations was less than the range of metal concentrations found in the Ewing study.
- The harbor's waters and sediments are frequently disturbed by: (1) the natural influence of the tidal flux; (2) NAB's logistic support operations and amphibious training requirements, including boat traffic; and (3) the periodic dredging operations. These disturbances will affect the ecological resources of Little Creek Harbor and will tend to re-suspend and redistribute ECOCs throughout the harbor and overshadow any apparent fate-and-transport relationship to the various sources in the harbor.
- The Restoration Goal Index calculated for Little Creek Harbor indicated that the benthic macro-invertebrate community meets benthic restoration goal requirements.

Although some localized impacts from ECOCs may be related to Site 7, there does not appear to be a significant impact on the ecological resources of Little Creek Harbor from the site. Data collected in the SEA indicate limited toxicological impact and the absence of severe environmental media contamination. However, there is evidence of metal concentrations in the harbor at levels greater than what would be expected to occur naturally. These concentrations are consistent with a chronic exposure scenario with the contamination originating from a variety of sources, from both within and outside the harbor.

2.6.3 Remedial Action Objectives

On the basis of the potential current and future risks posed by the site, a series of site remedial action objectives (RAOs) was established. The RAOs, which were developed in the FS, were based on the following assumptions and limitations:

- Subsurface soil and waste at Site 7 have not been fully investigated. The presence of hazardous substances in the subsurface is assumed because the site was a former landfill.
- The intent of site remediation under the IR program is to mitigate human health risks rather than to restore the site to natural conditions. The remedial objective is to mitigate migration of these contaminants to the adjacent environment, i.e., groundwater, surface water, sediment, and surface soil.
- Ecological assessments for Little Creek Cove and the adjoining surface water streams have not indicated any specific impact from the landfill.

RAOs are statements that specify site remediation goals and identify which constituents of concern, media, and exposure pathways need to be addressed by the selected remedial action. Remedial or cleanup goals established exposure levels that are protective of human health and the environment. The RAOs for Site 7 were developed by considering applicable or relevant and appropriate requirements (ARARs), the toxic or carcinogenic potential of constituents of concern, and the aggregate risk posed by multiple constituents.

The RAOs developed for Site 7 include:

- Reduce the human health risk associated with the ingestion of site soil and groundwater.
- Mitigate the migration of constituents of concern from the site groundwater to the nearby surface water streams and to any interconnected aquifers.
- Mitigate the human health risks attributable to Site 7 associated with ingestion of surface water in Little Creek Cove and local canals near the site.

The specific remediation goals are to prevent exposure to surface soil, subsurface soil, and groundwater on the site at levels that present a carcinogenic risk of greater than 1×10^{-4} or a hazard index of greater than 1.0 and that prevent exposure to site-related surface water and sediment of those same levels.

The restoration of the water-table aquifer to drinking water standards is not considered a remediation goal because the aquifer at the site is not used nor is likely to be used for drinking water purposes. In addition, because the aquifer in question discharges to the surface water at the site boundary, the only access to the site groundwater would be via a supply well installed directly in the landfill, which is unlikely.

2.7 Description of Alternatives

A detailed analysis of possible remedial alternatives for Site 7 soil, groundwater, surface water, and sediments is included in the draft final FS for Site 7. The alternatives were developed according to EPA documents entitled *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (October 1988) and *Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites* (December 1988). A summary of the remedial alternatives developed to address contamination associated with Site 7 soil, groundwater, surface water, and sediments is presented below.

2.7.1 Alternative 1—No Further Action

Under this alternative, no further effort or resources would be expended at Site 7. However, because contaminated media would remain on the site, a review of site conditions would be

required every 5 years. This 5-year review is mandated by CERCLA. Alternative 1 serves as a baseline against which the effectiveness of other alternatives are evaluated.

The costs of this alternative are expected to be approximately \$25,000 for the 5-year review and related monitoring.

2.7.2 Alternative 2—Institutional Controls with Monitoring

This is a partial containment alternative, with no treatment. The major components of Alternative 2 include:

- Placement of cover soil and topsoil and the reestablishment of vegetative cover in the open areas of the site to prevent erosion and deter infiltration of rainwater and leaching of soil contaminants to the groundwater.
- Removal of visible debris along the north edge of the landfill.
- Installation of a chain-link fence along the eastern and southern sides of the site to prevent unauthorized access.
- Implementation of a public awareness program, including posting of warning signs.
- Implementation of groundwater and land-use restrictions and revisions to the Base Master Plan to restrict future uses of the site. These land-use restrictions are discussed in more detail in Section 2.8.2.4.3.
- Installation of protective measures in the erosion-prone areas on each side of the canal crossing on the west side of the site.
- Performance of semiannual long-term monitoring of site groundwater, surface water, and sediment.
- Performance of a 5-year review of site conditions.

Soil or topsoil cover will be added in areas where the current amount of topsoil is inadequate to support vegetation. Approximately 7,200 and 2,500 cy of topsoil will be used to cover the western and central parts of the landfill, respectively. An additional 4,900 cy of cover material also will be required in the central part of the landfill.

Surface debris, consisting primarily of wooden timbers, floats, drums, and miscellaneous rubbish including household items, is currently located in several concentrated piles at the landfill. Approximately 1,000 cy of this debris is projected to be removed from the site.

Protective measures in erosion-prone areas of the landfill will be required. Protection will primarily consist of placing riprap on the canal embankment adjacent to the canal crossing and on both sides of the gravel road, at the intersection of the canal.

This alternative does not remove contaminated materials, but lowers the potential for receptors coming into contact with contaminated media. The potential for contaminants to migrate from the area is reduced but not eliminated. Because contaminated media will remain on the site, long-term monitoring of the site will be necessary. Monitoring will involve semiannual sampling of groundwater, surface water, and sediment. A 5-year review of the semiannual sampling results also will be required to ensure that adequate protection of human health and the environment continues to be provided.

Action-specific ARARs for this alternative include Occupational Safety and Health Administration (OSHA) health and safety standards for activities such as constructing fences, posting warning signs, and adding soil and topsoil cover in the landfill. The ARARs will be met by providing proper personal protective equipment, training, and safety equipment to workers. Federal and Virginia maximum contaminant level (MCLs) and health advisories (chemical-specific ARARs) are not achieved because this alternative does not involve any treatment. Location-specific ARARs and to be considered (TBC) criteria are met under this alternative. Federal and state wetland and floodplain regulations are not applicable because the activities to be performed within the wetlands and floodplains are minimal and are not covered by permit regulations.

The estimated costs associated with Alternative 2 are as follows:

- Capital: \$474,000
- Annual operation, monitoring, and maintenance: \$59,000
- Total present worth (30-year): \$1,380,000

2.7.3 Alternative 3—Geosynthetic Cap on the Landfill with Monitoring

This is a containment alternative, with no treatment. The major components of Alternative 3 include:

- Fortification of the existing perimeter fence.
- Implementation of groundwater and land-use restrictions and revisions to the Base Master Plan to restrict future site use.
- Implementation of a public awareness program, including posting of warning signs.
- Installation of a geosynthetic clay liner (GCL) and geomembrane cap to minimize percolation of precipitation.
- Performance of semiannual long-term monitoring of groundwater, surface water, and sediment.
- Performance of a 5-year review of site conditions.

Containment of the contamination, without treatment measures, is provided. A GCL will be installed within the landfill boundary. A geomembrane, such as high-density polyethylene (HDPE), will be placed over the GCL, and a vegetative layer will, in turn, be installed and maintained over the cap. Installation will require approximately 1.7 million square feet of both HDPE liner and GCL, 62,000 cy of cover soil, and 31,000 cy of topsoil. The liner also will require periodic maintenance to ensure its continued integrity.

Long-term environmental monitoring of the site will be necessary. Monitoring will involve semiannual sampling of groundwater, surface water, and sediment. A 5-year review of the semiannual sampling results will also be required to ensure that adequate protection of human health and the environment continues to be provided.

Potential for contact with contaminated surface soil is eliminated by installing the cap. The cap also reduces erosion of contaminated soil to the surface water. Contact with surface water would be deterred via perimeter fencing and warning signs. Implementing institutional controls will prevent contact with groundwater.

Federal and Virginia MCLs and health advisories are not achieved because this alternative does not involve any treatment. ARARs for this alternative include OSHA health and safety standards for activities such as constructing fence, posting warning signs, and installing the cap on the landfill. The ARARs will be met by providing proper personal protective equipment, training, and safety equipment to workers. Location-specific ARARs and TBCs, including federal and state wetland and floodplain regulations, can be met under this alternative with mitigation. However, this alternative does not meet the intent of Executive Order 11990, which requires that federal agencies minimize wetland degradation and preserve and enhance the beneficial uses of wetlands, because installation of the cap will be more detrimental to the wetlands than if no such action is taken.

The estimated costs associated with Alternative 3 are as follows:

- Capital: \$5,020,000
- Annual operation, monitoring, and maintenance: \$59,000
- Total present worth (30-year): \$5,936,000

2.7.4 Alternative 4—Cap and Slurry Wall with Monitoring

This is a total containment alternative with no treatment. The major components of Alternative 4 include:

- Fortification of the existing perimeter fence.
- Implementation of groundwater and land-use restrictions and revisions to the Base Master Plan to restrict future uses of the site.
- Implementation of a public awareness program, including posting of warning signs.
- Installation of a GCL and geomembrane cap to minimize percolation of precipitation.
- Construction of a slurry wall around the landfill to inhibit groundwater migration.
- Performance of semiannual long-term monitoring of groundwater, surface water, and sediment.
- Performance of a 5-year review of site conditions.

Vertical and horizontal containment of the landfill, without treatment, is provided. In this alternative, as in Alternative 3, a GCL and geomembrane cap will be installed over the landfill.

In addition, Alternative 4 will involve the installation of a soil-bentonite slurry wall, constructed around the perimeter of the landfill. The soil-bentonite slurry wall will span a total linear distance of 6,600 feet and will extend to a depth of approximately 20 feet, where it will be keyed into an underlying clay layer. It is anticipated that groundwater flow surrounding the landfill will be diverted around the landfill by the slurry wall, and groundwater on the site will be contained.

A long-term reduction in human health risks is anticipated under this alternative. The residual risk from dermal contact with surface soil will be within the target risk range of 10^{-6} to 10^{-4} . Contact with contaminated soil is reduced greatly due to the presence of the cap and the land-use restrictions. Infiltration is reduced by the cap and horizontal migration is reduced by

the slurry wall. Therefore, the potential for migration of contaminants of concern from site groundwater to nearby surface water is largely reduced.

Action-specific ARARs triggered by this alternative include OSHA health and safety standards and RCRA facility standards pertaining to installation of the GCL and the slurry wall. The ARARs can be complied with by providing trained personnel and appropriate personal protective and safety equipment, and by following RCRA facility standards properly. Federal and Virginia MCLs and health advisories are not achieved by this alternative; however, the water-table aquifer at the site is not currently used for drinking water, and restoration of the aquifer is not an RAO. Location-specific ARARs and TBCs, including federal and state wetland and floodplain regulations, could be met under this alternative with proper mitigation. However, this alternative does not meet the intent of Executive Order 11990, which requires that federal agencies minimize wetland degradation and preserve and enhance the beneficial uses of wetlands, because the installation of the cap and slurry wall will be more detrimental to the wetlands than if no such action is taken.

The estimated costs associated with Alternative 4 are as follows:

- Capital: \$13,000,000
- Annual operation, monitoring, and maintenance: \$64,000
- Total present worth (30-year): \$14,050,000

2.7.5 Alternative 5—Selective Removal or Treatment of Soil with Monitoring

This is a partial treatment alternative. The major components of Alternative 5 include:

- Fortification of the existing perimeter fence.
- Implementation of groundwater and land-use restrictions and revisions to the Base Master Plan to restrict future uses of the site.
- Implementation of a public awareness program, including posting of warning signs.
- Under Option A, removal or treatment of selected surface and subsurface areas of landfill.
- Or under Option B, conducting onsite stabilization of selected soil.
- Performance of semiannual long-term monitoring.
- Performance of a 5-year review of site conditions.

In Alternative 5, limited quantities (approximately 83,000 cy) of surface soil and subsurface soil containing contaminants of concern will be excavated and transported to an offsite permitted facility for disposal or stabilized onsite. An additional investigation would be necessary to identify the areas and quantities of significantly elevated contaminant concentrations.

Long-term environmental monitoring of the site will be necessary to monitor possible contaminant migration. Monitoring would involve semiannual sampling of groundwater, surface water, and sediment. A review of the analytical results, conducted after 5 years, will be necessary to ensure that the protection of human health and the environment is maintained. This review also will determine if additional remedial actions concerning the site are necessary.

A long-term reduction in human health risks is anticipated under this alternative. Contact with contaminants in site media is largely eliminated by excavating or treating soil around potential hot-spot areas, by installing a perimeter fence and posting of warning signs, and by implementing institutional controls. Contaminant migration also is reduced by this alternative, as the source of contamination is either partially removed or treated.

Action-specific ARARs triggered by this alternative include OSHA health and safety standards, RCRA excavation and fugitive dust requirements, RCRA land disposal restrictions, DOT regulations for hazardous materials transport, and Virginia solid waste regulations. It is expected that these action-specific ARARs can be met by providing proper personal protective equipment, specified training, and safety equipment to site workers and by following RCRA facility standards and DOT regulations properly. Federal and Virginia MCLs and health advisory standards are not achieved as this alternative does not involve treatment of the groundwater. Location-specific ARARs and TBCs, including federal and state wetland and floodplain regulations, could be met under this alternative with proper mitigation. However, this alternative does not meet the intent of Executive Order 11990, which requires that federal agencies minimize wetland degradation and preserve and enhance the beneficial uses of wetlands, because the excavation and soil removal activities will be more detrimental to the wetlands than if no such action is taken.

The estimated costs associated with Alternative 5 are as follows:

Alternative 5A (excavation)

- Capital: \$42,600,000
- Annual operation, monitoring, and maintenance: \$39,000
- Total present worth (30-year): \$43,200,000

Alternative 5B (stabilization)

- Capital: \$13,030,000
- Annual operation, monitoring, and maintenance: \$49,000
- Total present worth (30-year): \$13,780,000

2.8 Summary of Comparative Analysis of Alternatives

The five remedial alternatives were evaluated in the FS in accordance with EPA document entitled *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (October 1988). The nine evaluation criteria used to compare and select an alternative are discussed below. The criteria are divided into three categories: threshold criteria, primary balancing criteria, and modifying criteria.

2.8.1 Threshold Criteria

2.8.1.1 Overall Protection of Human Health and the Environment

This evaluation criterion addresses whether an alternative provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

All alternatives, except Alternative 1 (no further action), provide adequate protection of human health and the environment from site-related risks. Risks through ingestion of surface

soil and surface water are largely reduced by blocking human contact with site contaminants. As long as fencing, institutional controls, and soil cover or capping are maintained, site-related risks will remain below EPA criteria under Alternatives 2, 3, 4, and 5.

2.8.1.2 Compliance with ARARs

This evaluation criterion addresses whether an alternative will meet all of the ARARs or other federal and state environmental statutes or provide grounds for invoking a waiver. Compliance with chemical-, location-, and action-specific ARARs is evaluated.

All alternatives, except Alternative 1, can be designed and implemented to satisfy all action-specific ARARs. Alternative 1 does not meet solid waste regulations because releases from the site are neither mitigated or monitored.

Chemical-specific ARARs, such as federal MCLs and health advisories, are not achieved under any alternative because none of the alternatives involve treatment of the entire contaminated landfill mass and groundwater and hence do not allow these criteria to be met. The water-table aquifer at the site is not used for drinking water and is not intended to be used for drinking purposes and, therefore, restoration of the aquifer to drinking-water levels is not considered an RAO.

Location-specific ARARs and TBC criteria, including federal and state wetland and floodplain regulations, could be met under all alternatives with proper design and management.

2.8.2 Primary Balancing Criteria

2.8.2.1 Long-Term Effectiveness and Permanence

This evaluation addresses the magnitude of residual risk remaining and the ability of an alternative to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

Alternative 1 does not prevent or reduce the magnitude of risk to human health or the environment. It is the only alternative that fails to address human health risks associated with ingestion of surface soil and surface water.

Alternatives 2 through 5 are expected to reduce the risks identified in the BRA. The future risk from ingestion of surface soil is mitigated by interrupting the exposure pathway. Installation of topsoil cover, multimedia cap, or excavation and removal of soil around hot-spot areas effectively isolates the contaminated soil from potential receptors, thereby greatly reducing the potential risks. The risk for ingestion of surface water by trespassers and future residents is reduced to some extent by land-use restrictions, fencing, and warning signs. The residual risk from ingestion of surface water and surface soil should be less than the target risk range of 10^{-6} to 10^{-4} . The future risk associated with the ingestion of groundwater is addressed through land-use restrictions.

Because alternatives 2 through 5 do not entirely remove the source of contamination from the site, the site remedy must be reviewed every 5 years. Semiannual monitoring is proposed for a possible period of 30 years.

2.8.2.2 Reduction of Toxicity, Mobility, and Volume Through Treatment

This evaluation criterion addresses the level of reduction of toxicity, mobility, and volume of site contamination provided by the remedial alternative. The evaluation focuses on the amount of hazardous material that will be destroyed, the type of treatment residuals that will remain after treatment, and the degree to which the treatment reduces site hazards.

Alternative 1 provides no reduction in the toxicity, mobility, or volume of contaminated media.

Alternative 2, which involves the installation of a vegetated cover, will reduce erosion of contaminated soil and will reduce infiltration of rainfall to some extent, which will reduce leaching to groundwater and surface water. Alternative 3 will provide a greater reduction in infiltration than Alternative 2, and Alternative 4 will additionally provide a barrier for groundwater from discharging to the surface water.

Alternative 5, which involves excavation of soil around hot-spot areas, would provide the greatest reduction in both the volume and mobility of contaminants if hot spots could be adequately located.

Alternatives 2 through 5 provide no means for groundwater remediation. The water-table aquifer at the site is not used or likely to be used for drinking water purposes as the City of Virginia Beach Public Utilities Department has indicated that it is standard practice to prohibit the use of the shallow water-table aquifer as a potable or nonpotable source. Furthermore, because the groundwater discharges directly from the site into Little Creek Harbor, the only access to the groundwater would be through a well installed directly into the landfill.

2.8.2.3 Short-Term Effectiveness

This evaluation criterion addresses the effects on the surrounding community and the environment during construction and implementation of the remedial alternative.

Alternative 1 is the best in terms of short-term effectiveness because it results in no site disturbance. Because no excavation or earthmoving is required, site contaminants will not be released to the air at an increased rate. This alternative best protects the community in the short term, but this alternative never achieves protection of human health.

Alternatives 2 through 5 include significantly greater amounts of site disturbance compared to Alternative 1, resulting in the need for mitigation activities to reduce air emissions. Because these alternatives involve significant amount of earthwork and will require the use of heavy earth-moving equipment, the potential for work-related accidents to occur exists. The use of proper operational procedures and construction techniques will minimize the risk of any onsite accidents. Risk to workers due to dermal contact with contaminated soil also is possible particularly with Alternatives 4 and 5. Risks will be mitigated by ensuring that workers are required to wear appropriate personal protection equipment.

The short-term impacts to the environment would be the traffic problems and an increase in noise from construction activity. Air monitoring will be performed during site remediation activities to evaluate emissions. Proper dust control measures, such as water spray, would be used to minimize emissions of particulates.

2.8.2.4 Implementability

This evaluation criterion addresses the technical and administrative feasibility of the alternative, including the availability of services and materials needed to implement the alternative.

2.8.2.4.1 Technical Feasibility

Because Alternative 1 involves no remedial measures, technical feasibility is not an issue. The earth-moving equipment, materials, and construction procedures required for Alternatives 2 and 3 are conventional and are used extensively in commercial and industrial applications and are available in surrounding locales. The installation of a slurry wall (Alternative 4) would require more expertise and a significant amount of maintenance and monitoring to ensure its effectiveness. The identification and removal or stabilization of all significant hot spots would be difficult to ensure and would require a widespread sampling program. The sampling and analysis of the samples and the 5-year site status reviews also could be accomplished with little difficulty.

2.8.2.4.2 Availability of Services and Materials

The services and materials required to successfully implement Alternatives 2 through 5 are readily available in the area. Numerous contractors are available for competitive bidding to perform the work related to these alternatives.

2.8.2.4.3 Administrative Feasibility

Implementation of these alternatives involves a fair amount of institutional administration. Significant long-term management of an inspection and maintenance program to ensure the structural and functional integrity of the cap (Alternatives 3 and 4) and slurry wall (Alternative 4) would be required. The implementation of Alternatives 3 and 4 may require wetlands permits due to construction on and near wetlands. Alternative 2 would not require wetlands permits because no regulated activities would occur within the wetlands. The development and implementation of the monitoring program and subsequent 5-year site status reviews require the involvement of many concerned environmental agencies, such as EPA and VDEQ.

Implementation of these alternatives involves developing and using institutional controls. The Navy shall implement the following institutional controls within 60 days of completion of the remedial action, and Site 7 access will be limited to protect the remedial action and to limit exposure due to the continuing presence of hazardous substances.

- a. Fencing shall be maintained around Site 7 as shown on the remedial design plans, cautionary signs shall be posted around the perimeter of Site 7, and monitoring well heads will be protected.
- b. The NAB Little Creek Master Plan is a comprehensive planning document consulted by both the Little Creek Base personnel and the Atlantic Division, Naval Facilities Engineering Command when making planning, development and construction decisions. The NAB Little Creek Master Plan shall reflect the location and dimensions of Site 7; the location of any fencing, signs and monitoring wells; and the following use restrictions at Site 7: no construction changes to the remedial design can occur without approval of the Commander, NAB Little Creek, and coordination with State and Federal regulators; no residential development; no use of shallow groundwater; and no public access to the site.

- c. A notation shall be filed in the real property file maintained at NAB Little Creek and the Atlantic Division, Naval Facilities Engineering Command for Site 7, indicating the physical controls established at the site to restrict access, and all of the information concerning Site 7 reflected in the NAB Little Creek Master Plan.

If Site 7 is ever transferred to another Federal Government entity, the Navy shall insure that the institutional controls described above will remain in effect after the transfer by preparing a site map of Site 7 that is marked with the location and dimensions of the site, the location of fencing, warning signs, and monitoring wells. This site map will be included as a attachment to the appropriate transfer document, and the transfer document will reflect the use restrictions established in the NAB Little Creek Master Plan, as well as the need of the transferee Federal Government entity to maintain the fencing, warning signs, and well heads. As between the Navy and its transferee, any Navy obligations to the transferee federal entity for continued responsibility for the transferred site will be made contingent on the transferee federal entity's adherence to the limitations on the use of the site spelled out in the site map and the transfer document.

If Site 7 is conveyed to an non-federal entity, and the Navy is the agency empowered to dispose of the property, the Navy will prepare a deed that contains an easement or covenant in favor of the U.S. Government, imposing the same use restrictions described in the NAB Little Creek Master Plan. The Navy will also prepare a survey plat, similar to the site map described above, that reflects the existence of this deed and the easement that has been imposed on Site 7. Upon conveyance of the property, both the deed and the survey will be recorded, and the Navy will make arrangements to insure that the integrity of the fencing, warning signs and well heads are maintained, as well as insuring that the land use restrictions are complied with by the grantee. As between the Navy and its transferee, any Navy obligation to the transferee non-federal entity for continued responsibility for Site 7 will be made contingent on the transferee non-federal entity's adherence to the limitations on the use of Site 7 spelled out in the site map and transfer document.

If Site 7 is conveyed to a non- federal entity, and the Navy is not the agency empowered to dispose of the property, the Navy will take all steps necessary and permissible to ensure that the disposal agency takes the steps outlined above, unless the property is remediated to residential standards prior to such transfer.

2.8.2.5 Cost

This evaluation criterion identifies and discusses the capital, operation, and maintenance, and present-worth cost of each remedial alternative.

The estimated costs associated with each alternative are summarized in Table 1. The present-worth costs were calculated using a discount rate of 5 percent and a 30-year time interval.

TABLE 1
Cost Comparison of Alternatives

Alternative	Capital Cost	Annual O&M Cost	Total Present-Worth Cost (30 Years)
1	\$25,000	\$0	\$25,000
2	\$474,000	\$59,000	\$1,380,000
3	\$5,020,000	\$59,000	\$5,936,000
4	\$13,000,000	\$64,000	\$14,050,000
5A (excavation)	\$42,600,000	\$39,000	\$43,200,000
5B (stabilization)	\$13,030,000	\$49,000	\$13,780,000

2.8.3 Modifying Criteria

2.8.3.1 State/Support Agency Acceptance

This evaluation criterion indicates whether, based on review of the ARARs, the state concurs with, opposes, or has no comment on the preferred alternative.

VDEQ has reviewed the draft-final PRAP for Site 7 and attended the June 17 RAB meeting which addressed comments on the PRAP. VDEQ has subsequently submitted comments on the draft-final DD. These comments are discussed in Section 3, the Responsiveness Summary. VDEQ has agreed that Alternative 2 should be the selected remedy and agrees with what land use restrictions are required. However, the Navy and VDEQ do not agree on how specifically the land use restrictions will be implemented. The land use restriction wording outlined in Section 2.8.2.4.3 of this document has been furnished by the Assistant Secretary of the Navy's office (Installations & Environment).

2.8.3.2 Community Acceptance

This evaluation criterion indicates whether, based on a review of the PRAP, the public concurs with, opposes, or has no comment on the preferred alternative.

At the conclusion of the 30-day public comment period for the PRAP, one public comment was received. The respondent was concerned that the preferred alternative may be inadequate to address potential future risks and requested further clarification as to why the site should not require a cap constructed of material with low permeability. The public comment was addressed to the satisfaction of the respondent during a RAB meeting on June 17, 1997. This comment is further discussed in Section 3, the Responsiveness Summary.

2.9 Selected Remedy

On the basis of the comparative evaluation of the alternatives summarized above, Alternative 2, Institutional Controls was selected. Alternative 2 appears to provide the best balance of trade-offs among alternatives with respect to the evaluating criteria. Although Alternatives 3, 4, and 5 arguably provide greater protection, their added benefits over Alternative 2 are minimal and are directed solely at the groundwater to surface water pathway, which does not appear to be a significant risk driver. Also, their effectiveness for providing these added benefits is uncertain and their relative cost is high to very high.

Alternative 2 is able to meet the RAOs and remediation goals identified in Section 2.6.3. Specifically, Alternative 2 will prevent exposure to current unacceptable human health risks

posed by the surface soil by providing a protective, erosion-resistant soil and vegetative cover. Exposure to risks posed by the site groundwater, subsurface soil, and buried waste will be prevented by removing exposed waste, and implementing land-use restrictions as discussed in Section 2.8.2.4.3.

Current and future human health risks posed by the surface water and sediment in the western canal do not appear to be related to Site 7. However, these risks will be addressed by posting warning signs along the canal and monitoring the water and sediments in the canal and other surface water bodies on a semiannual basis. It should be noted that the specifics of the long-term monitoring plan have not been finalized.

A more detailed discussion of how the selected remedy satisfies the other statutory requirements of CERCLA is included in the following section.

2.10 Statutory Determination

2.10.1 Protection of Human Health and the Environment

Alternative 2 provides adequate protection of human health and the environment from site-related risks. Risks through ingestion of surface soil and surface water are largely reduced by blocking human contact with site contaminants. As long as fencing, institutional control, and soil cover or capping are maintained, site-related risks will remain below EPA criteria under Alternative 2.

2.10.2 Compliance with ARARs

Alternative 2 can be designed and implemented to satisfy all action-specific ARARs.

RCRA closure requirements for hazardous waste disposal units are not considered to be action-specific ARARs for this remedial action even though hazardous wastes may have been disposed of in the landfill. Waste disposal activities had ceased and the landfill had been closed by 1979, before the effective date of RCRA.

Federal and Virginia Solid Waste Management Regulations (40 CFR 257 and VR 672-20-10, respectively) are not necessarily ARARs for this site because they only apply to solid waste facilities operating after December 1988. However, there are certain cases where these regulations may apply; for example, if the landfill presents an offsite hazard due to releases from the site or improper management. Because this is not currently the situation, state solid waste requirements that apply if the landfill were to become a hazard in the future are considered applicable or relevant and appropriate.

Several chemical-specific ARARs, such as federal MCLs and health advisories, are not achieved by Alternative 2 because it does not involve treatment of the groundwater beneath the landfill to drinking water standards. CERCLA regulations provide for waivers of ARARs under certain conditions, several of which would apply in this case; these include:

- **The selected alternative, land-use restrictions prohibiting wells from being installed within the site boundary, will attain the equivalent of the ARAR.** The water-table aquifer at the site is not used for drinking water and is not intended to be used for drinking purposes and, therefore, restoration of the aquifer to drinking-water levels is not considered an RAO. In addition, because the aquifer in question discharges to the surface water at the downgradient site boundary, the only access to site groundwater would be

via a well installed directly in the landfill. Surface water discharge ARARs would be met. This situation can be prevented relatively easily with land-use restrictions.

- **Compliance by treating all groundwater to MCLs will not provide a balance between protecting public health and the availability of funds.** Treatment of the water-table aquifer to drinking water standards would be a very expensive endeavor, which if achievable would only protect human health if the aquifer directly under the landfill were to be used as a drinking water source.

Location-specific ARARs and TBC criteria, will be met under Alternative 2 with proper design and management. Federal and state wetland permit requirements do not apply to Alternative 2 because no regulated actions will take place within the limits of the wetlands.

Tables 2, 3, and 4 summarize the chemical-specific, action-specific, and location-specific ARARs that will be attained by this remedy.

2.10.3 Cost-Effectiveness

Alternative 2 is the most cost-effective of the alternatives considered, with the exception of Alternative 1, No Action, which does not comply with the ARARs or RAOs.

2.10.4 Utilization of Permanent Solutions and Alternative Treatment or Resource Recovery Technologies

Alternative 2 effectively reduces all site-related health risks to acceptable levels by reducing the potential for human exposure and the migration of contaminants from the landfill to surface water, sediment, and groundwater. It consists of remedial measures with high reliability and allows for a cost-effective remediation of the site.

While Alternatives 3, 4, and 5 arguably provide greater protection, their added benefits over Alternative 2 are minimal and are directed solely at the groundwater to surface water pathway, which does not appear to be a significant risk driver. Also, their effectiveness for providing these added benefits is uncertain and their relative cost is high to very high.

Alternative 2 is considered unable to meet chemical-specific ARARs (MCLs for the groundwater); however, no alternative is projected to achieve these requirements and groundwater remediation is not considered a RAO. Alternative 2 prevents access to existing contamination and is able to reduce the mobility and volume of contamination associated with the landfill by reducing infiltration through, and erosion from, the landfill surface and reducing further entry of contaminants from the landfill into the surface water and sediment.

Alternative 2 meets the statutory requirement for permanence. The soil cap, fencing, and land-use restrictions will permanently mitigate risks with proper maintenance and enforcement. Resource recovery will be included in the alternative because a significant part of the debris removed can be recycled or reused.

2.10.5 Preference for Treatment as a Principal Element

This alternative does not satisfy the preference to employ a treatment technology as a principal element because treatment was determined to be impractical. The identification and removal or stabilization of all significant hot spots would be difficult to ensure and would require a widespread sampling program. Treatment of the hot spots would

TABLE 2

Chemical-Specific ARARs for Selected Remedy
 Site 7, NAB Little Creek, Virginia Beach, Virginia

Requirement	Citation	Prerequisites	Comments
Chemical-Specific ARARs Attained by Selected Remedy			
Ambient Water Quality Criteria (AWQC)	33 USC 1314(a) and 42 USC 9621(d)(2) Clean Water Act	Discharges to water of the United States and groundwater.	AWQC are unenforceable standards but are appropriate and relevant to discharges from the site to the surrounding surface water. The surface water and groundwater will be monitored semiannually to determine if discharges from the site are causing exceedances of AWQC in the surface water.
Water quality standards (based on water use and class of surface water)	33 USC 1313 and 57 <i>Federal Register</i> 60920-60921	Discharges to water of the United States.	Federal and state water quality standards would be applicable for any discharges to surface waters. Discharges to surface water (from contaminated groundwater or surface runoff) should be evaluated. Discharges that would occur as part of the response action should be evaluated under action-specific requirements. The surface water and groundwater will be monitored semiannually to determine if this ARAR is being met.
	VR 680-21-01.14	Discharges to surface water in Virginia.	
Toxicity characteristic leaching procedure (TCLP) regulatory levels and other RCRA hazardous waste criteria.	Title 22 OCR, 66261.24(a). VR 672-10-01, Section 3.9.A	Hazardous waste treatment, storage, or disposal.	Applicable for determining whether waste removed from the site is hazardous. All soils and other wastes removed from the site will be characterized for hazardous waste characteristics where appropriate.

TABLE 2

Chemical-Specific ARARs for Selected Remedy
 Site 7, NAB Little Creek, Virginia Beach, Virginia

Requirement	Citation	Prerequisites	Comments
Groundwater protection standards: owners/operators of RCRA treatment, storage, or disposal facilities must comply with conditions in this section that are designed to ensure that hazardous constituents entering the groundwater from a regulated unit do not exceed the concentration limits for contaminants of concern set forth under Section 264.94 in the uppermost aquifer underlying the waste management area beyond the point of compliance.	40 <i>CFR</i> 264.94, except 6624.94(a)(2), and 94(b) VR 672-10-01, Section 10.5.E, except 10.5.E(1)(b) and E(2)	Uppermost aquifer underlying a waste management unit beyond the point of compliance; RCRA hazardous waste, treatment, storage, or disposal.	Relevant and appropriate for Site 7. Not applicable because Site 7 is not a RCRA facility; site was closed before the effective date of RCRA. Criteria will be met at a point of compliance at edge of site because groundwater discharges to surface water at that point.

Chemical-Specific ARARs Not Attained by Selected Remedy

Maximum Contaminant Levels (MCLs)	40 <i>CFR</i> 141	Public drinking water supply systems.	Relevant and appropriate requirement for Site 7 groundwater. Not applicable because the aquifer is not used nor is it likely to be used for drinking water purposes. This ARAR meets several waiver criteria: <ul style="list-style-type: none"> • Land-use restrictions prohibiting wells will attain equivalent of ARAR. • Compliance with the ARAR will not provide a balance between protecting public health with the availability of funds.
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TABLE 2

Chemical-Specific ARARs for Selected Remedy
Site 7, NAB Little Creek, Virginia Beach, Virginia

Requirement	Citation	Prerequisites	Comments
Groundwater standards established for state antidegradation policy	VR 680-21-04	Public water system.	Relevant and appropriate requirement for Site 7 groundwater. Not applicable because the aquifer is not used nor is it likely to be used for drinking water purposes. This ARAR meets several waiver criteria: <ul style="list-style-type: none">• Land-use restrictions prohibiting wells will attain equivalent of ARAR.• Compliance with the ARAR will not provide a balance between protecting public health with the availability of funds.

TABLE 3

Action-Specific ARARs for Selected Remedy
 Site 7, NAB Little Creek, Virginia Beach, Virginia

Action	Requirement	Citation	Prerequisites	Comments
Action-Specific ARARs Attained by Selected Remedy				
Excavation	Movement of excavated materials that are RCRA wastes to new location and placement in or on land will trigger land disposal restrictions for the excavated waste or closure requirements for the unit in which the waste is being placed.	40 <i>CFR</i> 268.40	Material containing RCRA hazardous waste subject to land disposal restrictions are placed in another unit.	Applicable if hazardous waste is encountered during excavation. Minor excavation to install fence posts only. Any excavated wastes will be characterized and disposed of offsite if determined to be hazardous.
Discharge of visible emissions and fugitive dust	Fugitive dust/emissions may not be discharged to the atmosphere at amounts in excess of standards.	VR120-04, Rule 4-1	Any source of fugitive dust/emissions.	Applicable. Will be met with appropriate dust control measures during earthwork activities.
Treatment when waste will be land disposed	Treatment of waste subject to ban on land disposal must attain levels achievable by best demonstrated available treatment technologies (BDAT) for each hazardous constituent in each listed waste, if residual is to be land disposed. BDAT standards for spent solvent wastes and dioxin-containing wastes are based on one of four technologies or combinations: steam stripping, biological treatment, carbon adsorption, and incineration. Any technology may be used if it will achieve the concentration levels specified.	40 <i>CFR</i> 268.40 and 42 268.30 and 31 42 US 6924(d) (3)(e)(3)	Placement of RCRA hazardous waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, or underground mine or cave.	Applicable only if hazardous wastes are encountered during debris removal or fence post excavation. Wastes will be characterized as necessary and treated or disposed of properly.

TABLE 3

Action-Specific ARARs for Selected Remedy
 Site 7, NAB Little Creek, Virginia Beach, Virginia

Action	Requirement	Citation	Prerequisites	Comments
Placement of waste in land disposal unit	Attain land disposal treatment standards before putting waste into landfill to comply with land ban restrictions.	40 <i>CFR</i> 268.40	Placement of RCRA hazardous waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, or underground mine or cave.	Applicable only if hazardous wastes are encountered during debris removal or fence post excavation. Wastes will be characterized as necessary and disposed of properly.
Hazardous materials transportation	No person shall represent that a container or package is safe unless it meets the requirements of 49 USC 1802, et seq., or represent that a hazardous material is present in a package or motor vehicle if it is not.	49 <i>CFR</i> 171.2(f)	Interstate carriers transporting hazardous waste and substances by motor vehicle. Transportation of hazardous material under contract with any department of the executive branch of the federal government.	Applicable if hazardous wastes are to be transported offsite (from fence post excavation or debris removal).
Solid waste disposal	A facility or practice shall not contaminate an underground drinking water source beyond the solid waste boundary or a court- or state-established alternative.	40 <i>CFR</i> 257.3-4 and Appendix I	Solid waste disposal facility and practices except agricultural wastes; overburden resulting from mining operations, land application of domestic sewage, location, and operations of septic tanks; solid or dissolved materials in irrigation return flows, industrial discharges that are point sources subject to permits under CWA; source special nuclear or by-product material as defined by the Atomic Energy Act; hazardous waste disposal facilities that are subject to regulation under RCRA Subtitle C; disposal of solid waste by underground well injection, and municipal solid waste landfill units.	Relevant and appropriate. Not applicable because the shallow aquifer is not a drinking water source. This will be met because the aquifer does not extend beyond the boundaries of the unit, it discharges to surface water.

TABLE 3

Action-Specific ARARs for Selected Remedy
 Site 7, NAB Little Creek, Virginia Beach, Virginia

Action	Requirement	Citation	Prerequisites	Comments
Solid waste disposal (continued)	A facility shall not cause a discharge of pollutants into waters of the U.S. that is in violation of the <u>substantive</u> requirements of the NPDES under CWA Section 402, as amended.	40 CFR 257.3-3(a)		Applicable. Groundwater and surface water will be monitored to determine if this ARAR is met.
	A facility shall not cause a discharge of dredged material or fill material to waters of the U.S. that is in violation of the <u>substantive</u> requirements of SWA Section 404.	40 CFR 257.3-3 VR 672-20-10 Section 5.1.C(12)		Relevant and appropriate. Erosion control measures will be used to prevent discharges of sediment.
	A facility or practice shall not cause nonpoint source pollution of waters of the U.S. that violates applicable legal substantive requirements implementing an areawide or statewide water quality management plan approved by the administrator under CWA Section 208, as amended	40 CFR 257.3-3(a) VR 672-20-10, Section 5.1.C(12)		Applicable. Groundwater and surface water will be monitored to determine compliance with this requirement.
	Post-closure care requirements for solid waste disposal facilities. <ul style="list-style-type: none"> • Maintain integrity of cover • Monitor groundwater 	40 CFR 257 VR 672-20-10, Section 5.1.F	For facilities in operation after 1988 or for facilities closed before 1988 that pose a hazard offsite.	Not applicable because facility was closed before 1988 and does not pose a hazard offsite. Relevant and appropriate for preventing future hazards.
Action-Specific ARARs Not Attained by Selected Remedy				
None				

TABLE 4
 Location-Specific ARARs for Selected Remedy
 Site 7, NAB Little Creek, Virginia Beach, Virginia

Action	Requirement	Citation	Prerequisites	Comments
Location-Specific ARARs Attained by Selected Remedy				
Within floodplain	Actions taken should avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values.	40 <i>CFR</i> 6, Appendix A, excluding Sections 6(a)(2), 6(a)(4), and 6(a)(6) 40 <i>CFR</i> 6.302	Action that will occur in a floodplain, i.e., lowlands, and relatively flat areas adjoining inland and coastal waters and other flood-prone areas.	Applicable. Debris removal within floodplain will be performed in accordance with these requirements.
Wetlands	Action to minimize the destruction, loss, or degradation of wetlands.	40 <i>CFR</i> 6, Appendix A; excluding Sections 6(a)(2), 6(a)(4), and 6(a)(6) 40 <i>CFR</i> 6.302	Wetlands as defined by Executive Order 11990, Section 7.	Not applicable. No regulated work will be done within the wetlands.
	Action to prohibit discharge of dredged or fill material into wetlands without permit.	40 <i>CFR</i> 230.10 40 <i>CFR</i> 231 (231.1, 231.2, 231.7, and 231.8)	Wetlands as defined by Executive Order 11990, Section 7.	Applicable. Erosion control plans will be implemented to prevent sediment discharges to wetlands.
Location-Specific ARARs Not Attained by Selected Remedy				
None				

primarily address contaminants leaching to groundwater, but the restoration of the water-table aquifer to drinking water standards is not considered an objective of this remediation because the aquifer at the site is not used, nor is it likely to be used, for drinking water purposes.

2.11 Documentation of Significant Changes

The preferred alternative identified in the PRAP was Alternative 2, Institutional Controls. As the result of state, EPA, and public comment, the preferred alternative has been identified as the final selected remedy without significant changes.

SECTION 3

Responsiveness Summary

The responsiveness summary addresses comments on the PRAP received during the public and regulatory review period and comments on the DD received during the regulatory review period.

3.1 Comments on the PRAP

One comment was received during the public and regulatory review period. This comment was received from a member of the public who also happens to sit on the RAB. The respondent was concerned that the preferred remedy, which included a soil cover, was not adequate to prevent future risks and requested further clarification from the Navy and the regulators as to why a more substantial cap system, such as that required for municipal landfills, should not be installed.

A verbal response to the commenter was provided at the June 17 RAB meeting. This response included a general discussion between the Navy, VDEQ, RAB members, and general public. After this discussion, the author of the initial comment stated that he was satisfied that the Navy and VDEQ had adequately evaluated the available options and associated risks in the selection of Alternative 2 and that his request was adequately addressed. The minutes from this meeting are provided as Appendix A.

3.2 Comments on the DD

Comments were received from VDEQ on the draft final DD. The original comments are presented as Appendix B. Navy responses are provided below.

Response to Comment # 1 - Section 1.3 was revised to indicate that the remedies shall include "groundwater use" restrictions as well as land use restrictions. Sections 2.7.2 through 2.7.5 were also revised as requested. References to land-use restrictions occur throughout the DD. It can be assumed that this term includes restrictions to the use of the land and the groundwater under it (or emanating from it).

Response to Comment # 2 - The referenced sentence in Section 2.6.3 was deleted.

Response to Comment # 3 - A sentence to this effect was added to the third paragraph of Section 2.9 which discusses the selected remedy.

Response to Comment # 4 - The Navy remedy includes institutional controls in the form of future land use restrictions. The State has proposed specific requirements regarding how these land use restrictions should be memorialized. How institutional controls are implemented and enforced at Federal facilities is subject to an ongoing dialogue between EPA, States and the Services. The language in this document reflects the latest legal guidance given by the Assistant Secretary of the Navy's office. The Navy and the State are in complete agreement on what land use restrictions are appropriate following actual

remediation. The State's concerns are on how such land use restrictions are to be implemented. The Navy believes that its proposed plan for implementation will ensure that all restrictions will be followed. The Navy's use of alternative methods for implementation of the land use restrictions will have no effect on the site remedial work proposed. The Navy will continue to work with the State of Virginia on other sites to develop institutional control language that is agreeable to both parties. Note that federal government entities are subject to extensive requirements under CERCLA 120 (h) regarding the cleanup of real property to be transferred out of federal hands.

Appendix A

Minutes from June 17, 1997, meeting of the
NAB Little Creek Restoration Advisory Board

Naval Amphibious Base Little Creek
Virginia Beach, Virginia
Restoration Advisory Board (RAB) Meeting
June 17, 1997

ATTENDEES:

Mr. Scott Park Remedial Project Manger, NAB Little Creek Atlantic Division Naval Facilities Engineering Command (LANTDIV)	(757) 322-4788
Ms. Kelly Greaser Installation Restoration Program Manager NAB Little Creek	(757) 363-4571
CDR S. J. Lord Base Civil Engineer NAB Little Creek	
Mrs. Maureen Connors Environmental Programs Branch Manager NAB Little Creek	(757) 464-7063
Mrs. Janice Elia Director, Environmental Quality Division NAB Little Creek	(757) 464-8564
Mr. Scott MacEwen CLEAN II Activity Manager, NAB Little Creek CH2M HILL	(703) 471-1441
Ms. Anne Estabrook Project Design Engineer CH2M HILL	(703) 471-1441
Mr. Robert Weld Remedial Project Manager VADEQ Federal Facilities	(804) 698-4227
Mr. Bob Stroud Remedial Project Manager USEPA Region III RPM	(215) 566-3366
Mr. Robert Deegan Sierra Club	(757) 497-4154

Mr. Newton Berliner
Baylake Pines Civic League

(757) 460-5931

Mr. Jeff Waller
City of Virginia Beach

(757) 427-4825

Mr. Robert Dean
Clean the Bay Day

(757) 427-6606

Ms. June Barrett-McDaniels
Aquarius Engineering

(757) 496-2570

Meeting

The Restoration Advisory Board (RAB) Meeting was held on June 17, 1997 in the third floor conference room at the Bachelor Officer's Quarters (BOQ) at Naval Amphibious Base (NAB), Little Creek. The meeting began at 1:05 p.m.

Welcome by CDR Lord, Base Civil Engineer.

At NAB Little Creek, the environmental division is within Base Civil Engineering (BCE).

In 1996, Little Creek's environmental division received the USEPA Region III Chemical Preparedness Award and the Secretary of the Navy's Pollution Prevention Award, and our Natural Resources Manager, Catherine Zielske, received the Secretary of the Navy and Department of Defense Natural Resources and Conservation Award. NAB is committed to the environment and cleaning up past practices, and sharing activities with the public. The more community participation, the better

CDR Lord shared some background on the RAB process, pointing out that this meeting is the culmination of previous community involvement. He feels the base's environmental success is the community's environmental success. He asked attendees to listen to all input with open minds, and emphasized that questions are welcome.

Introduction by Kelly Greaser

Everyone in the room introduced themselves (see list of attendees, above). Ms. Greaser encouraged everyone to sign in and to leave their address if interested in receiving the meeting minutes. She described the three handouts available: overheads & agenda, list of acronyms, package of maps with the IR sites to be discussed. Various documents to be discussed today are located on the back table.

View Video: Installation Restoration - A Navy Pledge to the Future

Phases of IR:

- Preliminary Assessment - possible sites were identified based on historical information
- Site Inspection - physical inspection
- Remedial Investigation
- Feasibility Study
- Remedial Design
- Remedial Action
- Closeout - made in conjunction with regulators and the local community

The Navy solicits community involvement during all phases of the IR program. The community is kept informed and public participation is sought. The RAB is the community representative.

Emphasis is placed on Innovative Management Approaches, concurrent phases of process, teaming, and seeking consensus.

Kelly Greaser - Site 16 NFRAP Status

This site was a transformer that was struck by lightning that led to a spill of approximately 5 gallons of PCB-containing dielectric fluid.

The PCB Removal Action was completed in July 1995.

A Final Closeout Report was submitted in September, 1996.

The RAB was notified of the closeout, the administrative record was updated, and no further action is planned.

Site 7, Amphibious Base Landfill

This site operated from 1962-1979. It operated as both a trench and an area landfill. Some of the waste in the landfill is below the groundwater table because of the trench filling method used.

The site is about 38 acres in size, containing an estimated 1.2 million cubic yards of waste, primarily municipal solid waste, with probably very little "hazardous waste".

The site was officially closed by the Department of Health in 1982.

Historical aerial photos show that primary landfilling activity was on the western half of the site. Only sewage sludge and dredge material was placed on the east side of site.

Previous sampling at the site consisted of:

- Round 1 Verification Step, 1986
- Interim Remedial Investigation, 1991
- Remedial Investigation and Feasibility Study (RI/FS), 1994

According to the baseline risk assessment, the only current risk is to child and adult trespassers using surface water as drinking water. Future risk to child and adult residents exists from surface soil, and groundwater and surface water if used as drinking water.

The purpose of the FS was to evaluate different remedial action alternatives.

Remedial Action Objectives (RAOs):

- Reduce risks from surface soil and groundwater
- Mitigate migration of contamination from groundwater to surface water
- Mitigate risks from surface water attributable to Site 7
- Restoration of the aquifer to drinking water quality is not an objective.

Alternatives:

1. No Further Action - \$25,000
2. Institutional Controls - \$1.4 million
3. HDPE/Clay Cap - \$5.9 million
4. Cap and Slurry Wall - \$14 million
5. Selective removal and treatment of hot spots - \$43 million

Each alternative was evaluated using the nine evaluation criteria from the National Contingency Plan (NCP)

Discussion of FS Alternatives

Alternatives 1, 4, and 5 were eliminated. Alternative 1 does not mitigate risk, Alternative 4 is excessively costly for little reduction in risk. Alternative 5 was eliminated because hot spots have not been identified at this site.

Evaluation of Alternative 2 and Alternative 3 were discussed in detail in response to a comment received during the public comment period.

1. Alternative 2: Institutional Controls

- Install 15,000 cy of fill/topsoil in the open area
- Remove approximately 1,000 cy of debris
- Install new fence on the south and east sides of site
- Post warning signs along the site perimeter, access gates, and along the canal
- Reinforce the access road crossing at canal
- Implement land use restrictions
- Implement long-term monitoring of the surface water, sediment and groundwater

Ms. Greaser then summarized the evaluation Alternative 2 using the nine criteria.

2. Alternative 3: HDPE/Clay cap

- Install an HDPE/clay cap
- Install a new fence on the south and east sides
- Post warning signs
- Implement land use restrictions
- Implement long-term monitoring of the surface water, sediment and groundwater

Ms. Greaser summarized the evaluation of Alternative 3 by the nine criteria.

Summary:

- Both alternatives reduce short and long-term risk to human health and the environment, and RAOs are met for both.

-
- Both meet action- and location-specific ARARs. Neither meets chemical-specific ARARs for groundwater within the site boundary, however this is not an objective. The intent of Executive Order (E.O.) 11990 (minimizing disturbance of wetlands) is not met by Alternative 3 because the cap will have to cover portions of the landfill that are considered emergent wetlands.
 - Alternative 3 reduces infiltration more than Alternative 2, which would theoretically reduce leaching of contaminants from the vadose zone to the groundwater. However, risks associated with leaching to groundwater do not appear to be significant and any potential reduction in risk does not appear to be justified by additional expense. Also, it is likely that some of the waste in the landfill is situated below the water table as a result of the manner in which it was filled (trench and backfill). In this case leaching of contaminants from the waste to the groundwater will occur even if a cap is constructed.

Questions

Robert Dean - Is there any methane at the landfill?

Kelly Greaser - Methane is not a priority pollutant. There are no indications that methane is a problem at the site.

Newton Berliner - Mentioned the methane generation problems at landfill with high organic content (tannery wastes) in Woburn, MA.

Scott MacEwen - Even if methane is being generated at the site, there is probably not much subsurface migration of methane because of the canals that intercept the water table on each side. If an HDPE cap is proposed, however, he would recommend soil gas study to determine if venting of methane gas is necessary.

Jeff Waller - Why does the HDPE cap disturb the wetlands, but not the soil cover?

Kelly Greaser - The soil cover would only be installed in the central, open area, not in the wetlands. To be effective, a geosynthetic cap would have to cover the entire waste disposal area (including vegetated areas).

Robert Deegan - This site is one of largest landfills on base, and also one of closest to residential areas. Are the state and city satisfied by the selection of Alternative 2?

Kelly Greaser - While residential communities are nearby, they are to the south and groundwater flow is to the north.

Robert Weld - Capping alternatives are evaluated based on the proposed future use of site. Site 7 is not expected to be used in the immediate future. The State feels that Alternative 2 is protective, and doesn't feel that the increased cost of Alternative 3 offers a significant increase in protection.

Robert Deegan- How about the City?

Jeff Waller - The city's perspective is to comply with all environmental regulations, but not to act as a regulator. They will defer to VADEQ in this.

Robert Dean - What will happen to the 1,000 cy of debris removed from site?

Kelly Greaser - Most of the debris is fairly innocuous - wood, metal, plastic, etc. Debris will be disposed of offsite, and some of it may be recyclable.

Robert Dean - What about other possible future uses of site? It seems like valuable real estate.

Janice Elia - The site is within the Explosive Safety Quantity Distance (ESQD) of a munitions magazine, which is another restriction to future use. (No inhabited buildings can be present within the ESQD. See the attached map for the ESQD boundary.)

Kelly Greaser - (showed location of the nearby munitions magazine and the approximate ESQD boundary)

Robert Deegan - Stated that he appreciates and understands the Navy's explanation and rationale for recommending Alternative 2 and accepts DEQ's analysis and conclusions concerning their acceptance of that alternative.

Site 7 Proposed Remedial Action Plan

Alternative 2 is the proposed remedial action.

This meeting marks the close of the public comment period.

The Draft Final Decision Document will be available for review after PRAP is finalized.

Questions

June Barrett McDaniels - Does Alternative 2 include revegetation?

Kelly Greaser - The alternative does include revegetation.

Newton Berliner - What types of vegetation are being proposed? Ground covers or grasses?

Kelly Greaser - We have been working with the Base's Natural Resource Manager to select vegetation to establish beneficial habitats for animals.

Break

Scott MacEwen - Site 7 Monitoring Plan

The Draft Final Monitoring Plan (MP) has been submitted, the Final MP will be submitted after comments are received.

Monitoring is a component of all alternatives considered in the Feasibility Study.

MP Objectives:

- Part of the institutional controls alternative
- Necessary because waste is left on site
- Monitor semi-annually for 5 years
- Monitor discharges from site to groundwater, surface water, and sediment and re-evaluate site-related risks after 3 years and 5 years.

A total of 13 monitoring points around the landfill:

-
- Six groundwater monitoring wells will be sampled: LC-GW3 is background well, also GW-1, GW-6, GW-7, GW-8, and GW-9. Groundwater samples will be analyzed for VOCs, SVOCs, PCBs, total and dissolved metals.
 - Seven surface water sampling locations will be sampled: two background locations and five downstream locations. Samples will be analyzed for VOCs, SVOCs, PCBs, total and dissolved metals, and hardness.
 - Sediment samples will be collected at same locations as surface water samples from depths of 0" to 6". Samples will be analyzed for SVOCs PCBs, total metals, and TOC.

Each round of results will be compared to Trigger Levels

Trigger levels were developed based on human health and environmental risk. If results exceed trigger levels, site conditions will be further evaluated.

Question

Newton Berliner - How are trigger levels set? Will there be a trigger level for each individual contaminant?

Scott MacEwen - Trigger levels will be calculated for each contaminant of concern. Calculation takes into account potential cumulative effect of all contaminants on likely receptors.

Site 7 Remedial Design

Design was split into two contracts for the most economical implementation:

- RAC - debris removal and fence installation (activities which involve some uncertainty and possible contact with contaminants).
- Fixed price contract - soil cover and vegetation, gravel access road and other well defined activities.

Preliminary survey of site was conducted to determine existing cover thickness:

- 30 hand auger holes in cover
- 0" to 12" cover in central area
- 12" to 24" cover with 2" topsoil in west area
- No waste in east area.

A preliminary survey of surface debris and a topographic survey was also completed.

RAC Contract (Debris Removal):

- Estimated 1,000 cy of mixed debris.
- Debris will be removed/disposed of offsite, recycled if possible.
- Existing fence on south side of the site will be upgraded. New fence will be added along east side of site.

Fixed Price Contract (Soil Cover Improvements)

- Install temporary sediment and erosion control measures.

-
- Place 12 " of cover and 6" of topsoil on central area.
 - Place 4" to 6" of topsoil on the west side of the site.
 - Improve the access road crossing the canal.
 - Construct a gravel access road across the site.
 - Post warning signs.

Questions

Robert Dean - What is total allocation of funds for this project? Isn't 30 years of monitoring necessary?

Scott Park - Currently \$750,000 is allocated. Budget is in place for 10 years of monitoring. Five years will be completed and then the monitoring program will be reevaluated. Each round of sampling will cost about \$50,000 to \$60,000.

Robert Dean - Does this cost include installation of wells?

Scott MacEwen - Only one well will be installed. Two existing wells will be recased due to salt water damage. Thirty years of monitoring will probably be required, but monitoring program may be changed after 5-year reevaluation.

Schedule: RAC construction will begin after the Decision Document is finalized. The fixed priced contract construction will begin in FY 1998.

Site 5 and 11 GW Monitoring Report Status

Site 5 - Motor Oil Disposal Area

Site 11 - School of Music Plating Shop

Two rounds of sampling were done in May 1996 and December 1996. The Draft Final monitoring report was submitted in June 1997.

Site 5 History

More than 50,000 gallons of used motor oil was generated at the site. A Preliminary Site Inspection (PSI) was done in 1991 and a Site Inspection (SI) was done in 1993.

Low concentrations of TPH were detected in soil. 1,1-DCA was detected in GW ranging from 23 to 76 µg/l.

No unacceptable risk is posed by soil or groundwater.

The monitoring objective is to confirm no-risk determination in groundwater, and to evaluate migration of 1,1-DCA.

Findings:

- 1,1-DCA and chloroethane were detected at similar levels to the PSI and SI. Chloroethane is possibly a break down product of 1,1-DCA
- Results confirmed no-risk
- Reports of onsite disposal of large quantities of oil were overstated
- Recommend no further action

Site 11 History

The shop operated from 1964 to 1974. Plating wastes were disposed of in a drain to underground neutralization tank.

Previous investigations found metals in the tank and in the soil around the tank at levels representing some future risk.

Trichloroethylene (TCE) was detected in one of three groundwater monitoring wells.

The tank, piping, and soil were removed in 1995. No chlorinated hydrocarbons were found in the materials removed.

The groundwater monitoring plan objectives were to determine if the tank removal reduced risk and also to confirm the no-risk determination.

Findings:

- TCE was found in LC11-GW1 (same well as before), no contamination was found in the other wells. Results concluded that the removal action was successful. Results also determined that the groundwater flow direction varies at different times of the year depending on groundwater elevation.
- The TCE contamination in LC11-GW1 was found to be decreasing but was still above MCLs.
- The report recommend further delineation of the TCE plume by Geoprobe and the installation of downgradient perimeter monitoring points.

Break

Scott Park - Sites 9 & 10 Final Proposed Remedial Action Plan

Site 9 - Driving Range Landfill: operated from 1950-1956, 6 acres

Site 10 - Sewage Treatment Plant Landfill: operated from 1941 to 1968, 18 acres

At each site there are approximately 40,000 cy of non-hazardous municipal wastes.

Three rounds of groundwater sampling and one round of surface soil sampling have been completed.

There is no current risk at either site.

The proposed remedy is groundwater monitoring and institutional controls.

The Decision Document outlines the selected remedy and demonstrates compliance with the NCP.

Institutional controls will include:

- Warning signs
- Land use restrictions in Base Master Plan
- Base operational requirements (notification and concurrence of base environmental will be required for intrusive activities)
- Real estate records will be noted

The Groundwater Monitoring Plan for Sites 5, 9, 10, and 11 will be finalized and distributed shortly.

Kelly Greaser - Update on Other IR Sites:

Site 11 School of Music

A screening sampling event is proposed to determine the extent of TCE contamination.

Site 12 Exchange Laundry Disposal Area

Sampling in August and September, 1995 indicated that natural attenuation may be appropriate for this site. A Phase 2 Supplemental Remedial Investigation is proposed to evaluate natural attenuation.

Site 13 - PCP Dip Tank and Wash Rack

Sampling in August and September, 1995 indicated that a PCP source area may be present on site. A soil removal action will be evaluated. Groundwater remediation will be considered later.

Summary:

Site 5 - Closeout pending concurrence

Site 7 - Remedial Action pending concurrence

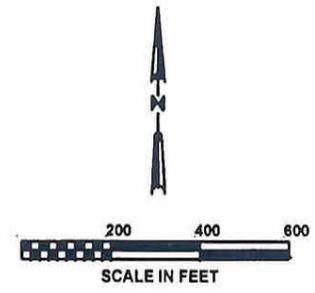
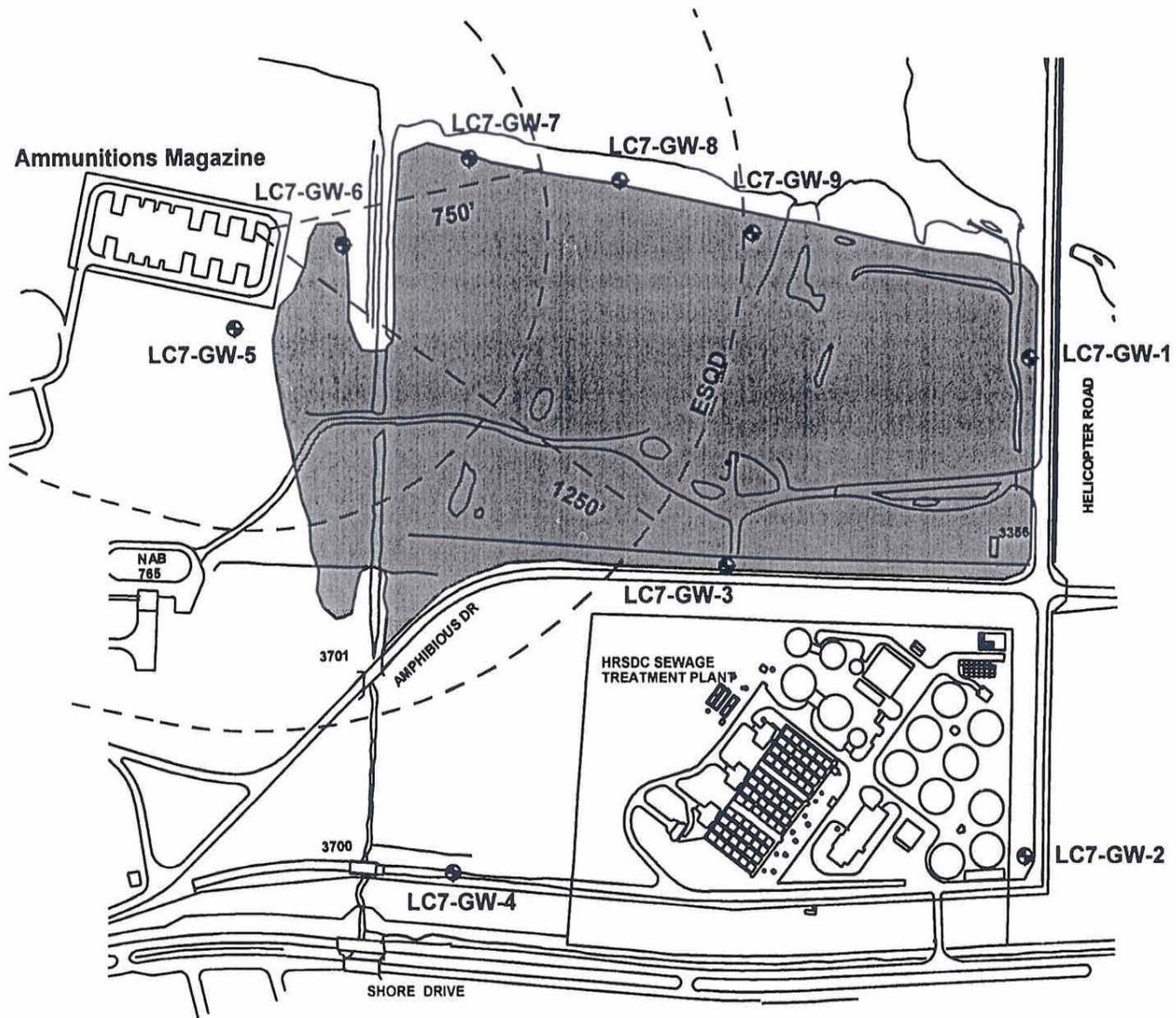
Sites 9 and 10 - Groundwater monitoring

Site 11 - Screening sampling

Site 12 - Natural attenuation sampling and risk assessment

Site 13 - Soil removal action pending concurrence

Meeting adjourned at 4:15.



- LEGEND**
- SITE BOUNDARY
 - LC7-GW-1 EXISTING MONITORING WELL
 - - - EXPLOSIVE SAFETY QUANTITY DISTANCE

Appendix B

**Comments on Draft Final DD by VDEQ
dated December 1, 1997**



COMMONWEALTH of VIRGINIA

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December 1, 1997

Mr. Scott R. Park
Department of the Navy
Atlantic Division, Code 1822
Naval Facilities Engineering Command
1510 Gilbert Street
Norfolk, Virginia 23511-2699

Subject: Naval Amphibious Base Little Creek (NABLC), Virginia Beach, Virginia
Review of the *Draft Final Decision Document Site 7: Amphibious Base Landfill*

Dear Mr. Park:

The Virginia Department of Environmental Quality (VDEQ), Office of Federal Facilities Restoration has completed its review of the subject document. Based on this review, we offer the following comments:

- 1) Section 1.3, Page 1-2, 3rd Bullet: This component of the remedy should include groundwater use restrictions in addition to land-use restrictions. This will also require changes to similar statements in Sections 2.7.2 through 2.7.5.
- 2) Section 2.6.3, Page 2-11, 2nd Bullet: Please delete the sentence, "Therefore, selection of the preferred remedy is based solely on human health risks."
- 3) Section 2.8.2.4.3, Page 2-19, 4th Paragraph: Please note that the specifics of the monitoring plan mentioned in this section have not yet been finalized.
- 4) Section 2.8.2.4.3, Page 2-19, 6th Paragraph: Please modify this paragraph as follows:

"Additional steps also will be taken to ensure that if the site is ever transferred to another federal government entity or out of the federal government's possession, the land restrictions would remain in effect, ~~if necessary, based on the results of the long-term monitoring.~~ In order to accomplish this, the Navy shall, within 90 days after completion of the remedy,

produce a survey plat prepared by a professional land surveyor registered by the Commonwealth of Virginia indicating the location and dimensions of disposal area and the extent of groundwater contamination. Monitoring well locations should be included and identified on the survey plat. The plat shall contain a note, prominently displayed, which states the owner's future obligation to restrict disturbance (excavation or construction) of the property; post-closure use of the property shall prohibit residential use, access or use of groundwater underlying the property for any purpose except monitoring, and shall not disturb the function of the monitoring systems. The Navy shall submit the survey plat to the local recording authority when all components of the selected remedy, with the exception of the long term monitoring, have been completed. If the site were to be transferred to another federal entity, the survey and the land use restrictions would be included in the appropriate transfer documents, with monitoring conducted to ensure adherence to restrictions. If the site were to be transferred out of federal possession, the land-use restrictions would be included in the deed, affecting the transfer; the deed (or some other instrument which is normally examined during title search at the local recording authority) shall include the survey plat, a notation notifying any potential purchaser of the property that the land has been used to manage solid waste, and an appropriate deed restriction, unless further remedial efforts were agreed upon or required by law. Note that federal government entities are subject to extensive requirements under CERCLA §120 (h) regarding cleanup of real property to be transferred out of federal hands."

- 5) Section 2.8.3.1, Page 2-20: Please note that VDEQ is withholding concurrence with this Draft Final Decision Document pending resolution of these comments.

If you have any questions regarding these comments, please feel free to contact me at (804) 698-4227.

Sincerely,



Robert J. Weld
Remedial Project Officer
Office of Federal Facilities Restoration

cc: Durwood Willis - VDEQ
Kelly Greaser - NABLC
Bob Stroud - EPA Region III