Final

Engineering Evaluation/Cost Analysis (EE/CA) Oceana Salvage Yard Access Road and Burial Unit

Naval Air Station Oceana
Virginia Beach, Virginia

Contract Task Order 0060

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Prepared by

CH2MHILL

Virginia Beach, Virginia

Executive Summary

This report presents an Engineering Evaluation/Cost Analysis (EE/CA) for a Non-Time-Critical Removal Action (NTCRA) for the Oceana Salvage Yard Access Road and Burial Unit, located adjacent to Oceana Boulevard and within the boundary of Naval Air Station (NAS) Oceana. The Oceana Salvage Yard Access Road provides ingress and egress through Navy property by connecting Oceana Boulevard to the Oceana Salvage Yard.

Previous investigations have been completed onsite and on the adjacent Oceana Salvage Yard property to determine the nature and extent of contamination. An Environmental Survey was completed in 1997 (ABB Environmental Services, 1997) and soil samples were collected from the Access Road in 2005 (CH2M HILL, 2005). These investigations identified lead-contaminated soil and buried, crushed car batteries and debris within and along the Access Road and its shoulders and within an area identified as the Burial Unit. Additionally, areas of surface debris and debris mounds were encountered near the Access Road and Burial Unit. This debris is identified throughout this report as non-roadway associated debris.

The removal action objective of this NTCRA at the Oceana Salvage Access Road, Access Road Shoulders, and Burial Unit is to prevent exposure to contaminants potentially posing unacceptable risk to human health related to lead contamination in soil. Groundwater is not addressed by this removal action. The following alternatives were evaluated to meet this objective:

- **Alternative #1—**No Action
- **Alternative #2a—**Gravel and Asphalt Cap of the Access Road, Onsite Soil Stabilization/Immobilization of Lead in the Access Road Shoulders and Burial Unit, and Removal of Non-roadway Associated Debris
- **Alternative #2b—**Gravel and Asphalt Cap of the Access Road, Excavation of the Access Road Shoulders and Burial Unit with Offsite Disposal and Restoration, and Removal of Non-roadway Associated Debris
- **Alternative #3—**Excavation, Offsite Disposal and Restoration of the Access Road, Access Road Shoulders, and Burial Unit, and Removal of Non-roadway Associated Debris

As a common component to Alternatives #2a, #2b, and #3, non-roadway associated debris present in the vicinity of the site will be removed as a maintenance/housekeeping effort to restore the site to original conditions.

For Alternatives #2a, #2b, and #3, excavation is to a maximum depth of 2 feet below ground surface (bgs). Confirmation sampling throughout the excavation floors will be required. Where lead concentrations in the excavation floor exceed 800 milligrams per kilogram (mg/kg), the placement of a warning barrier will be required on the excavation floor prior to backfilling. The Access Road shoulders are defined to be the 10 feet strips of land paralleling both edges of the Access Road.

Alternative #1, No Action, does not meet the objectives of the NTCRA to eliminate the potential for exposure to contaminants that may pose a potential human health risk.

Alternative #2a, Gravel and Asphalt Cap of the Access Road, Onsite Soil Stabilization/Immobilization of Lead in the Access Road Shoulders and Burial Unit, and Removal of Non-roadway Associated Debris, is effective in reducing exposure to soil by potential human receptors. The lead in soil will be treated by mixing the soil with an additive to immobilize the lead, rendering it non-hazardous and acceptable for onsite reuse. Associated cost requirements are moderate and construction requirements are common practice. In areas where concentrations of lead greater than 800 mg/kg remain at the site (beneath the asphalt/gravel cap and warning barriers), land use controls (LUCs) and post-closure operation and maintenance, including periodic inspection, would be required. The alternative provides for restoration of the roadway with an asphalt cover over the gravel and minimizes future maintenance requirements.

Alternative #2b, Gravel and Asphalt Cap of the Access Road, Excavation of the Access Road Shoulders and Burial Unit with Offsite Disposal and Restoration, and Removal of Non-roadway Associated Debris is similar to Alternative #2a; however, this alternative requires excavation and offsite disposal of lead contaminated soil within the Access Road shoulders, and Burial Unit. The lead in soil may be mixed onsite with an additive to stabilize the lead, rendering it non-hazardous for transport and disposal.

Alternative #3, Excavation, Offsite Disposal and Restoration of the Access Road, Access Road Shoulders, and Burial Unit, and Removal of Non-roadway Associated Debris is more effective than Alternatives #2a and #2b in preventing potential human exposure because this alternative requires removal of the contaminated soil and debris from the site to a depth of 2 feet bgs. The lead in soil may be mixed onsite with an additive to stabilize the lead, rendering it non-hazardous for transport and disposal. However, the cost of this Alternative #3 is significantly greater than the other alternatives because of the larger quantity of materials requiring offsite disposal.

Based on the comparative analysis of the removal alternatives provided in this EE/CA, the recommended removal action is Alternative #2b, Gravel and Asphalt Cap of the Access Road, Excavation of the Access Road Shoulders and Burial Unit with Offsite Disposal and Restoration, and Removal of Non-roadway Associated Debris. Alternative #2b achieves the removal action objective, complies with ARARs, eliminates the onsite potential risks to human health related to lead contamination in soil, and is straightforward to implement utilizing standard construction methods and resources. This alternative is consistent with the Draft (address Navy and privately owned Oceana Salvage Yard property) and Final (addresses privately owned Oceana Salvage Yard property) *Administrative Settlement and Order on Consent for Removal Response Action, Oceana Salvage Yard Site, Docket No. CERC-03-2007-0130DC*, which was prepared by the United States Environmental Protection Agency (USEPA) Region III for the site. Although the requirements of this draft settlement provided for a gravel surface to replace the existing gravel Access Road, the Navy is opting to provide an asphalt cap over the surface on the Access Road for site restoration to minimize future maintenance needs compared to a gravel surface. Additionally, the housekeeping/ maintenance action to remove non-roadway associated debris is intended to return the site to original site conditions. This alternative is also consistent with actions completed by the USEPA on the privately-owned adjacent Oceana Salvage Yard property in November 2008.

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Acronyms and Abbreviations

ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-term Environmental Action—Navy
CTO	contract task order
DPT	direct push technology
EE/CA	Engineering Evaluation and Cost Analysis
ft^2	square feet
HSP	Health and Safety Plan
LUC	land use control
mg/kg	milligrams per kilogram
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NTCRA	Non-Time-Critical Removal Action
O&M	operation and maintenance
PCB	polychlorinated biphenyl
PPE	personal protective equipment
RCRA	Resource, Conservation, and Recovery Act
RSL	risk screening level
SARA	Superfund Amendments and Reauthorization Act
SVOC	semivolatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
TPH	total petroleum hydrocarbons
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound
yd^3	cubic yards

SECTION 1

Introduction

This report presents an Engineering Evaluation/Cost Analysis (EE/CA) for a Non-Time-Critical Removal Action (NTCRA) for the Oceana Salvage Yard Access Road located on Oceana Boulevard, within the boundary of Naval Air Station (NAS) Oceana. This EE/CA is prepared under the Naval Facilities Engineering Command, Mid-Atlantic Division (NAVFAC) Navy Contract N62470-08-D-1000, Navy Comprehensive Long-term Environmental Action—Navy (CLEAN) 1000, Contract Task Order (CTO) 0060.

1.1 Regulatory Background

This document is issued by the Department of the Navy (Navy), under Section 104 of the Comprehensive Environmental Response Compensation, and Liability Act (CERCLA) (42 U.S.C. §§9601 et seq., 10 U.S.C. §2701 et seq., and Executive Order 12580 [January 23, 1987]) and the Superfund Amendments and Reauthorization Act (SARA) of 1986. Section 104 of CERCLA and SARA allows an authorized agency to provide for remedial action and to remove, or arrange for removal of hazardous substances, pollutants, or contaminants at any time, or to take any other response measures consistent with the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) as deemed necessary to protect public health or welfare and the environment. Work conducted at the site is consistent with the Draft (address Navy and privately owned Oceana Salvage Yard property) and Final (addresses privately owned Oceana Salvage Yard property) *Administrative Settlement and Order on Consent for Removal Response Action, Oceana Salvage Yard Site, Docket No. CERC-03-2007-0130DC*, which was prepared by the United States Environmental Protection Agency (USEPA) Region III for the site and is in accordance with the NCP and CERCLA.

The NCP, 40 *Code of Federal Regulations* (CFR) 300, provides regulations for implementing CERCLA and SARA and regulations specific to removal actions. The NCP defines a removal action as:

> *. . . the cleanup or removal of released hazardous substances from the environment, such actions as may necessarily be taken in the event of the threat of release of hazardous substances into the environment, such actions as may be necessary to monitor, assess, and evaluate the release or threat of release of hazardous substances, the disposal of removed material, or the taking of such other actions as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare or to the environment, which may otherwise result from a release or threat of release.*

USEPA has three categories of removal actions—emergency, time-critical, and non time-critical—based on the type of situation, the urgency and threat of the release or potential release, and the time frame in which the action must be initiated. This removal action is considered a NTCRA. NTCRAs are defined in 40 CFR 300.415(b)(4) as "actions pertaining to an imminent threat to human health and the environment and that have planning periods of 6 months or more."

This removal action is being considered for the Oceana Salvage Yard Access Road, Access Road Shoulders, and Burial Unit, where soils are impacted by lead from the use of damaged batteries as construction fill material for the Access Road and disposal of lead-containing debris in the Burial Unit. Groundwater is not addressed by this NTCRA. Non-roadway debris will be removed to the extent practical as a maintenance/housekeeping effort to restore the site to original conditions.

The 40 CFR 300.415 requires the lead agency to conduct an EE/CA when a NTCRA is planned for a site. The goals of an EE/CA are to identify the objective(s) of the removal action and to analyze the effectiveness, implementability, and cost of various alternatives that may satisfy these objectives. An EE/CA documents the removal action alternatives and selection process. Where the extent of the contamination is well-defined and limited in extent, NTCRAs also allow for the expedited cleanup of sites in comparison to the remedial action process under CERCLA.

Community involvement requirements for NTCRAs include preparing an EE/CA and making it available for public review and comment for a period of 30 days. An announcement of the 30-day public comment period on the EE/CA is required in a local newspaper and a public meeting may be held upon request. Written responses to significant comments will be summarized in an Action Memorandum and included in the Administrative Record.

1.2 Purpose and Objectives

Submittal of this document fulfills the requirements for NTCRAs as defined by CERCLA, SARA, and the NCP. This EE/CA has been prepared in accordance with *Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA* (USEPA, 1993).

This EE/CA compares four removal alternatives based on their technical feasibility, ability to protect human health, and cost. Individual goals of this EE/CA are to:

- Provide a framework for evaluating and selecting alternative technologies
- Satisfy environmental review and public information requirements for removal actions
- Satisfy administrative record requirements for documenting the removal action selection

The removal action objective of this NTCRA at the Oceana Salvage Access Road, Access Road Shoulders, and Burial Unit is to prevent exposure to contaminants potentially posing unacceptable risk to human health related to lead contamination in soil. Removal of non-roadway associated debris is a common component of Alternatives #2a, #2b, and 3 is to restore the site to original conditions to the extent practical. The four alternatives evaluated are:

- **Alternative #1—**No Action
- **Alternative #2a—**Gravel and Asphalt Cap of the Access Road, Onsite Soil Stabilization/ Immobilization of Lead in the Access Road Shoulders and Burial Unit, and Removal of Non-roadway Associated Debris

- **Alternative #2b—**Gravel and Asphalt Cap of the Access Road, Excavation of the Access Road Shoulders and Burial Unit with Offsite Disposal and Restoration, and Removal of Non-roadway Associated Debris
- **Alternative #3—**Excavation, Offsite Disposal and Restoration of the Access Road, Access Road Shoulders, and Burial Unit, and Removal of Non-roadway Associated Debris

SECTION 2

Site Characterization

This section provides a brief summary of background information for NAS Oceana. It includes a description of the Oceana Salvage Yard Access Road and Burial Unit and a discussion of previous site investigations.

2.1 Base History

NAS Oceana, located in Virginia Beach, Virginia, has been in existence since 1940 when it was established as a small auxiliary airfield. Since 1940, NAS Oceana has grown to more than 16 times it original size and is now a 6,000-acre master jet base supporting a community of more than 9,100 Navy personnel and 11,000 dependents. The primary mission of NAS Oceana is to provide the personnel, operations, maintenance, and training facilities to ensure that fighter and attack squadrons on aircraft carriers of the U.S. Atlantic Fleet are ready for deployment.

2.2 Site History and Previous Investigations

The Oceana Salvage Yard Access Road and Burial Unit are located along the eastern boundary of the NAS Oceana property (**Figure 2-1**). The site is not within the gated portion of the base, but it is owned by the Navy. The road provides the only ingress and egress from Oceana Boulevard to the Oceana Salvage Yard, which is privately owned. A Deed of Easement was signed by the Navy and Oceana Salvage Yard on December 18, 2007.

The Oceana Salvage Yard Burial Unit is located north of the Access Road at the eastern end near the Oceana Salvage Yard (**Figure 2-1**). From 1993 through 1995, the Salvage Yard property owners purportedly engaged in a cleanup of the Burial Unit. There currently is an unknown amount of waste remaining within the boundaries of the Burial Unit. During a 1997 Site Assessment (ABB Environmental Services, 1997), it was discovered that battery casings and other debris remained at the location of the Burial Unit. The Salvage Yard property owners did not create a closure plan during the purported cleanup period from 1993 through 1995. In May 1998, a closure plan was submitted by the property owners to the Virginia Department of Environmental Quality (VDEQ) which included the Burial Unit.

The Oceana Salvage Yard Access Road was first investigated as part of an Environmental Survey of the entire salvage yard (ABB Environmental Services, 1997). During this investigation, several soil samples were collected along the Access Road and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and inorganics. Lead was detected in soil from two waste piles located within the Oceana Salvage Yard at concentrations of up to 86,500 milligrams per kilogram (mg/kg). Interviews of salvage yard personnel indicated that a large volume of crushed car battery casings were brought to the salvage yard in the 1960s and were used as fill material for the road base.

In January 2005, CH2M HILL completed a direct push technology (DPT) investigation to verify whether the Access Road was actually constructed on crushed car batteries (CH2M HILL, 2005). DPT soil samples were collected at 25 locations along the roadway to a depth of 4 feet below ground surface (bgs). Waste containing battery casings was encountered at all but one sample location. Battery fragments were encountered between approximately 0.1 and 3 feet bgs. The average depth to the bottom of the battery fragment was approximately 2.5 feet bgs, however the battery fragments extended to 3.0 feet bgs at two locations. The thickness of the layer of battery fragments was approximately 0.5 feet to 1 foot. All soil samples were field screened for lead using field test kits. Many of the samples exceeded the field test kit detection limit of 400 mg/kg. Four soil samples were collected for laboratory lead analysis. Concentrations of lead detected in these samples ranged from 18.1 mg/kg to 149,000 mg/kg. Lead concentrations detected were found above the residential soil screening level of 400 mg/kg and the industrial soil screening level of 800 mg/kg from USEPA's Risk Screening Level (RSL) Table (USEPA, 2010) therefore were determined to potentially pose unacceptable risks to human receptors. A risk assessment was not completed.

In support of this EE/CA, additional samples were collected along the shoulders of the Access Road (October 2010) and from within the Burial Unit (April 2011) to define the areas exceeding 800 mg/kg of lead in soil. The results are summarized in Section 3.

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NAS Oceana Boundary

Salvage Yard Access Road

N

0 1500 3000 Feet

Figure 2-1
Oceana Salvage Yard Access Road Location Map
Oceana Salvage Yard Access Road EE/CA
Naval Air Station Oceana
Virginia Beach, Virginia

CH2MHILL

SECTION 3

Identification of Removal Action Objectives

Previous investigations identified lead contamination in the soil beneath the Oceana Salvage Yard Access Road, Access Road Shoulders, and the Burial Unit located north of the Access Road on the eastern side near the boundary with the Oceana Salvage Yard. Therefore, the objective of the removal action for this site is to minimize the potential risks to public health and the environment associated with lead-contaminated soil beneath the Access Road, Access Road Shoulders, and within the Burial Unit. All non-roadway debris will be removed as a maintenance/housekeeping effort to restore the site to original conditions. Groundwater is not addressed.

3.1 Statutory Limits on Removal Actions

The NCP 40 CFR Part 300.415 dictates statutory limits of $2 million and 12 months of USEPA fund-financed removal actions, with statutory exemptions for emergencies and actions consistent with the removal action to be taken. However, this removal action will not be USEPA fund-financed. The *Navy/Marine Corps Installation Restoration Manual* (Navy, 1997) does not limit the cost or duration of the removal action; nonetheless, cost effectiveness is a recommended criterion for the evaluation of removal action alternatives.

3.2 Removal Action Scope

The scope of the removal action to be initiated at the Oceana Salvage Yard Access Road, Access Road shoulders, and Burial Unit includes remediation of contaminated soils. This removal action will be designed to ensure that contaminated soils are remediated and/or capped with a protective cover to protect human health.

The NCP recognizes capping or covering of contaminated soils as an appropriate removal alternative for consideration under NTCRAs (40 CFR 300.415[e][4]). Therefore, in this document alternatives that include capping will be referred to as "removal actions," which is consistent with the NCP.

Contamination from battery fragments within the Access Road, Access Road shoulders, and Burial Unit soil is known to extend below the ground surface. During the evaluation of alternatives, it is assumed that the battery fragments extend to approximately 2.5 feet bgs in the Access Road, as determined in the 2005 DPT investigation (CH2M HILL, 2005), and 2 feet bgs in the Access Road shoulders and Burial Unit. The excavation depth in each of the three areas is 2 feet. Lead concentrations in post-excavation confirmation samples exceeding 800 mg/kg at an excavation depth of 2 feet will be covered with a warning barrier prior to backfilling.

In support of this EE/CA, sampling has been performed within the 10 feet shoulders on either side of the Access Road and the Burial Unit to identify areas where lead in soil exceeds 800 mg/kg. **Figure 3-1** demonstrates the results of this sampling. The Access Road

shoulders were divided into 10-foot by 50-foot grid cells parallel to the road. Composite soil samples were collected from 0 to 2 feet bgs (where refusal was not encountered) in each grid cell and analyzed for total lead. The results indicated that 18 of these grid cells contained lead in exceedance of 800 mg/kg and therefore require excavation and restoration.

The Burial Unit was divided in 25-foot by 25-foot grid cells within the estimated boundary to collect composite soil samples from 0 to 2 feet bgs (where refusal was not encountered) in each grid cell and analyzed for total lead. Results indicated 18 (out of 21) of the grid cells contained lead in exceedance of 800 mg/kg and therefore require excavation and restoration.

3.3 Removal Action Schedule

The EE/CA will be placed in the Administrative Record and notice of its availability for public review will be published in the local newspaper. The EE/CA will then be subjected to a 30-day public comment period. The public comment period will be held from May 23, 2011 to June 22, 2011. A public information session is planned for June 8, 2011 at the Virginia Beach Central Public Library during the public comment period. Following the public comment period, if comments are received, a Responsiveness Summary summarizing responses to significant comments will be prepared and included in an Action Memorandum. The Action Memorandum will also describe the proposed removal action and will be placed in the Administrative Record. Since this removal action has been designated non-time-critical, the start date will be ultimately determined by factors other than the urgency of the threat, including weather conditions, the availability of resources, and site constraints. The total project period is predicted to last 10 months, from the approval and signature of the Action Memorandum to completion of the NTCRA. Estimates of critical milestone durations are summarized below:

- EE/CA Public Comment Period—1 month
- Preparation and Review of Work Plan—3 months
- Subcontracting and Mobilization—2 months
- Removal Action—2 months
- Report Writing—2 months

The removal action time frame includes the time required for mobilization and setup of equipment and performing the selected removal action. Section 4 provides details regarding the amount of time necessary to complete the removal action.

3.4 Applicable or Relevant and Appropriate Requirements

The removal action will, to the extent practicable, comply with applicable or relevant and appropriate requirements (ARARs) under federal and state environmental laws, as described in 40 CFR 300.415. **Appendix A** contains the ARAR tables and provides a summary of each potentially related environmental law. Other federal and state advisories, criteria, or guidance will, as appropriate, be considered in formulating the removal action. Applicable requirements are those requirements specific to the conditions at the Oceana Salvage Access Road, Access Road shoulders, and Burial Unit and the surrounding vicinity

that satisfy all jurisdiction prerequisites of the law or requirements. Relevant and appropriate requirements are those that do not have jurisdiction authority over the particular circumstances at the site and surrounding vicinity, but are meant to address similar situations, and therefore, are suitable for use at the Access Road, Access Road shoulders, and Burial Unit. ARARs are determined by the lead agency, the Navy. The Navy has evaluated the ARARs relative to the Access Road, Access Road shoulders, and Burial Unit since these areas are located on Navy property. As outlined by 40 CFR 300.415(j), the Navy may consider the urgency of the situation and the scope of the removal action to be conducted in determining whether compliance with ARARs is practicable. The NCP, 40 CFR 300.400(g)(2), specifies factors to consider in determining what requirements of other environmental laws are relevant and appropriate:

- The purpose of the requirement in relation to the purpose of CERCLA
- The media regulated by the requirement
- The substance(s) regulated by the requirement
- The actions or activities regulated by the requirement
- Variations, waivers, or exemptions of the requirement
- The type of place regulated and the type of place affected by the release or CERCLA action
- The type and size of the facility or structure regulated by the requirement or affected by the release
- Consideration of the use or potential use of affected resources in the requirement

In some circumstances, a requirement may be relevant to the particular site-specific situation but may not be appropriate because of differences in the purpose of the requirement, the duration of the regulated activity, or the physical size or characteristic of the situation it is intended to address. There is more discretion in the judgment of relevant and appropriate requirements than in the determination of applicable requirements.

Three classifications of requirements are defined by USEPA in the ARAR determination process: chemical-specific, location-specific, and action-specific.

3.4.1 Chemical-Specific ARARS

Chemical-specific ARARs are health or risk management-based numbers or methodologies that result in the establishment of numerical values for a given media that would meet the NCP "threshold criterion" of overall protection of human health and the environment. These requirements generally set protective cleanup concentrations for the chemicals of concern in the designated media, or set safe concentrations of discharge for remedial activity. Federal and Commonwealth of Virginia chemical-specific regulations that have been reviewed are summarized in **Appendix A**.

3.4.2 Location-Specific ARARS

Location-specific ARARs restrict removal activities and media concentrations based on the characteristics of the surrounding environments. Location-specific ARARs may include

restrictions on removal actions within wetlands or floodplains, near locations of known endangered species, or on protected waterways. The federal and Commonwealth of Virginia location-specific regulations that have been reviewed are summarized in **Appendix A**.

To maintain compliance with the Clean Water Act (the federal location-specific ARAR that addresses wetlands), the Removal Action will strive to minimize potential harm and preserve and enhance wetlands to the extent possible. During this Removal Action, wetlands are expected to be temporarily and permanently impacted. Specifically, excavated areas in the shoulders of the Access Road and the Burial Unit will temporarily impact wetlands, which will be restored by matching surrounding elevations and planting a wetland vegetative seed mix. Permanent impacts will occur along the immediate edge of the Access Road where the transition from road surface to the shoulder wetlands occurs. Wetlands impacts will be mitigated in accordance with United States Army Corps of Engineers (USACE) requirements and will consist of restoring the road shoulder areas as wetlands, purchasing wetland credits, and creating improved wetland areas.

3.4.3 Action-Specific ARARS

Action-specific ARARs are requirements that define acceptable treatment and disposal procedures for hazardous substances. Federal and Commonwealth of Virginia Action-specific ARARs that may affect the development and conceptual arrangement of removal alternatives are summarized in **Appendix A**.

VBO \\NORTHEND\PROJ\USNAVFACENGCOM\370292OCEANA\MAPFILES\388948_CONFIRMATION_SAMPLING\FIGURE3-1_LEAD_SAMPLING_RESULTS.MXD MUNWIN 5/18/2011 3:33:00 PM

Legend

- NAS Oceana Boundary
- Burial Unit Boundary
- Grid Cell
- Impacted Area (Lead in Soil > 800 mg/kg)
- Grid Cell Extended to Match New Road
- Created Wetlands
- Approximate Locations of Debris Piles/Surficial Debris (Table 4-1)

N
W E
S

0 60 120
Feet

Figure 3-1
Oceana Salvage Yard
Lead Sampling Results
Non-Time Critical Removal Action
NAS Oceana
Virginia Beach, Virginia

SECTION 4

Identification and Analysis of Removal Action Alternatives

This section presents a discussion of the potential removal action technologies for the Oceana Salvage Yard Access Road, Access Road shoulders, and Burial Unit. For the discussion of alternatives, the following estimates have been used:

- The Access Road is estimated to be approximately 838 feet long by an average of 27 feet wide (22,626 square feet [ft^2] or 0.52 acres).
- The 10-foot shoulder area on both sides of the Access Road where lead in soil exceeds 800 mg/kg contains wetland vegetation. At the eastern edge of the Access Road, the shoulders widen due to the area previously being utilized for temporary storage. These areas are considered part of the shoulder area and will also be addressed. The total area of the road shoulders requiring excavation and restoration is 13,650 ft^2 (0.31 acres). The resulting excavation (in-place) volume requiring immobilization/stabilization and/or offsite disposal is 987 cubic yards (yd^3).
- The area of the Burial Unit is estimated to be approximately 11,875 ft^2 (0.27 acres) based upon the results presented in **Figure 3-1**.
- Contamination from battery fragments in the Access Road, Access Road shoulders, and Burial Unit soil require excavation to 2 feet bgs. Where post-excavation samples exceed 800 mg/kg for lead in soil, the placement of a warning barrier will be required prior to backfilling the excavation/stabilization of soil.
- The non-roadway associated debris at the site consists of batteries, battery fragments, insulated cables, rubber hosing, tile, metal, glass, plastic, kitchen appliances, construction debris, and miscellaneous car parts (e.g., tires, metal structures, car seats, truck bed). The amount of non-roadway associated debris has been observed as buried and/or surficial debris; the estimated amount of non-roadway associated debris is approximately 710 yd^3 of debris, however this estimate is based on visual observation of the site conducted March 2011 (**Table 4-1**). It is assumed approximately 270 yd^3 of the debris will need to be disposed of at an approved hazardous waste facility.
- Temporary impacts to wetlands will result from excavations within the Access Road shoulders (10,408 ft^2/0.24 acres) and the Burial Unit (11,875 ft^2/0.27 acres). The non-roadway associated debris will also require temporary impacts to access and remove the debris; however, the affected area will need to be determined by the removal action contractor based upon ingress and egress paths. Permanent impacts (2,488 ft^2/0.057 acres)are anticipated to be limited to each side of the asphalt Access Road to provide a gradual transition from the road surface down to the wetland elevations along the Access Road Shoulders.

Figure 4-1 shows the layout of the extent of work for the Oceana Salvage Yard Access Road, Access Road shoulders, and Burial Unit.

4.1 Identification of Removal Action Alternatives

Soil samples collected from beneath the Oceana Salvage Yard Access Road, Access Road shoulders, and Burial Unit indicate the presence of lead. The objective of this Removal Action is to minimize the potential for exposure to lead in soil at Oceana Salvage Yard Access Road, Access Road shoulders, and Burial Unit. All non-roadway debris will be removed as a maintenance/housekeeping effort to restore the site to original conditions. The four potential removal action alternatives developed and evaluated for the Oceana Salvage Yard Access Road and Burial Unit are:

- **Alternative #1—**No Action
- **Alternative #2a—** Gravel and Asphalt Cap of the Access Road, Onsite Soil Stabilization/Immobilization of Lead in the Access Road Shoulders and Burial Unit, and Removal of Non-roadway Associated Debris
- **Alternative #2b—** Gravel and Asphalt Cap of the Access Road, Excavation of the Access Road Shoulders and Burial Unit with Offsite Disposal and Restoration, and Removal of Non-roadway Associated Debris
- **Alternative #3 -** Excavation, Offsite Disposal and Restoration of the Access Road, Access Road Shoulders, and Burial Unit, and Removal of Non-roadway Associated Debris

4.1.1 Description of Removal Action Alternatives Common Components

There are several activities that are components of multiple alternatives. A description of those activities follows to reduce the redundancy in the individual alternative descriptions:

Erosion and Sediment Controls

Erosion and sediment controls will be installed for Alternatives #2a, #2b, and #3. Specific controls will be developed by the contractor in the Removal Action Work Plan. The controls will be installed and maintained in accordance with the *Virginia Erosion and Sediment Control Handbook* (DCR, 1992). Erosion and sediment controls will consist, at a minimum, perimeter controls such as silt fencing. Dust control measures will be implemented to prevent dust from leaving the site and limiting fugitive dust exposure to site workers and Oceana Salvage Yard employees and patrons.

Site Clearing

Site clearing will be required for Alternatives #2a, #2b, and #3. This will consist of removing brush and trees.

Waste Characterization Sampling

Waste characterization samples will be collected for alternatives that require offsite disposal of material (Alternatives #2a, #2b, and #3). Waste characterization analysis consists of full Toxicity Characteristic Leaching Procedure (TCLP), corrosivity, reactivity, ignitability, along

with any additional testing required by the disposal facility. Waste characterization samples will be collected as required by the disposal facility.

If immobilization/stabilization of lead in soil is considered by the contractor, a small scale pilot test must be conducted to determine the efficiency of the additive to the soil. The pilot test will include waste characterization sampling of the stabilized soil to determine waste characteristics. Based on the alternative, the stabilized soil may be used for fill material (Alternative #2a) or disposed offsite as non-hazardous material (Alternatives #2b and #3).

Excavation

Alternatives #2a, #2b, and #3 have components that require excavation. Sampling conducted in the fall of 2010 delineated the portions of the Access Road shoulder where lead exceeds 800 mg/kg and requires removal/restoration (**Figure 3-1**). Sampling completed in April 2011 identified areas where the concentrations of lead within the Burial Unit are above 800 mg/kg (**Figure 3-1**). Since the water table may be encountered during the removal action, materials excavated from below the water table may be saturated and require dewatering. A dewatering pad may be constructed on the site to allow water to drain from the soil that is saturated; it is anticipated that no dewatering additives will be necessary to sufficiently solidify the material. Water generated from the dewatering of saturated soil will need to be managed appropriately (e.g., lead may be present). Details for the management of wet excavated materials will be addressed in detail in the Removal Action Work Plan.

Personal Protective Equipment

Proper personal protective equipment (PPE) will be necessary for all workers disturbing and handling of lead-contaminated soils in all alternatives. The contractor will submit the appropriate health and safety plan (HSP) to the Navy for approval prior to the initiation of removal action activities.

Soil Stabilization

Alternative #2a proposes that excavated soils be mixed with an additive in an effort to lower the solubility of the lead in soils, rendering the soil 'stabilized' by immobilizing the lead. For cost estimating, a product from MT2, ECOBOND, was assumed. This product was successfully used in a similar application at the adjacent Oceana Salvage Yard; however, no bench-scale or pilot-scale tests were conducted to support this EE/CA regarding its potential effectiveness and/or the ability for wetland vegetation to reestablish in excavated areas. These tests, or some other means of verifying the application, will need to be performed to evaluate which additive will be the most effective for stabilizing the lead-contaminated soil. The actual method of stabilization may vary during project implementation. For Alternative #2a, the stabilized, non-hazardous material following treatment may be used for backfill. Under Alternatives #2b and #3, the treated material would result in a non-hazardous characterization for offsite disposal.

Offsite Borrow

No onsite borrow source exists for gravel, vegetative support material, or topsoil. Alternatives #2b and #3 require all offsite borrow materials to be brought to the site. All offsite borrow materials will be certified 'clean' through analytical testing of VOCs, SVOCs, PCBs and metals and comparison to USEPA RSLs for industrial scenarios. Additionally,

cover material will contain less than 50 mg/kg total petroleum hydrocarbons (TPH) and less than 10 mg/kg concentration of benzene, toluene, ethylbenzene, and xylene (BTEX). General fill and vegetative support material will consist of clean fill. Vegetative support material will be used to provide a suitable base for topsoil, which will also serve to support the wetland vegetation. The removal action contractor will need to coordinate with Navy Natural Resources for suitable soil to establish wetland regrowth.

Vegetative Stabilization through Native Grasses

Alternatives #2a, #2b, and #3 include vegetative stabilization through native grasses will consist of seeding with temperature- and drought-resistant native grasses in accordance with the *Virginia Erosion and Sediment Control Handbook* (DCR, 1992).

Permanent and Temporary Wetland Impacts

The Access Road shoulders and the Burial Unit have been identified as wetlands according to a Jurisdictional Determination completed by the USACE. Alternatives #2a, #2b, and #3 result in temporary and permanent wetland impacts during construction activities. Temporary impacts along the shoulders of the Access Road will result in 13,650 ft^2 (0.31 acres) of temporary impacts to existing wetlands. Based upon the grids in **Figure 3-1**, the Burial Unit removal and restoration will account for 11,875 ft^2 (0.27 acres) of temporary wetland impacts for those grid cells exceeding 800 mg/kg of lead in soil. The non-roadway debris will also require temporary impacts to access and remove the debris; however, the extent of impact is dependent upon the ingress and egress paths used by the removal contractor. These will need to be addressed in the Removal Action Work Plan. Permanent impacts (2,488 ft^2/0.057 acres) are only anticipated along the immediate edges of the Access Road, where a gravel transition is necessary to transition from the newly constructed asphalt road surface to the restored shoulder. The work plan to be developed for the implementation of the removal action will clearly address the impacts and the restoration measures to the disturbed wetlands. The Navy will coordinate with USACE on the specific requirements; the removal action contractor will be responsible for implementing restoration measures for the impacted wetland areas.

Non-Roadway Associated Debris

Alternatives #2a, #2b, and #3 require removal of all non-roadway associated debris which is buried and/or lying on the surface throughout the site; the estimated amount of non-roadway associated debris is approximately 649 yd^3 of debris, however this estimate is based on visual observation of the site. For cost estimating purposes, approximately 270 yd^3 was estimated to be disposed of as hazardous material (0.5 yd^3 of potential asbestos containing material and 269.5 yd^3 of high lead contamination), the remaining material (379 yd^3) was estimated to be inert and may be disposed of at a non-hazardous disposal facility. Co-mingled soil and soil beneath non-roadway associated debris may be removed based on concentrations of lead (greater than 800 mg/kg) and the extent of excavation will be refined in the Removal Action Work Plan.

Land Use Controls

Alternatives #2a, #2b, and #3 leave lead contaminated soil in place (beneath warning barrier) at concentrations greater than the USEPA industrial use RSL, therefore land use

controls (LUCs) and periodic inspection will be required upon the complete of the removal action.

4.1.2 Alternative #1—No Action

The no action alternative implies that no removal work will be done at this site. The site will be left as it currently exists, leaving the soil in place. Under this alternative, no controls or removal technologies will be implemented. It is assumed that the current level of maintenance will be sustained.

4.1.3 Alternative #2a— Gravel and Asphalt Cap of the Access Road, Onsite Soil Stabilization/Immobilization of Lead in the Access Road Shoulders and Burial Unit, and Removal of Non-roadway Associated Debris

Access Road

This alternative proposes that the Access Road will be capped with gravel and asphalt to serve as a protective barrier from human exposure to lead-contaminated soil. The Access Road cap will include an orange (or equally effective color) warning barrier placed on the existing gravel road surface and covered with a gravel base (5 inches) and asphalt surface (6 inches). The warning barrier will serve two purposes as it will help to promote cap integrity and it will serve as a warning to anyone performing future excavation activities within the road.

Access Road Shoulders

This alternative will require the excavation and backfill of soils in the 10-foot shoulders of the Access Road having concentrations of lead >800 mg/kg to a maximum depth of 2 feet. While the soil stabilization/immobilization could potentially be done in-situ, the requirement to verify lead concentrations with confirmation sampling at a depth of 2 feet in the bottom of the excavation and application of the warning barrier (where lead concentration exceeds 800 mg/kg) essentially requires all materials to at least temporarily be excavated for treatment.

Once stabilization/immobilization of the lead is complete and TCLP test indicates a non-hazardous characteristic for lead, the treated soil may then be re-used as backfill on top of the warning barrier for site restoration. The placement of the warning barrier is required in areas where the floor confirmation samples exceed the USEPA lead industrial use RSL (800 mg/kg).

Wetland vegetation must be restored and trees removed during excavation activities must be replaced to the extent approved by the USACE and Navy.

Appropriate dust control measures must be employed during excavation and handling of soils to prevent creating hazardous conditions for the site workers and neighboring property employees and patrons.

Burial Unit

This alternative also proposes that the Burial Unit be excavated to a maximum depth of 2 feet bgs where soils contain >800 mg/kg lead. The excavation will result in approximately

1,000 yd^3 of soil to be generated for immobilization/stabilization. Like the Access Road shoulders, the *in situ* treatment/ immobilization/stabilization of lead in soil is not feasible given the requirement to verify lead concentrations at the 2 feet depth prior to backfilling. The excavated soil will need to be temporarily staged in a containment cell for the immobilization/stabilization and testing to confirm that lead concentrations are <800 mg/kg and that TCLP results for lead are characterized as non-hazardous.

Following the excavation, it is anticipated that areas beneath the excavation limits (at 2 feet bgs) may remain at the site with lead contamination >800 mg/kg. Post-excavation samples will be collected from the bottom of the excavation area to identify the remaining soils with lead concentrations >800 mg/kg. An orange (or equally effective color) warning barrier will be placed on all remaining soil with lead concentrations >800 mg/kg at a depth of 2 feet. The treated soil may then be backfilled on top of the protective barrier for site restoration. Erosion and sediment controls and permanent seeding will be established in accordance with the *Virginia Erosion and Sediment Control Handbook* (DCR, 1992).

Appropriate dust control measures will be employed when excavating and handling the soils to prevent creating hazardous conditions for the site workers and neighboring property employees and patrons.

4.1.4 Alternative #2b—Gravel and Asphalt Cap of the Access Road, Excavation of the Access Road Shoulders and Burial Unit with Offsite Disposal and Restoration, and Removal of Non-roadway Associated Debris

Access Road and Shoulders

Identical to Alternative #2a, this alternative involves capping the Access Road and excavating/backfilling soils >800 mg/kg of lead in the 10 feet shoulders on either side of the Access Road. A warning barrier is to be placed where lead exceeds 800 mg/kg at the 2 feet depth following excavation. This alternative, however, provides for offsite disposal of the excavated material and for clean fill materials to be imported for site restoration. While the excavated soil will be disposed of offsite with this alternative, it may be immobilized/ stabilized onsite prior to transport and disposal to render it non-hazardous. For cost estimating purposes, it was also assumed that if the excavated materials are not immobilized/stabilized onsite that it will be characteristic hazardous waste for lead. Both scenarios are presented in the cost estimate.

Burial Unit

This alternative addresses the Burial Unit identically to the Access Road shoulders; however, the excavated materials (2 feet) will be disposed of offsite. The excavated material may be immobilized/stabilized on site prior to offsite disposal. A warning barrier to be placed where lead exceeds 800 mg/kg at the 2 feet depth following excavation as determined by confirmation sampling.

4.1.5 Alternative #3—Excavation, Offsite Disposal and Restoration of the Access Road, Access Road Shoulders, and Burial Unit, and Removal of Non-roadway Associated Debris

Access Road

This alternative proposes that the entire Access Road be excavated to a depth of 2 feet. Confirmation sampling in the bottom of the excavation will be used to define areas where lead exceeds 800 mg/kg, and consistent with Alternatives #2a and #2b, the warning barrier will be placed. Based upon the elevated lead concentrations obtained from within and beneath the Access Road during previous sampling events, it is assumed the material will require disposal as hazardous waste unless it is immobilized/stabilized on site prior to transport and disposal. However, because the road is known to be constructed upon spent battery casings, this portion of the excavated materials that may react differently to the onsite immobilization/stabilization treatment due to the percentage of material that is not soil.

Following the excavation, the Access Road will be restored with a gravel and asphalt cover as with Alternatives #2a and #2b.

Access Road Shoulders

The access road shoulders will be addressed identically to Alternative #2b.

Burial Unit

The Burial Unit will be addressed identically to Alternative #2b.

4.2 Evaluation Criteria

The evaluation criteria are based on the USEPA guidance document *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA* (1993).

4.2.1 Effectiveness

The *effectiveness* criterion addresses the expected results of the removal alternatives. It includes two major subcategories: protectiveness and ability to achieve the removal objectives.

Protectiveness

To be protective, the removal alternative must be:

- Protective of public health and community;
- Protective of workers during implementation;
- Protective of the environment; and
- Compliant with ARARs.

Ability to Achieve Removal Objectives

To successfully achieve the removal objective, the removal alternative must:

- Meet the expected level of treatment or containment
- Have no residual effect concerns
- Maintain long-term control

4.2.2 Implementability

The *implementability* criterion encompasses the technical and administrative feasibility of the removal action. It includes three subcategories: technical feasibility, availability of resources, and administrative feasibility.

- Technical Feasibility
  - Construction and operational consideration
  - Demonstrated performance and useful life
  - Adaptability to environmental conditions
  - Contribution to performance of long-term removal actions
  - Implementation within the allotted time
- Availability of Resources
  - Availability of equipment
  - Availability of personnel and services
  - Laboratory testing capacity
  - Offsite treatment and disposal capacity
  - Post-removal site control
- Administrative Feasibility
  - Required permits and/or easement or rights-of-way
  - Impacts on adjoining property
  - Ability to impose institutional controls
  - Likelihood of obtaining exemptions from statutory limits (if needed)

4.2.3 Cost

The *cost* criterion encompasses the life-cycle costs of a project, including the projected implementation costs and the long-term operational and maintenance costs of the remedial action. For the detailed cost analysis, the expenditures required to complete each alternative were estimated in terms of capital costs, including direct and indirect costs, to complete initial construction activities. Direct costs include the cost of labor, construction equipment, land and site development, wetland management, soil treatment (where necessary), transportation, and disposal. Indirect costs include engineering expenses and contingency allowances.

Annual operation and maintenance (O&M) costs, which are post-construction costs required to ensure the continued effectiveness of the removal action, are incorporated into the cost estimate. Expenditures that occur over a time period are analyzed using present worth, which discounts all future costs to a common base year. Present worth analyses allows the cost of the removal action to be compared on the basis of a single figure representing the

amount of money that, if invested in the base year and disbursed as needed, will be sufficient to cover all costs associated with the life of the removal action. Assumptions associated with present worth calculations include a discount rated of 3 percent (OMB Circular No. A-94, Appendix C, Revised January 2003), cost estimates in the planning years in constant dollars, and a period of performance that will vary on the activity, but will not exceed 30 years.

The costs estimated are provided to an accuracy of +50 percent and –30 percent. The alternative cost estimates are in 2011 dollars and based on information published by R.S. Means *Site Work and Landscape Cost Data* (2011) and *Environmental Cost Data – Assemblies* (2002). In addition, costs from similar projects were used to develop the alternative cost estimates. Where R.S. Means data were not available or not applicable, phone quotes, similar projects, or engineering estimates were used for unit pricing. Refer to **Appendix B** for all cost estimate details pertaining to each alternative discussed in the following sections.

The capital cost (without contingency and markups) of common components is estimated to be $324,801 and included within each individual alternative cost estimate (**Appendix B**).

4.3 Analysis of Removal Action of Alternatives

Table 4-2 presents a comparison of the four alternatives with respect to effectiveness, ease of implementation, and cost.

4.3.1 Alternative #1—No Action

The no action alternative implies that no removal work will be done at the Oceana Salvage Yard Access Road, Access Road shoulders, or Burial Unit. The site will be left as it currently exists, leaving the battery fragments and lead-impacted soil in place. Additionally, all non-roadway associated debris would remain onsite.

Effectiveness

Selection of this alternative does not satisfy the objectives of this EE/CA, does not protect human health and the environment, and is not desirable because no measures will be implemented to prevent human exposure to known lead contamination in soil.

Implementability

No work is associated with this alternative; therefore, this can be easily implemented.

Cost

There is no cost associated with the no action alternative.

4.3.2 Alternative #2a— Gravel and Asphalt Cap of the Access Road, Onsite Soil Stabilization/Immobilization of Lead in the Access Road Shoulders and Burial Unit, and Removal of Non-roadway Associated Debris

This alternative proposes that the Oceana Salvage Yard Access Road be capped with gravel and asphalt and that soils with lead >800 mg/kg in the Access Road shoulders and the Burial Unit be excavated, stabilized/immobilized on site and used as backfill for site

restoration once TCLP analysis confirms excavated material is characterized as non-hazardous. All non-roadway debris will be removed as a maintenance/ housekeeping effort to restore the site to original conditions. This alternative would require the establishment of LUCs to prevent future exposures, as well as periodic site inspections to verify and document that LUCs are being implemented for the Access Road as well as any other areas where soil beneath the excavation depth of 2 feet exceeds 800 mg/kg and the warning barrier is present.

Effectiveness

This alternative meets the removal action objective to prevent future exposure to the contaminated soil and buried debris through a combination of excavation, onsite immobilization/stabilization, as well as providing a protective cover. All areas beneath the Access Road, as well as areas within the Access Road shoulders and the Burial unit where lead exceeds 800 mg/kg, will be covered with a protective barrier. Post excavation sampling will be conducted to determine these areas where LUCs are required. LUCs will be implemented and enforced to effectively eliminate potential human contact with the soil.

Construction activities could pose a short-term exposure to construction workers from inhalation of dust, which would be reduced by the use of PPE and the use of dust control procedures in accordance with a HSP.

This alternative would not provide a reduction in the toxicity or volume of contaminants beneath the Access Road; however LUCs implementation and enforcement will effectively eliminate potential human contact with soil. There would be a reduction in the toxicity and volume of contaminants in the Access Road shoulders and the Burial Unit soil through the onsite immobilization/stabilization.

Implementability

This alternative requires equipment and technologies that are proven and commercially available. Site access is readily available for the type of equipment necessary. In order to not affect the operation of the Oceana Salvage Yard, the Access Road will need to remain usable during construction activities; this limits available space in which to construct a containment cell within which to stage excavated materials while the onsite immobilization/stabilization process is completed.

Though contained, contaminated soil will remain at the site, requiring the implementation of LUCs, site inspections, and associated reporting. Implementing the LUCs and conducting the requisite inspections and reporting are administratively and technically feasible with readily available resources.

Cost

The capital cost for Alternative 2a is estimated to be $800,653. The annual (O&M costs are estimated to be $10,200 for a period of 30 years. **Appendix B** contains preliminary cost estimates for this alternative, including potential variation in capital cost of -30 percent to +50 percent in accordance with EE/CA guidance. Applying such a variation to the estimated capital cost indicates the actual cost is likely to be between $560,457 and $1,200,980.

4.3.3 Alternative #2b—Gravel and Asphalt Cap of the Access Road, Excavation of the Access Road Shoulders and Burial Unit with Offsite Disposal and Restoration, and Removal of Non-roadway Associated Debris

This alternative is essentially the same as Alternative 2a, but provides for the excavated materials to be transported offsite for disposal. Onsite immobilization/stabilization may be completed to render the excavated materials non-hazardous for transport and disposal.

Effectiveness

This alternative meets the removal action objective to prevent future exposure to the contaminated soil and battery fragments through a combination of excavation and offsite disposal as well as providing a protective cover. All areas beneath the Access Road, Access Road shoulders, and the Burial unit where lead exceeds 800 mg/kg, will be covered with a warning barrier. Post excavation sampling will be conducted to determine these areas LUCs will be implemented, which will be effective in eliminating potential human contact with the soil as long as LUCs are enforced.

Construction activities could pose a short-term exposure to construction workers from inhalation of dust, which would be reduced by the use of PPE and the use of dust control procedures in accordance with a HSP.

This alternative would not provide an immediate reduction in the toxicity or volume of contaminants beneath the Access Road. There would be a reduction in the toxicity or volume of contaminants in the Access Road Shoulders and Burial Unit soil through offsite disposal of excavated materials..

Implementability

The implementability is very similar to Alternative #2a. If the excavated materials are directly loaded for offsite shipment (assumed hazardous), then the challenges associated with keeping the access road in use and constructing a temporary containment cell for the immobilization/stabilization process are not incurred.

Cost

The capital cost for Alternative #2b is estimated to be $1,805,796 assuming hazardous disposal of excavated material and $1,171,983 assuming stabilization/immobilization of excavated material and nonhazardous offsite disposal. The annual O&M costs are estimated to be $10,200 for a period of 30 years. A**ppendix B** contains preliminary cost estimates for this alternative, including potential variation in capital cost of -30 percent to +50 percent in accordance with EE/CA guidance. Applying such a variation to the estimated capital cost indicates the actual cost is likely to be between $820,388 and $2,708,694 (range covers both non-hazardous and hazardous off-site disposal scenarios).

4.3.4 Alternative #3—Excavation, Offsite Disposal and Restoration of the Access Road, Access Road Shoulders, and Burial Unit, and Removal of Non-roadway Associated Debris

This alternative proposes that the contaminated soil in the Access Road, Access Road shoulders, and the Burial Unit would be excavated to a depth of 2 feet and appropriately

disposed of in a landfill. Site restoration will consist of a warning barrier for all areas with lead remaining in soil greater than 800 mg/kg of lead in the floor of the excavation areas as determined by confirmation samples. LUCs will need to be maintained on those areas where soil contamination is above 800 mg/kg at the 2 feet excavation depth and the warning barrier is placed.

Effectiveness

This alternative meets the objective of the removal action. Removal of contaminated soil, debris, and battery fragments would be permanently effective in reducing the possible threat to human health and the environment by eliminating the potential for contact with the soil. An immediate reduction in the contaminant levels in the soil would be anticipated. This alternative would provide an immediate reduction in the toxicity and volume of contaminants in the soils. Soil remaining in place at the 2 feet excavation depth with lead concentrations above 800 mg/kg will be covered with the warning barrier, clean fill, and LUC will be implemented and enforced to prevent potential unacceptable exposure.

Construction activities could pose a short-term exposure to construction workers from inhalation of dust, which would be reduced by the use of PPE and the use of dust control procedures in accordance with a HSP.

Since the excavated materials will ultimately be disposed of at a landfill, the offsite disposal alternative would not meet the NCP preference of onsite treatment and site reuse over land disposal.

Implementability

The implementation of this alternative would require the use of standard excavation, earth moving, and hauling equipment. Excavation and materials handling are common construction activities and site access is readily available for the type of equipment necessary for this work. As with Alternatives 2a and 2b, there are logistical challenges related to keeping the Access Road open during construction activities for the removal action.

Though contained, contaminated soil hotspots will remain at the site, requiring the implementation of LUCs, site inspections, and associated reporting. Implementing the LUCs and conducting the requisite inspections and reporting for these areas are administratively and technically feasible with readily available resources.

Cost

The capital cost to Alternative #3 is $3,022,403 assuming offsite hazardous disposal and $1,791,055 assuming onsite stabilization and offsite nonhazardous disposal. The annual O&M costs are estimated to be $10,200 for a period of 30 years for the areas where lead contamination remains in place above 800 mg/kg as determined by post-excavation confirmation sampling. **Appendix B** contains a preliminary cost estimate for this alternative, including potential variation in capital cost of -30 percent to +50 percent in accordance with EE/CA guidance. Applying these variations to the estimated cost indicates costs are likely to be between $1,253,738 and $4,533,605 (range covers both non-hazardous and hazardous off-site disposal scenarios).

Table 4-1

Non-roadway Associated Debris Estimate

Field ID	Length (ft)	Width (ft)	Depth (ft)	Assumed Percentage of Solid Debris*	Volume (ft^3)	Volume (yd^3)
Debris Pile 1	67	74	2.5	5	620	23
Debris Pile 2	205	45	2	10	1845	68
Debris Pile 3	275	75	2.5	4	2063	76
Debris Pile 4 **	425	85	4	10	14450	535
Southern Access Road Surficial Debris	380	35	0.5	2	133	5
Northern Access Road Surficial Debris	380	15	0.5	2	57	2
Estimated amount of Non-roadway Associated Debris to be removed during Removal Action:						**710**

Notes:

ft - foot/feet

ft^3 - cubic feet

yd^3 - cubic yard

*Assumed percentage of solid debris are based on visual observations during site visit conducted in Mach 2011; the site visit included digging into debris piles to determine a percentage of the piles were solid debris. Co-mingled soil is not included in this estimate.

**Debris Pile 4 contains a high density of battery casings/fragments throughout half of the measured area (estimated). Therefore, 270 CY of debris is assumed to be hazardous disposal for removal alternatives.

TABLE 4-2

Evaluation of Removal Alternatives

Alternative	Description	Effectiveness	Ease of Implementation	Cost
Alternative #1 No Action	No removal work performed. Site left "as is."	Both short- and long-term effectiveness are low. The contaminated soil would remain in place with no barrier. Potential exposure to lead contamination will not change.	Easy implementation. No action to implement.	No Cost $0
Alternative #2a Gravel and Asphalt Cap of the Access Road, Onsite Soil Stabilization/Immobilization of Lead in the Access Road Shoulders and Burial Unit, and Removal of Non-roadway Associated Debris	Remove access road exposure route via installation of a cover consisting of a protective barrier, 6 inches of aggregate base course, and 5 inches of asphalt base course. Area 10 ft to roadside and burial unit will have immobilization/stabilization of lead in contaminated soils above 800 mg/kg lead. Contaminated soil greater than 2 ft will be covered with a barrier prior to stabilization/immobilization of contamination soil from 0 to 2 ft in depth. Non-roadway associated debris disposed of offsite.	For the access road short-term effectiveness is high and long-term effectiveness is moderate. ause it is dependent upon land use controls. The asphalt road surface is intended to reduce the frequency of maintenance Barrier would be placed on top of contaminated soil, removing the exposure route. Cover would remain in place pending inspections and maintenance. For the burial unit both short- and long-term effectiveness would be high. Contaminated soil to a 2 ft depth would either be immobilized/stabilized or covered with a protective barrier.	Moderate implementation. This alternative would use technologies that are demonstrated and commercially available. Site access is readily available for the type of equipment necessary for this alternative. Though contained, contaminated soil would remain at the site, requiring the implementation of LUCs/ICs, site inspections, and associated reporting.	Capital Cost $800,653
Alternative #2b Gravel and Asphalt Cap of the Access Road, Excavation of the Access Road Shoulders and Burial Unit with Offsite Disposal and Restoration, and Removal of Non-roadway Associated Debris	Remove access road exposure route via installation of a cover consisting of a protective barrier, 6 inches of aggregate base course, and 5 inches of asphalt base course. A protective barrier will be placed prior to installation of the gravel and asphalt cap over the Access Road. Area 10 ft to roadside will be excavated for all soils above 800 mg/kg lead, and restored with 1.5 clean fill and 6" topsoil. Burial unit excavated to 2', protective barrier for all soils above 800 mg/kg lead, filled with 1.5' clean fill and 6" topsoil. Excavated soil may be disposed of as hazardous or non-hazardous based on contractor discretion to treat soil. Non-roadway associated debris disposed of offsite.	For the access road short-term effectiveness is high and long-term effectiveness is moderate because it is dependent upon land use controls. The asphalt road surface is intended to reduce the frequency of maintenance. Warning barrier would be placed on top of contaminated soil, removing the exposure route. Cover would remain in place pending inspections and maintenance. For the burial unit both short- and long-term effectiveness would be high. Contaminated soil would either be removed and replaced with clean backfill or covered with a protective barrier.	Moderate to easy implementation. This alternative would use technologies that are demonstrated and commercially available. Site access is readily available for the type of equipment necessary for this alternative. Though contained, contaminated soil would remain at the site, requiring the implementation of LUCs/ICs, site inspections, and associated reporting. On-Site Stabilization of the excavated soil would provide for non-hazardous soil transportation off-site or may be disposed of as hazardous soil.	Capital Cost $1,171,983 - $1,805,796
Alternative #3 Excavation, Offsite Disposal and Restoration of the Access Road, Access Road Shoulders, and Burial Unit, and Removal of Non-roadway Associated Debris	Excavate access road to 2 ft and burial unit to 2 ft. Place protective barrier over any areas where contamination remains greater than 800 mg/kg lead. For road 2 ft clean fill, 6 inches of aggregate base course, and 5 inches of asphalt base course. For 10 ft sides 1.5 ft of clean fill, 6 inches of topsoil. For burial unit, 1.5 ft of clean fill and 6 inches of topsoil. Excavated soil may be disposed of as hazardous or non-hazardous based on contractor discretion to treat soil. Non-roadway associated debris disposed of offsite.	Both short- and long-term effectiveness are high. Contaminated soil would be removed up to 2 ft in the access road, access road shoulders, and burial unit and any remaining contaminated soil would be covered with a protective barrier.	Moderate implementation. The implementation of this alternative would require the use of standard excavation, earth moving, and hauling equipment. Excavation and materials handling are common construction activities.Though contained, contaminated soil would remain at the site, requiring the implementation of LUCs/ICs, site inspections, and associated reporting.On-Site Stabilization of the excavated soil would provide for non-hazardous soil transportation off-site or may be disposed of as hazardous soil.	Capital Cost $1,791,055 - $3,022,403

V:\USNAVFACENGCOM\370292OCEANA\MAPFILES\388948_CONFIRMATION_SAMPLING\FIGURE4-1_OCEANA SALVAGE ACCESS ROAD.MXD MUNWIN 4/26/2011 3:54:31 PM

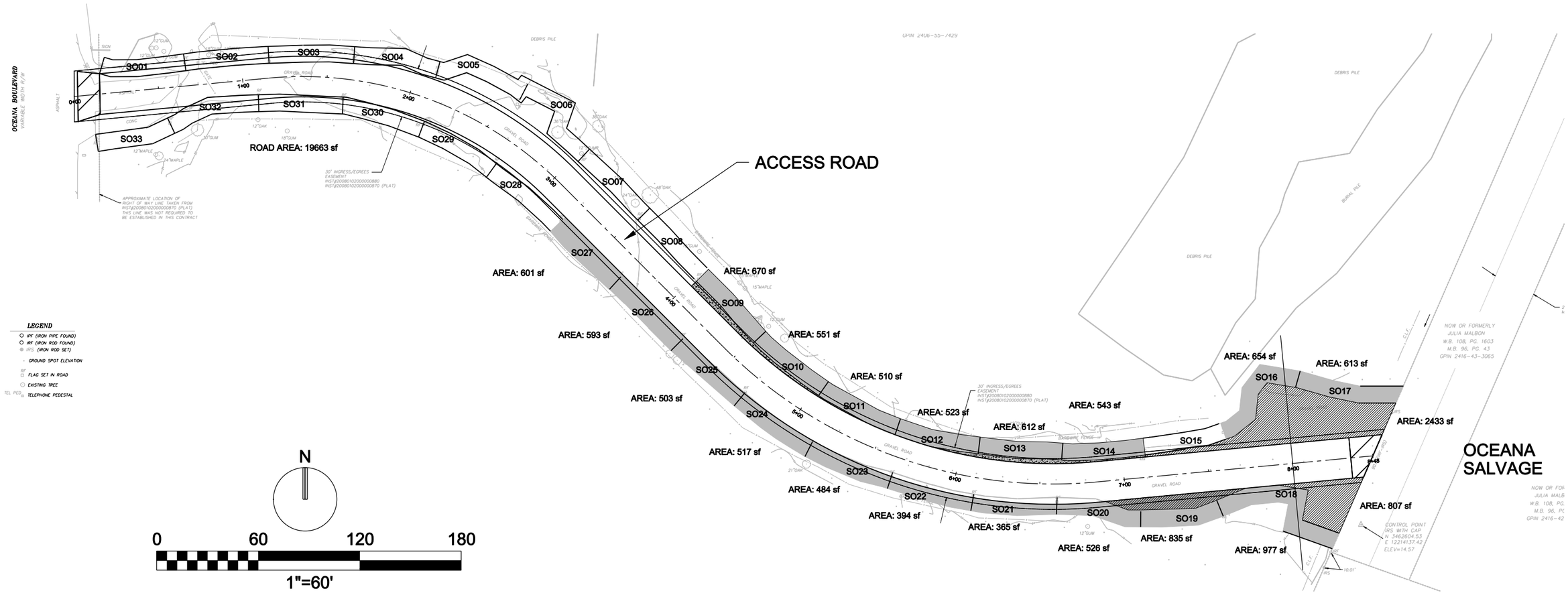
Legend

- Extent of Work
- Burial Unit Boundary
- NAS Oceana Boundary

N
W E
S

0 60 120
Feet

Figure 4-1
Oceana Salvage Yard Access Road
Non-Time Critical Removal Action
NAS Oceana
Virginia Beach, Virginia



ACCESS ROAD PLAN

NTS

LEGEND

SO27	GRID CELL NUMBER
	GRID CELL
	GRID CELL EXCEEDING 800MG/KG OF LEAD IN SOIL
	IMPROVED AREAS TO BE RESTORED AT WETLAND ELEVATION
	GRID CELL EXTENDED TO MATCH NEW ROAD

FIGURE4-2.DGN

FIGURE 4-2

ACCESS ROAD
ACCESS ROAD SHOULDERS
OCEANA SALVAGE
ENGINEERING EVALUATION
/COST ESTIMATE

CH2MHILL.

SECTION 5

Comparative Analysis of Removal Action Alternatives

This section provides a comparative analysis of the four removal alternatives presented in Section 4 to assist the decision-making process by which a removal action will be selected. In Section 4, these alternatives were evaluated according to their effectiveness, ease of implementation, and cost. In this section, the alternatives are directly compared for each of the three criteria.

Table 5-1 summarizes the results of the alternative comparison.

TABLE 5-1
Remedial Alternative Comparison

Alternative	Effectiveness	Implementation	Cost
Alternative #1—No Action	Not Effective	Easy	No cost
Alternative #2a— Gravel and Asphalt Cap of the Access Road, Onsite Soil Stabilization/Immobilization of Lead in the Access Road Shoulders and Burial Unit, and Removal of Non-roadway Associated Debris	Moderate	Moderate	Moderate
Alternative #2b— Gravel and Asphalt Cap of the Access Road, Excavation of the Access Road Shoulders and Burial Unit with Offsite Disposal and Restoration, and Removal of Non-roadway Associated Debris	Moderate	Easy to Moderate	Moderate
Alternative #3 - Excavation, Offsite Disposal and Restoration of the Access Road, Access Road Shoulders, and Burial Unit, and Removal of Non-roadway Associated Debris	Effective	Moderate	High

5.1 Effectiveness

Alternative #1 is not effective. It is not protective of human health and the environment, does not achieve compliance with ARARs, and does not achieve the removal action objective of this EE/CA.

Alternatives #2a, #2b, and #3 are effective by effectively eliminating human receptor contact with the contaminated soil and battery fragments. Alternative #3 would provide the greatest long-term level of protection at the site since it includes removal of a majority of the contaminated soil and battery fragments beneath the Access Road, Access Road shoulders, and Burial Unit and provide for a clean cover as well as a warning barrier where lead contamination remains above concentrations greater than 800 mg/kg. Although Alternatives #2a and #2b would remove the potential for direct exposure through the

placement of cover material and the enforcement of LUCs for the Access Road, Access Road shoulders, and the Burial Unit.

The removal of the non-roadway associated debris restores the site to original conditions and discourages future dumping at the site.

Only Alternative #2a meets the NCP's preference for onsite treatment and site reuse over land disposal. Disposal in a permitted facility is still required for Alternatives #2b and #3.

5.2 Implementability

Alternative #1 involves no action and therefore is easy to implement.

Alternatives #2a and #2b would be technically easier to implement than Alternative #3. Capping an existing Access Road and excavation and restoration of the Access Road shoulders and the Burial Unit and removal of non-roadway associated debris are typical construction project activities. LUCs will be necessary for Alternatives #2a and #2b. LUCs will also be required for Alternative #3 where post-excavation sample results indicate remaining lead concentrations above 800 mg/kg. Providing a cover on the existing Access Road will require, at a minimum, the temporary closure of at least one traffic lane to Oceana Salvage during construction, whereas excavating the Access Road in Alternative #3 is likely to disrupt the road traffic significantly during construction. Site activities may require access to the Oceana Salvage Yard to be temporarily restricted during construction activities.

Compliance with ARARs during implementation of Alternatives #2a, #2b, and #3 is summarized in **Appendix A**. Since Alternative #1 is not protective of human health and the environment, ARARs were not considered. Construction activities along either side of the Access Road may pose requirements related to the protection or restoration of wetlands.

In addition to the ARARs identified in **Appendix A**, the Navy will comply with the following executive order:

- Executive Order 11990, Protection of Wetlands, which requires federal agencies conducting certain activities to avoid or minimize, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands if a practicable alternative exists.

5.3 Cost

The estimated capital costs for Alternatives #1, #2a, #2b, and #3 are listed below. With the exception of Alternative #1, each alternative is assumed to require periodic inspection and reporting to maintain the effectiveness of the LUCs where lead contamination remains above 800 mg/kg.

- Alternative #1 $0
- Alternative #2a $800,653
- Alternative #2b $1,171,983 (non-hazardous disposal); $1,805,796 (hazardous disposal)
- Alternative #3 $1,791,055 (non-hazardous disposal); $3,022,403 (hazardous disposal)

SECTION 6

Recommended Removal Action Alternative

This EE/CA was performed in accordance with current USEPA and Navy guidance documents for NTCRA (USEPA, 1993; Navy, 2000) under CERCLA. The EE/CA has identified and analyzed four alternatives to mitigate potential human health risk associated with contaminated soil and battery fragments at the Oceana Salvage Yard Access Road, Access Road shoulders, and Burial Unit. All non-roadway debris will be removed as a maintenance/ housekeeping effort to restore the site to original conditions.

The comparative analysis included evaluating the effectiveness, implementability, and cost of each alternative. The evaluation of effectiveness included reviewing the protectiveness of the alternative, compliance with ARARs to the extent practical, long-term effectiveness and permanence, reduction in toxicity, mobility or volume, short-term effectiveness, and its ability to meet the removal action objective. Implementability included looking at the technical feasibility, availability, and administrative feasibility of the alternatives. The evaluation of cost included a review of capital costs and total net present values of each alternative.

Based on the comparative analysis of the alternatives completed in Section 5, the recommended removal action is Alternative #2b, Gravel and Asphalt Cap of the Access Road, Excavation of the Access Road Shoulders and Burial Unit with Offsite Disposal and Restoration, and Removal of Non-roadway Associated Debris. The selection of this alternative provides the best balance of the evaluation criteria. Alternative #2b is consistent with the aforementioned Draft and Final Administrative Settlement and Order on Consent (USEPA 2007 and 2008). The addition of the asphalt is intended to reduce the frequency at which maintenance of the Access Road is required. Since contamination is left in place, uncertainty remains with respect to a continuing contaminant source that could adversely affect the environment. Alternative #3 is effective in removing the source of contamination from the site but is substantially more difficult to implement than either Alternatives #2a or #2b.

Alternative #2b consists of capping the Access Road, excavating and restoring the Access Road shoulders and the Burial Unit, and placing a protective layer over areas where lead contamination exceeds 800 mg/kg as determined by sampling following excavation. Additionally, the removal of non-roadway associated debris will restore the site to original conditions to the extent practical. The access road will be capped with a suitable gravel base and asphalt in order to maximize the benefit of the cap while minimizing the maintenance required at the site. The entire site will be subject to LUCs s to effectively eliminate exposure pathways to the contamination that remains in place.

Alternative #2b achieves the removal action objective, complies with ARARs, eliminates the onsite risks to human health, and is straightforward to implement utilizing standard construction methods and resources.

SECTION 7

References

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Appendix A
ARAR Tables

Appendix A
ARAR Tables

Tables

A-1 Federal Chemical-Specific ARARs

A-2 Federal Location-Specific ARARs

A-3 Federal Action-Specific ARARs

A-4 Virginia Chemical-Specific ARARs

A-5 Virginia Location-Specific ARARs

A-6 Virginia Action-Specific ARARs

Appendix A

TABLE A-1
Federal Chemical-Specific ARARs

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comment
There are no Federal Chemical-Specific ARARs for the Selected Remedy.					

TABLE A-2
Virginia Chemical-Specific ARARs

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comment
There are no Virginia Chemical-Specific ARARs for the Selected Remedy.					

TABLE A-3
Federal Location-Specific ARARs

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comment
***Clean Water Act* [33 USC §§ 1251-1387][a]**					
Wetlands	Avoid adverse effects, minimize potential harm, and compensate for unavoidable impacts.	Existing wetland is filled in or permanently destroyed.	40 CFR 230.2(b), .10-.12, .20-.32, .41, .53, .60-.77, .93, .94(c)(2)-(c)(12), .95-.98 33 CFR 320.4(a)-(d), (h), (p), (r), 332.3, 332.4(c)(2)-(c)(12),, 332.5-8	Applicable	Poor quality wetland areas are present along the 10-foot distance off the sides of the access road. Any activities conducted in wetland areas will involve restoration/compensation of wetlands.
***Coastal Zone Management Act* [16 USC §§ 1451-1464][a]**					
Coastal zone or area that will affect the coastal zone	Federal activities must be consistent with, to the maximum extent practicable, state coastal zone management programs.	Action causes an effect in state's coastal zone.	*Coastal Zone Management Act*; 16 USC 1456(c), 15 CFR 930.30 - .33, .36(a), .39(b-d)	Applicable	Construction activities at Oceana Salvage affect the state's coastal zone, the activities will be consistent to the maximum extent practicable with the State's enforceable policies.
***Migratory Bird Treaty Act* [16 USC § 703][a]**					
Migratory bird area	Forbids the unregulated taking of native birds, their nests, or their eggs in the United States.	Presence of migratory birds.	*Migratory Bird Treaty Act*, 16 USC 703	Applicable	If migratory birds, or their nests or eggs, are identified at Oceana Salvage, construction activities will not destroy the birds, nests or eggs.

Note:

a: Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs.

TABLE A-4
Virginia Location-Specific ARARs

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comment
General Provisions Relating to Marine Resources Commission **[VA Code Ann. §§ 28.2-1300 to 1320 (1998)][a]**					
Wetlands	Compensation or mitigation for permanent loss of wetlands will be determined on a case-by-case basis.	Permanent loss of wetlands	*Wetlands Mitigation Compensation Policy, 4 VAC 20-390-30 to 50*	Applicable	Wetlands are present at Oceana Salvage. Any construction activities conducted in wetlands will involve restoration to natural conditions. If permanent loss of wetlands occurs, compensation or mitigation will be determined based on this regulation.
State Water Control Law **[VA Code Ann. §§ 62.1-44.2 to 44.34:28 (2003)][a]**					
Wetlands	Activities performed in a wetland will comply with these requirements.	Activities may be performed in a wetland.	*Virginia Water Protection Permit Program*, 9 VAC 25-210-50	Applicable	Any wetland activities will be conducted in accordance with this regulation.

Note:

a: Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs.

TABLE A-5
Federal Action-Specific ARARs

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comment
***Clean Water Act* [33 USC §§ 1251-1387][a]**					
Discharge of dredge-and-fill	No discharge of dredged or fill material will be allowed unless appropriate and practicable steps are taken that minimize potential adverse impacts of the discharge on the aquatic ecosystem.	Discharges of dredged or fill material to surface waters, including wetlands.	40 CFR 230.2(b), .10-.12, .20-.32, .41, .53, .60-.77, .93, .94(c)(2)-(c)(12), .95-.98 33 CFR 320.4(a)-(d), (h), (p), (r), 332.3, 332.4(c)(2)-(c)(12),, 332.5-8	Applicable	Construction operations that result in filling of adjacent wetlands will be conducted in accordance with these regulations.

Note:

a: Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs.

TABLE A-6
Virginia Action-Specific ARARs

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comment
***Stormwater Management Act* [VA Code Ann. §§ 10.1-562 – 573 (2005)][a]**					
Construction activities that disturb one acre or more of land.	Procedures, requirements, and Best Management Practices to be followed in connection with construction activities.	Construction activities that disturb one acre or more of land.	*Stormwater Management Regulations,* 4VAC 50-60-50-80 , 300, 310, 420, 430, 1100 to 1140, 1160, 1170, 1182, 1186	Applicable	If construction activities disturb one acre or greater of land, a site-specific stormwater management plan will be developed for these activities. The Navy will follow the substantive, but not procedural requirements of the regulation.
***Erosion and Sediment Control Law* [VA Code Ann. §§ 10.1-1300 to 1326 (1998)][a]**					
Construction activities that disturb 10,000 sq ft or more of land.	Regulations for the effective control of soil erosion, sediment deposition and nonagricultural runoff which must be met in any control program to prevent the unreasonable degradation of properties, stream channels, waters and other natural resources.	Construction activities that disturb 10,000 sq ft or greater of land.	*Erosion and Sediment Control Regulations*, 4 VAC 50-30-40, 60.A	Relevant and Appropriate	If construction activities disturb at least 10,000 sq ft, an erosion and sediment control plan will be established to monitor and prevent erosion of soils to adjacent water bodies.
***Virginia Waste Management Act* [VA Code Ann. §§ 10.1-1400 to 1457 (2004)][a]**					
Waste/soil/ water and Handling, Storage, treatment, and disposal of Investigative Derived Waste (IDW)	Wastes to be managed must be sampled for appropriate waste characterization, storage, and disposal requirements.	Management of wastes.	*Solid and Hazardous Waste Regulations* *9 VAC 20-60-261 (incorporating 40 CFR Part 261) (hazardous waste identification)* *9 VAC 20-62-262 (incorporating 40 CFR Parts 262.11 and 262.34) (generator requirements)* *9 VAC 20-80-140, 150, 240.C*	Applicable	This remedy will consist of on-site stabilization of the hazardous material and characterization via Toxicity Characteristic Leaching Procedure (TCLP) to confirm that the stabilized material is non-hazardous prior to onsite soil immobilization.
***Air Pollution Control Board* [VA Code Ann. §§ 10.1 -1300 to 1326 (1998)][a]**					
Fugitive dust caused by construction activities	Reasonable precautions will be taken to prevent particulate matter from becoming airborne.	Fugitive dust emission from disturbance of soil, treatment of soil or water, or other pollutant management activities.	*Standard for Fugitive Dust/Emissions*, 9 VAC 5-50-90	Applicable	Fugitive dust caused by construction activities will be managed according to this requirement.

Note:

a: Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs.

Appendix B
Cost Estimates

Appendix B
Cost Estimate Summary

		Cost Range	
Alternatives	**Engineer's Estimate**	**+50%**	**-30%**
Alternative #2a	$800,653	$1,200,980	$560,457
Alternative #2b (Stabilize/Non-hazardous disposal)	$1,171,983	$1,757,975	$820,388
Alternative #2b (Hazardous disposal)	$1,805,796	$2,708,694	$1,264,057
Alternative #3 (Stabilize/Non-Hazardous disposal)	$1,791,055	$2,686,582	$1,253,738
Alternative #3 (Hazardous disposal)	$3,022,403	$4,533,605	$2,115,682