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DRAFT FINAL ENGINEERING EVALUATION/COST ANALYSIS FOR AREA OF CONCERN J
AND R (AOC J AND R) AND SOLID WASTE MANAGEMENT UNITS 6 AND 7 (SWMU 6 AND
7) FORMER NAVAL AMMUNITIONS SUPPORT DETACHMENT VIEQUES ISLAND PUERTO
RICO (DRAFT FINAL ACTING AS FINAL VERSION)

12/01/2005
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Draft Final

**Engineering Evaluation/Cost Analysis
for
Area of Concern J and R, and
Solid Waste Management Units 6 and 7**

**Former Naval Ammunitions Support Detachment
Vieques Island, Puerto Rico**

Contract Task Order 007

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Prepared by



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Executive Summary

This report presents an Engineering Evaluation and Cost Analysis (EE/CA) for a non-time-critical removal action (NTCRA) for Area of Concern (AOC) J, AOC R, Solid Waste Management Unit (SWMU) 6, and SWMU 7 of the former Naval Ammunitions Support Detachment (NASD) in the western portion of Vieques Island, Puerto Rico. The EE/CA is prepared under the Naval Facilities Engineering Command, Atlantic Division (NAVFAC) Comprehensive Long-Term Environmental Action Navy (CLEAN) III Contract Number N62470-02-D-3052, Contract Task Order (CTO) 007.

Previous investigations have been completed at AOC J, AOC R, SWMU 6, and SWMU 7 to identify the nature and extent of waste, including debris and soil containing debris, as well as any associated potential contamination. The following provides a brief site description for each of these sites.

Discussions in this EE/CA regarding the nature and extent of contamination and the presence or absence of potential risks associated with the contamination at each site are summarized from the draft Remedial Investigation reports, and as such, are currently under regulatory consideration.

Site Descriptions

AOC J

AOC J is located on property owned by the Department of Interior (DOI) that has been designated as a wildlife refuge. The site is 2 miles west of the entrance to the former NASD and north of Highway 200 and extends approximately 50 feet south of the Vieques passage. The site is in a partially cleared wooded area and contains a water filled ditch along its western edge, which is the only surface water body within the site. AOC J was used as a solid waste disposal site for construction staging activities from 1965 until 1973, when some of the unidentified waste materials were removed and placed in an off-base municipal landfill. Most of the solid waste at AOC J is on the slopes of the ditch, with additional debris piles located up to 100 feet west of the ditch. The debris piles consist of metallic and non-metallic materials and one empty drum. The Draft Remedial Investigation Report for AOC J concluded that the site does not pose an unacceptable risk to human health or ecological receptors (CH2M HILL, 2004). This EE/CA addresses only removal of the debris and underlying soil containing debris located at AOC J. A munitions and explosives of concern (MEC) avoidance survey conducted in May 2000 found no unexploded ordnance (UXO) at the site. However, 105-mm shell casings and empty ammunition boxes were observed. A geophysical survey was conducted at AOC J to delineate the extent of buried waste. Subsurface debris does not extend beyond the ditch's western bank. The volume of waste present at AOC J is approximately 390 cubic yards.

AOC R

AOC is located on Municipality of Vieques (MOV) property. The site was used as a construction staging area and public works operational area from 1965 to 1971. Based on previous investigations and a visual inspection of the site in April 2005 by CH2M HILL, there are four areas on site containing solid waste. The first area contains a debris pile approximately 100 feet in length and 20 feet high along the slope of the quebrada on the western side of the site. The waste appears to have been pushed over the side of the ditch with some material partially buried to an estimated depth approximately 2 feet. These waste materials appear to consist of a practice bomb, ammunition cans, metal pipes and rocket launchers. The second area, just north of the concrete pad, consists of four 20-foot long, 18-inch diameter wood power poles with approximately 30 car tires on the power poles. On the east end of the concrete pad, a third debris pile measuring approximately 10 feet long by 10 feet wide by 6 feet high consists of white corrugated roofing sheet material. The fourth waste area contains four partially buried practice bombs, and is estimated to require removal of 5.5 cubic yards of waste. The practice bombs were visually identified as being inert. The total estimated waste present at AOC R is approximately 550 cubic yards.

SWMU 6

SWMU 6 is located on DOI property. The site is approximately 100 feet south of the Vieques Passage and was used for disposal of solid wastes, generated by Navy operations within the former NASD during the 1960s and 1970s. Waste discarded at the site includes: rusty metal, car parts, rubber tires, broken glass, rubble, and empty containers of lubricants, oil, solvents, and paints. Many items have deteriorated due to natural corrosion in the saltwater environment and are in the form of small pieces of metallic or glass debris. A Draft Remedial Investigation Report completed for the site concluded that the site does not pose an unacceptable risk to human health or the environment (CH2M HILL, 2004). This EE/CA addresses only removal of the wastes, including debris and any contaminated soil beneath the waste piles. No unexploded ordnance has been identified at SWMU 6 during the two munitions and explosives of concern (MEC) avoidance surveys performed at the site. However, munitions related items such as inert concrete filled bombs, empty bomb dispensers, and empty shell casings were identified. The main area of debris is just north of Highway 200 and runs along the road. The pile is approximately 165 feet long by 10 feet wide by 2 feet deep. Additionally, there are five large concrete filled bombs partially buried in water and sediment on the site. The total estimated waste present at SWMU 6 is 126 cubic yards.

SWMU 7

SWMU 7 is approximately 1,100 feet south of the Vieques Passage. From the early 1960s to the late 1970s, a steep ditch at the site was used for disposal of solid waste materials. Discarded materials disposed on SWMU 7 include old tires, sheet metal, empty containers such as drums, cans, and bottles, old batteries, and construction rubble. No known hazardous chemical or waste disposal occurred at this site. SWMU 7 is located on MOV property. Disposal activities appear to have been concentrated in a segment of the ditch approximately 420 feet along the length of the dirt access road where waste materials were pushed over the edge. Most of the waste material is confined to the steep slopes. Debris also includes: two sea mines, six rocket launchers, a Volkswagen Beetle, and hundreds of tires.

Based on the results of the RI, site conditions at SWMU 7 do not pose an unacceptable risk to human health or the environment (CH2M HILL, 2004). This EE/CA addresses only waste, including debris and any contaminated soil beneath the waste piles. The estimated volume of waste present is 1,800 cubic yards.

Development of Engineering Evaluation/Cost Analyses

The risk uncertainty associated with these sites is the continuing source of potential contamination to soil, sediment, surface water, and groundwater from the metallic and non-metallic waste material staged or partially buried at these sites. By removing the waste debris, the uncertainty and potential source of contaminants from historic disposal activities will be eliminated.

The objective of this NTCRA is to evaluate alternatives in order to protect human health and the environment, and to reduce or eliminate the potential future threat of contamination that may be associated with debris piles currently located within these sites. The following alternatives were evaluated for AOC J, AOC R, SWMU 6, and SWMU 7:

- No action
- Construction of a soil cover and long term monitoring (LTM)
- Complete removal of the debris, off site disposal, and site restoration

It is important to note that no unacceptable levels of potential risks were identified for AOC J, SWMU 6, and SWMU 7 (AOC R is currently being investigated). However, because sampling was not performed through the waste due to various reasons, including safety concerns, the Navy has made the conservative decision to evaluate various removal actions at each site. The intent of the removal actions is to address the uncertainty associated with the potential for the waste material to represent a future source of contamination.

This EE/CA addresses four sites: AOC J, AOC R, SWMU 6, and SWMU 7 as a whole. For AOC J, AOC R, SWMU 6, and SWMU 7, Alternative 1 (No Action) does not meet the objectives of the NTCRA to eliminate risk to human health and the environment. The no action alternative was included to serve as a baseline against which other alternatives are evaluated. As such, implementation of this alternative is not recommended.

For AOC J, AOC R, SWMU 6, and SWMU 7, Alternative 2 (construction of a soil cover and LTM) is effective in reducing exposure to human health and the environment, but requires long-term operation and maintenance (O&M) to control future land use and to provide for future cover maintenance, inspections, and groundwater assessment monitoring. However, since the waste will remain in place, long-term maintenance and site controls to restrict future access are necessary to provide long-term effectiveness. This alternative does not eliminate the source for potential contamination.

For AOC J, AOC R, SWMU 6, and SWMU 7, Alternative 3 (excavation, off-site disposal, and site restoration) is recommended over Alternative 2. It eliminates the debris, which has the potential to be a source of continuing potential human and ecological risk, has a moderate ease of implementation, and has a moderate implementation cost. Selection of Alternative 3 for AOC J, AOC R, SWMU 6, and SWMU 7 will meet the objectives of this EE/CA for these four sites located at the former NASD Vieques Island, Puerto Rico.

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Acronyms and Abbreviations

°F	degrees Fahrenheit
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirements
AST	above ground storage tank
bgs	below ground surface
bls	below land surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CES	Control of Erosion and Sediment
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
CTO	Contract Task Order
CY	cubic yard
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DOI	Department of Interior
DoN	Department of the Navy
ECHOS	Environmental Cost, Handling, Options and Solutions
EE/CA	Engineering Evaluation and Cost Analysis
EIS	Environmental Impact Statement
ERA	ecological risk assessment
HHRA	human health risk assessment
IC	institutional control
IR	Installation Restoration
LTM	long term monitoring
LUC	land use control
MCL	maximum contaminant level
MEC	munitions and explosives of concern
MEK	methyl ethyl ketone
MIBK	methyl isobutyl ketone
mm	millimeter
MOV	Municipality of Vieques
msl	mean sea level
NASD	Naval Ammunitions Support Detachment
NAVFAC	Naval Facilities Engineering Command, Atlantic Division
NCP	National Oil and Hazardous Substance Pollution Contingency Plan

NFA	No Further Action
NHPA	National Historical Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Registry of Historic Places
NTCRA	non-time- critical removal action
O&M	operation and maintenance
OE	ordinances and explosives
ORP	oxidation-reduction potential
ORS	ordinance related scrap
PA/SI	Preliminary Assessment/Site Investigation
PAH	polycyclic aromatic hydrocarbon
PCB	pesticides, polychlorinated biphenyl
PREQB	Puerto Rico Environmental Quality Board
PRG	preliminary remediation goal
PRPDES	Puerto Rico Pollutant Discharge Elimination System
RAO	Remedial Action Objective
RBC	Risk Based Concentration
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SF	square feet
SQAG	Sediment Quality Assessment Guidance
SVOC	semi-volatile compound
SWMU	Solid Waste Management Unit
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
UXO/OE	unexploded ordinance/ordinance and explosives
VOC	volatile organic compound

SECTION 1

Introduction

This report presents an Engineering Evaluation/Cost Analysis (EE/CA) for a non-time-critical removal action (NTCRA) for Area of Concern (AOC) J, AOC R, Solid Waste Management Unit (SWMU) 6, and SWMU 7 of the former Naval Ammunitions Support Detachment (NASD) in the western portion of Vieques Island, Puerto Rico. The EE/CA is prepared under the Naval Facilities Engineering Command, Atlantic Division (NAVFAC) Comprehensive Long-Term Environmental Action Navy (CLEAN) III Contract Number N62470-02-D-3052, Contract Task Order (CTO) 007.

A general location of Vieques Island, Puerto Rico is illustrated in Figure 1-1. A map showing the locations of AOC J, AOC R, SWMU 6, and SWMU 7 within the former NASD property is provided in Figure 1-2.

Discussions in this EE/CA regarding the nature and extent of contamination and the presence or absence of potential risks associated with the contamination at each site are summarized from the draft Remedial Investigation reports, and as such, are currently under regulatory consideration.

The following information is presented within this EE/CA:

- Site description
- Removal action objective and scope
- Removal action alternatives and technologies descriptions and comparison
- Recommendation of a preferred removal action alternative
- Schedule for the recommended removal action alternative

1.1 Regulatory Framework

This document is issued by the U.S. Department of the Navy (DoN), in partnership with the United States Environmental Protection Agency (USEPA) Region II and the Puerto Rico Environmental Quality Board (PREQB), under Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Superfund Amendments and Reauthorization Act (SARA) of 1986.

Section 104 of CERCLA and SARA allows an authorized agency to remove, or arrange for removal of, and to provide for remedial action relating to 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.

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 be necessary to monitor, assess, and evaluate the 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.” For time-critical removal actions, activities shall begin as soon as possible to “abate, prevent, minimize, stabilize, mitigate, or eliminate the threat to public health or welfare of the United States or the environment” (40 CFR Section 300.415(b)(3)). The removal actions presented for AOC J and AOC R, SWMU 6, and SWMU 7 are non-time-critical.

It is important to note that no unacceptable levels of potential risks were identified in the Draft RI report for each of the sites included in this EE/CA. The Draft RI reports are currently under regulatory review. However, because sampling was not performed through the waste due to various reasons, including safety concerns, the Navy has made the conservative decision to evaluate various removal actions at each site. The intent of the removal actions is to address the uncertainty associated with the potential for the waste material to represent a future source of contamination.

40 CFR Section 300.415 requires an EE/CA when a NTCRA is planned for a site. The goals of an EE/CA are to identify the objectives 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 evaluation and recommendation process. Where the extent of the contamination is well defined and limited in extent, NTCRAs also allow for the expedited cleanup of sites versus the more protracted remedial action process.

Community involvement requirements for NTCRAs include making the EE/CA 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. Written responses to significant comments are 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 defined by CERCLA, SARA, and the NCP. This EE/CA has been prepared in accordance with USEPA’s guidance document *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA*, PB93-963402 (USEPA, August 1993).

The EE/CA compares several alternatives for a NTCRA based on their technical feasibility, ability to protect human health and the environment, ability to prevent potential release of hazardous constituents, and cost. The primary objective of this EE/CA is to evaluate various remedial alternatives and present a recommendation for the preferred alternative. Secondary goals of this EE/CA are to: (1) satisfy environmental review and public information requirements for removal actions, (2) satisfy Administrative Record requirements for documenting the removal action selection, and (3) provide a framework for evaluating and selecting alternative technologies.

The following alternatives were evaluated for AOC J, AOC R, SWMU 6, and SWMU 7:

1. No action
2. Construction of a soil cover and long-term monitoring
3. Removal of the debris, off site disposal, and site restoration

In an effort to streamline and reduce redundancy of information, this EE/CA addresses four sites: AOC J, AOC R, SWMU 6, and SWMU 7. This EE/CA is organized as follows:

- Section 1 contains the regulatory framework for EE/CA, and background information, including description, nature and extent of contamination, and a streamlined risk evaluation for each site.
- Section 2 contains an identification of Remedial Action Objectives (RAOs).
- Section 3 discusses remedial action alternatives.
- Section 4 details an analysis of remedial action alternatives based on effectiveness, implementability, and cost.
- Section 5 presents a comparative analysis of remedial action alternatives.
- Section 6 presents a recommendation for the alternative that best satisfies the RAOs.
- Section 7 presents reference information used to prepare this EE/CA.

1.3 Site Description and Background

This section provides a brief summary of background information for AOC J, AOC R, SWMU 6, and SWMU 7.

Figure 1-1 illustrates the location of Vieques Island, Puerto Rico, in the Caribbean Sea approximately 7 miles southeast across Vieques Passage from the eastern tip of the main island of Puerto Rico. Vieques Island is the second largest island in the Commonwealth of Puerto Rico. It is approximately 20 miles long, and 3 miles wide, with an area of approximately 33,088 acres (51 square miles).

The sugarcane industry was the major economic base of Vieques during the late 19th century and early 20th century. Several sugarcane operations in Vieques were largely discontinued in the early 1940s when the U.S. Navy purchased large portions of the island. The U.S. Navy primarily used this land to conduct activities related to military training. The eastern end of Vieques Island was used for all aspects of naval gunfire training, including air-to-ground ordnance delivery and amphibious landings, as well as housing the main base of operations for these activities, Camp Garcia. Site operations on the western end of Vieques Island consisted mainly of ammunition loading and storage, and vehicle and facility maintenance, though some training occurred at NASD as well. The U.S. Navy ceased facility wide operations on the former NASD on April 30, 2001, when the land was transferred to the Department of Interior (DOI), Municipality of Vieques (MOV), and Conservation Trust. Sites AOC J, AOC R, SWMU 6, and SWMU 7 are located in the former NASD on property currently owned by DOI (AOC J and SWMU 6) and MOV (AOC R and SWMU 7).

The geology of western Vieques Island is characterized by plutonic rocks generally overlain by alluvial deposits. The plutonic rocks consist of granodiorites that were intruded by a quartz-diorite plutonic complex, and the rocks are exposed over a large percentage of the island. A gradual change in texture from coarse to fine-grained quartz-diorite has been observed from western to eastern Vieques. A saprolite formation occurs at the surface of the plutonic complex in some areas. The alluvial deposits are generally of Quaternary age, consisting of a mixture of sand, silt, and clay that together have an average thickness of 30 feet in western Vieques. The alluvial material consists of beach and dune deposits, and swamp and marsh deposits. The beach and dune deposits comprise calcite, quartz, plutonic rock fragments, and minor magnetite (United States Geological Survey (USGS), 1999).

Surface water on the former NASD consists of Arenas, El Pobre, and Kiani Lagoons at the northwestern end of the former NASD, and the Playa Grande Lagoon at the southeastern end (Figure 1-2), as well as intermittent streams. Most of the streams are ephemeral, flowing for only a short time after rainstorms. These streams generally flow in a northerly or southerly direction from the centrally located elevated inland areas (Greenleaf/Telesca, 1984).

The climate of Vieques Island is tropical-marine. Temperatures are nearly constant, with an annual average of about 79 degrees Fahrenheit (°F). The warmest month, August has an average temperature of 82 °F and the coolest month, February, has an average temperature of 76 °F (Greenleaf/Telesca, 1984). The easterly trade winds that regulate the climate of Puerto Rico result in a rainfall pattern characterized by a dry season from December through July and a rainy season from August to November. The western portion of Vieques Island, where the four sites are located, averages approximately 50 inches of rainfall per year, with 50 percent from August to November (USGS, 1989).

The topography of the former NASD is characterized by a series of low hills and small valleys intersected by drainage channels. The most elevated areas occur along a west to east axis near the center of the former NASD. The highest point is Mount Pirata, approximately 987 feet above mean sea level (msl). The slope of the former NASD tapers gradually down from the center of the island to the coastal areas, with the exception of steep slopes in the vicinity of Mount Pirata.

Species and habitat surveys performed at AOC J, AOC R, SWMU 6, and SWMU 7 did not identify any federally protected species or preferred habitats. One of the two known *Stahlia monosperma* (common name cobana negra) populations is located on the eastern boundary of Kiani Lagoon, which is close to SWMU 6. Although the threatened tree species cobana negra has been found in Kiani Lagoon, the habitat of SWMU 6 is a mixed mangrove community, which is not a preferred habitat of cobana negra.

A number of resources on the former NASD property are of interest from a cultural perspective, including conservation zones, cultural resources, and prehistoric and historic sites. U.S. Navy surveys have located a total of 12 archaeological sites and districts are listed on the National Registry of Historic Places (NRHP) for western Vieques. None of these 12 sites occur within the AOC J, AOC R, SWMU 6, and SWMU 7 areas. No cultural resources are expected to be encountered at AOC J, AOC R, SWMU 6, and SWMU 7, based on known history and lack of documented evidence of such resources.

1.3.1.1 AOC J

AOC J was used as a solid waste disposal site from 1965 to 1973. The U.S. Navy ceased facility wide operations on the former NASD on April 30, 2001, when the land was transferred to the DOI, MOV, and Conservation Trust. AOC J is now located on DOI property that has been designated as a wildlife refuge.

Figure 1-2 shows the location of AOC J within the former NASD property. AOC J is approximately 2 miles west of the entrance to the former NASD property. It is north of Highway 200 and approximately 50 feet south of the Vieques passage. The site is in a wooded area adjacent to an ephemeral stream. Topography at AOC J is generally flat with the ephemeral stream passing along the eastern portion of the site. Elevations range from approximately sea level to 10 feet above msl. Access to the site is by a dirt road extending north from Highway 200.

Soils encountered beneath AOC J consist of a mixture of clay and organic soil from ground surface to a depth of between 10 and 14 feet below land surface (bls), underlain by a sandy clay to a maximum depth investigated of 23 feet bls. Data collected at AOC J suggest the site is not underlain by the Resolución Valley aquifer. The water bearing zone at AOC J appears to be within the clay and sandy clay zones.

AOC J is underlain by a potentially semi-confined groundwater system composed of deposits made up of clay and sandy clay. Groundwater appears to be between 3 and 11 feet bls, with an easterly to northeasterly flow toward the water filled ditch. Salinity measurements of groundwater at AOC J indicate that saltwater intrusion has affected the groundwater.

The water-filled ditch, 20 to 40 feet wide and 3 to 6 feet deep, is typically stagnant. During periods of heavy and prolonged rainfall or ocean surge action, the water in the ditch may flow into or from the sea.

1.3.1.2 AOC R

AOC R was used as a construction staging area and public works operational area from 1965 to 1971. AOC R is located on land that was transferred to MOV on April 30, 2001, when the U.S. Navy ceased facility wide operations on the former NASD. Similar to AOC J, AOC R is located approximately 2 miles west of the entrance to the former NASD, and several hundred feet south of the Vieques Passage along Highway 200 (Figure 1-2). The topography of the site is relatively flat, with an ephemeral stream traversing a portion of its western boundary. This ephemeral stream is the same ephemeral stream adjacent to AOC J, which is topographically downgradient of AOC R.

AOC R contains a large concrete pad that was present at the site before the U.S. Navy purchased the area. In the late 1960s, a carpentry shop and an enlisted club were located on this concrete pad. Use of this concrete pad before the 1960s is not known. Currently the pad has numerous cracks. Light vehicle maintenance activities, such as oil changes, were conducted northwest of the concrete pad. In addition, during site visits conducted in 2004 and 2005, several areas of debris disposal were identified, including one area that encroaches on the ephemeral stream located along the western boundary of the site. Additionally a large above ground storage tank (AST) was once located near the south end of the site.

Soil conditions at this site are generally alluvial deposits of sandy clay with silt. Groundwater flow is assumed to be northerly toward the Vieques Passage, generally following the contour of the land surface.

1.3.1.3 SWMU 6

SWMU 6 was used for disposal of solid wastes during the 1960s and 1970s from Navy operations within the former NASD. Wastes discarded at the site include empty glass, rubble, and containers of lubricants, oil, solvents, and paints. SWMU 6 is within an area transferred to the DOI for use as a wildlife refuge.

Figure 1-2 shows the location of SWMU 6 within the former NASD property. SWMU 6 is located along Highway 200, approximately 100 feet south of the Vieques Passage in a mangrove swamp and tidal marsh area between two tidally influenced lagoons referred to as Kiani Lagoon North and Kiani Lagoon South. A canal traverses the western boundary of the site, connecting Kiani Lagoon and El Pobre Lagoon to the Vieques Passage. Topography at SWMU 6 is relatively flat with elevations between sea level and 1 foot above msl. Water from the lagoons rises and falls with tides and at times covers portions of the site.

The unconsolidated material of SWMU 6 consists mainly of silty sand with organic material from ground surface to a depth of 1 to 7 feet bls, underlain by a well-graded sand with crushed shells to a depth of at least 15 feet. Groundwater is encountered at depths of approximately 1 to 2 feet bls. Because of its hydraulic connection with the sea, groundwater flow at the site is tidally influenced.

1.3.1.4 SWMU 7

From the early 1960s to the late 1970s, SWMU 7 was used for disposal of solid waste materials. Discarded materials disposed of at SWMU 7 include old tires; sheet metal; empty containers such as drums, cans, and bottles; old batteries; and construction rubble. No known hazardous material or waste disposal occurred at this site. SWMU 7 is within an area transferred to MOV.

Figure 1-2 shows the location of SWMU 7 within the former NASD property. SWMU 7 is approximately 1,100 feet south of the Vieques Passage, along Highway 200. Topography at SWMU 7 consists of a gently sloping hill with a steep embankment along a 20 to 40 foot wide and 10 to 20 foot deep ephemeral stream, which contains flowing water only during periods of heavy or prolonged precipitation. Rapid flows in the ephemeral stream are expected due to distinct scouring marks along the embankment. Small, isolated areas of standing water have been observed in periods of dry weather, which were likely evaporating vestiges of the previous rain event. The ephemeral stream traverses the western portion of the site and leads to the sea.

Soils beneath SWMU 7 consist of a mixture of silty sand from ground surface to a depth of 4 to 8 feet bls, beneath which is a saprolite or weathered granodiorite. The water bearing layer within the silty sand layer is within the top 8 feet of SWMU 7 and is relatively tight. The water bearing zone within the saprolite is encountered at approximately 75 feet bls, but water levels stabilize at shallower depths, which suggests the groundwater is semi-confined. Groundwater flow at SWMU 7 is in a northwesterly direction (CH2M HILL, 2004).

1.4 Previous Site Investigations

Several investigations were conducted at AOC J, AOC R, SWMU 6, and SWMU 7 to determine the potential presence and nature and extent of contaminants related to historical disposal operations that occurred on these sites.

1.4.1 AOC J

Investigations conducted at AOC J comprise an Environmental Baseline Survey, an Ecological Survey, an Expanded Preliminary Assessment/Site Investigation (PA/SI), and a Remedial Investigation (RI). The subsections below present a brief description of the various investigations and their findings. More detailed discussions can be found in the respective reports referenced therein.

1.4.1.1 Environmental Baseline Survey

The findings of the Environmental Baseline Survey are discussed in the *Environmental Baseline Survey* (Environmental Resource Management Inc. [ERM], October 2000). Two subsurface soil samples were collected adjacent to the visible remains of the disposal site from a backhoe excavated pit. The samples were analyzed for volatile organic compounds (VOCs), semi-volatile compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and metals. No constituent concentrations were detected above human health risk-based screening criteria.

1.4.1.2 Ecological Survey

An ecological survey was conducted in August 2000 and concluded that no endangered or threatened species were present at AOC J. Details of the ecological survey can be found in the *Habitat Characterization of Solid Waste Management Unit (SWMU) 4, SWMU 5, SWMU 6, SWMU 7, and the Public Works Area* (Geo-Marine, August 2000).

1.4.1.3 Expanded PA/SI

The Expanded PA/SI, conducted in 2000, included a munitions and explosives of concern (MEC) avoidance study, the installation of a barbed wire fence to restrict access to the site, and collection and analysis of surface soil, surface water, sediment, and groundwater samples

Prior to sample collection, an MEC avoidance survey was conducted, during which two 106-millimeter (mm) shell casings, one flash tube, one 106 mm cartridge base, and six cartridge canisters were identified. However, no live munitions items were found.

In groundwater, several metals concentrations exceeded EPA maximum contaminant levels (MCLs) and/or EPA Region 9 tap water preliminary remediation goals (PRGs). VOCs, SVOCs, PCBs, and pesticides were either not detected or were detected at concentrations below MCLs and/or PRGs.

In surface water, only mercury exceeded its EPA Region IX surface water criterion and its background concentration, but its detection was at the method detection limit and, therefore, its result is estimated. VOCs, SVOCs, PCBs, pesticides, and explosives were either not detected or were detected below the Region IX surface water criteria.

Several metals were detected above EPA Region IX residential PRGs in surface soil. No exceedances of Region IX PRGs were detected in subsurface soil samples, and no exceedances of ecological screening values were detected in sediment samples.

Details of the Expanded PA/SI are presented in the *Expanded Preliminary Assessment/Site Investigation Phase II Seven Sites* (CH2M HILL, November 2002).

1.4.1.4 Remedial Investigation

Details of the Remedial Investigation performed at AOC J are documented in the CH2M HILL, April 2004 *Remedial Investigation Report Area of Concern (AOC) J* (CH2M HILL, April 2004). The RI for AOC J was conducted to supplement the previous investigations, to characterize the nature and extent of environmental contamination associated with the site, and to assess whether the site-related contaminants pose an unacceptable risk to human health and the environment. The RI investigation included geophysical surveys, an MEC avoidance survey, collection of site-specific surface and subsurface soil samples, groundwater samples, surface water samples, and sediment samples, and the collection and analysis of site specific background samples of groundwater, sediment, and surface water for comparison with concentrations of metals detected in media at AOC J.

The analytical results indicated that site activities may have contributed to the concentrations of a few metals detected in the soils, groundwater, and sediments. The absence of VOCs, SVOCs, pesticides (except DDT at one location), PCBs, and explosives above EPA Region 9 PRGs or ecological screening values indicates that these constituents are not potential contaminants of concern (COCs) at this site. However, to assess whether any of the constituent concentrations pose an unacceptable risk to human health and the environment, a human health risk assessment (HHRA) and an ecological risk assessment (ERA) were completed.

Based on the results of the HHRA, site-related impacts do not pose an unacceptable risk for existing and anticipated land uses. The HHRA found that for the existing and anticipated land use (recreational), potential risks to human receptors are within EPA's acceptable levels. It was also concluded that potential risk to maintenance workers and construction workers from exposure to site soils are within acceptable levels.

The risk assessment for residential land use at the site showed that potential risks from human exposure to the soils exceed the target risk range, primarily due to the presence of iron and vanadium in the soils. However, these metals were detected within the range of background levels. Further, the site is not intended for residential use.

The potential risks from exposure to groundwater through potable use for industrial and residential users exceed the target risk range/values due to the presence of several metals. Concentrations of metals in groundwater are significantly influenced by oxidation-reduction potential (ORP) conditions in the aquifer. The high concentrations of dissolved manganese in groundwater at the site indicate that manganese reduction, a natural biogeochemical process, is occurring to a significant degree. Additionally, the groundwater at the site is not suitable for potable use due to its high salinity.

The ERA concluded that constituents in surface soil, surface water, and sediment do not pose unacceptable risk to directly exposed soil organisms, nor do they pose a risk to upper

trophic level wildlife feeding on various terrestrial and aquatic prey items at the site. Concentrations of many of the metals detected onsite were comparable to background. Mean concentrations of the other soil metals and the few detected organic constituents were either below screening ecotoxicity values or had a low magnitude of exceedance.

1.4.2 AOC R

The results of the only investigations conducted to date at AOC R are documented in the *Environmental Baseline Survey* (ERM, October 2000) and the *Expanded PA/SI* (CH2M HILL, 2002). The EBS only identified AOC R as a site that will be investigated and, if necessary, restored under the Navy's IR program. The waste piles under consideration in this EE/CA are outside the boundaries of AOC R identified in previous documents.

The Expanded PA/SI field investigations, performed in 2002, included the collection of 34 surface soil samples. These samples were analyzed for metals, VOCs, SVOCs, pesticides, and PCBs. Aluminum, arsenic, chromium, iron, manganese, and vanadium were detected in surface soil samples at concentrations exceeding the EPA Region 9 industrial PRGs, residential PRGs, and/or leachability screening criteria. Arsenic, chromium, lead, and vanadium were identified at concentrations exceeding background metal values established by the background study conducted for the western portion of Vieques Islands. Several SVOC concentrations exceeded EPA Region 9 industrial and residential PRGs. These SVOCs were comprised of 3,3-dichlorobenzidine, benzo(a)fluoranthene, benzo(a)anthracene, indeno(1,2,3-c,d)pyrene, and dibenzo(a,h)anthracene. VOCs, PCBs, and pesticides were either not detected or were detected at concentrations below the screening criteria listed above.

A qualitative ecological survey conducted as part of the *Expanded PA/SI* indicated no federally protected species or preferred habitats were observed at this site. A RI will be conducted to further delineate the nature and extent of contamination and assess whether or not the site poses an unacceptable risk to human health and/or the environment.

1.4.3 SWMU 6

Several investigations have been conducted to evaluate the presence of contaminants from the historical disposal operations that occurred in the 1960s and 1970s. These investigations comprise the Confirmation Study, Expanded PA/SI, and RI. The EBS report includes only a brief site history of SWMU 6. No investigation was completed as part of the EBS.

1.4.3.1 Confirmation Study

The Confirmation Study was performed in 1988 (ESE, 1988) to evaluate potential contamination from the historical Navy disposal activities. This study included the collection and analysis of surface water, sediment, and soil samples. These samples were analyzed for pH, chromium (total and hexavalent), lead, methyl ethyl ketone (MEK), and methyl isobutyl ketone (MIBK). No groundwater samples were collected during the Confirmation Study.

A few metals (lead and chromium) were detected in the surface water, soil, and sediment samples. However, no elevated levels with respect to screening criteria of any constituents

were found in the surface water, soil, and sediment samples collected during the Confirmation Study.

1.4.3.2 Expanded PA/SI

The Expanded PA/SI investigation (CH2M HILL, 2000) included an MEC avoidance survey, installation of four groundwater monitoring wells, and collection of groundwater, surface water, sediment, surface soil, and subsurface samples that were analyzed for metals, VOCs, SVOCs, pesticides, PCBs, and explosives. Soil, surface water, and sediment samples were collected in similar locations as samples collected during the Confirmation Study. The Expanded PA/SI investigation also included a geophysical survey to delineate areas of metallic wastes.

Unfiltered (total metals) and filtered (dissolved metals) groundwater sample results indicate several metals were detected at concentrations exceeding MCLs and/or tap water RBCs. However, upgradient and downgradient concentrations of these metals were similar, which indicates that the site-specific levels were likely the result of background conditions and not a result of site related activities. The PCBs Aroclor 1221 and Aroclor 1232 were detected in a groundwater sample above EPA Region 9 PRGs. However, when the well was re-sampled to confirm the results, PCB concentrations were below detection limits, suggesting their presence in the original samples may have been false positives.

SVOCs detected in surface soil samples above human health, leachability, and/or ecological screening criteria (Sediment Quality Assessment Guidance [SQAG] and/or National Oceanic and Atmospheric Administration [NOAA]) comprised anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, fluoranthene, naphthalene, phenanthrene, and pyrene.

All VOCs, SVOCs, pesticides, PCBs, and explosives were either not detected or were detected below their human health and ecological screening criteria (where applicable) in subsurface soil, surface water, and sediment samples.

Arsenic was detected above the leachability criterion, although the concentrations were within the range of soil background levels.

Surface water samples showed arsenic, copper, lead, mercury, and silver detected at concentrations exceeding the human health and ecological screening criteria.

One sediment sample contained arsenic, chromium, lead, nickel, and zinc at concentrations exceeding the SQAG and/or NOAA screening criteria. Copper was detected in all sediment samples at concentrations below background criteria.

A geophysical survey was conducted to help delineate areas of buried metallic waste. Most metal debris appeared to be present in the northern portion of the site. Based on a visual estimation, the main area of debris is only 2 feet deep.

The MEC avoidance survey did not reveal any unexploded ordnance at the site. Inert items such as concrete filled bombs, found partially submerged in water and sediment, and empty shell casings have been documented at this site.

1.4.3.3 Remedial Investigation

The results of the RI are documented in the *RI Report for Solid Waste Management Unit (SWMU) 6 Vieques Island, Puerto Rico* (CH2M HILL, 2004). Activities performed during the investigation comprised a geophysical survey, an MEC avoidance survey, and the collection of groundwater level data and nearby tidal canal and lagoon water level data. Background samples were collected for groundwater, surface water and soil. Soil, groundwater, sediment, and surface water samples were analyzed for metals, VOCs, SVOCs, pesticides, PCBs, and explosives. In addition, an HHRA and ERA were completed to assess whether any of the constituents posed an unacceptable risk to human health or the environment.

Surface soil sample analyses showed exceedances of background levels and screening criteria of seven metals (antimony, arsenic, copper, iron, lead, thallium, and zinc). The elevated levels of iron and other metals were detected in the northwestern portion of the site where scrap metal is present. It was concluded that waste disposal activities may have had a limited impact on the surface soils in that area.

Subsurface soil sample analytical results indicated that only antimony exceeded background levels and screening criteria. Based on the isolated exceedance of only antimony in subsurface soil, the Draft RI concluded that waste disposal activities have had only a limited impact on subsurface soils.

Groundwater sample analytical results indicated that several inorganic and organic constituents were detected above background and EPA Region 9 tap water RBCs. Chloroform was detected in one groundwater monitoring well. Two previous detections of PCBs were not present in the RI sampling round. The analytical results of the unfiltered (total metals) and filtered (dissolved metals) groundwater samples showed concentrations of antimony, arsenic, cadmium, chromium, iron, lead, manganese, selenium, and thallium exceeded the screening criteria and background levels in one or more onsite groundwater monitoring wells.

Several analytical results from surface water samples showed that several metals were detected above screening criteria and background levels.

Sediment samples collected from the canal connecting to the Kiani Lagoon South and Kiani Lagoon north indicated that concentrations of several metals and the pesticides dichlorodiphenyldichloroethane (DDD), dichlorodipenyldichloroethylene (DDE), and dichlorodiphenyltrichloroethane (DDT) exceeded the ecological screening criteria. No pesticide background data were collected.

The results of the HHRA indicated that constituents in SWMU 6 soils and surface water do not present unacceptable risks or hazards, based on current and likely future land use. Although the residential child and adult cancer risks from groundwater exposure through potable use are above target limits due to arsenic concentrations, SWMU 6 groundwater is not potable due to high salinity.

The ERA concluded that although metals and some organic constituents were identified as contaminants of potential concern (COPCs), risks to lower trophic level receptors were negligible based on the low magnitude of screening value exceedances and comparisons to background/upgradient data. There were also no significant risks identified for terrestrial wildlife.

1.4.4 SWMU 7

Several studies have been conducted to evaluate the potential presence of contaminants from the historical disposal operations in the 1960s through the 1970s. These investigations comprise the Confirmation Study, Expanded PA/SI, and the RI. The EBS report includes only a brief site history of SWMU 7. No investigation was completed as part of the EBS.

1.4.4.1 Confirmation Study

The Confirmation Study (ESE, 1988) was performed in 1988 to evaluate potential contamination from the historical Navy disposal activities. This study included analyses of three groundwater samples, six soil samples, and three dry sediment samples. Samples were analyzed for pH, priority pollutants, oil and grease, VOCs, MEK, MIBK, ethylene dibromide, chromium (total and hexavalent), xylene, and lead.

Metals were the only constituents detected in the groundwater samples, with cadmium, total chromium, and nickel exceeding drinking water and ambient water quality criteria. These metals concentrations were attributed to background levels in this report. Soil or sediment samples did not exceed the screening criteria, and no COCs were identified. The Confirmation Study recommended no further action.

1.4.4.2 Expanded PA/SI

An MEC avoidance survey was performed prior to field activities of the Expanded PA/SI (CH2M HILL, 2000). The MEC avoidance survey noted the presence of ordinance related scrap (ORS) items in the ditch but no unexploded ordinance/ordinance and explosives (UXO/OE) items were found. This investigation included installation of two groundwater monitoring wells. Soil and sediment samples were collected from the site and the dry ditch. Samples were analyzed for metals, VOCs, SVOCs, pesticides, PCBs, and explosives and detections were compared to EPA Region 3 RBCs.

Unfiltered (total) metals groundwater sample results showed antimony, arsenic, iron, manganese, vanadium, and zinc were detected at concentrations exceeding MCLs and/or RBCs. Filtered (dissolved) metals analysis results indicated that aluminum, iron, manganese, and vanadium were detected above MCLs and/or RBCs. Metals were detected in all groundwater monitoring wells, including the upgradient groundwater monitoring well and are likely indicative of background concentrations, not site related activities. Perchlorate was detected in one well, but was not detected when the monitoring well was re-sampled.

Surface soil sample analytical results indicated that aluminum, arsenic, chromium, copper, iron, lead, manganese, thallium, vanadium, and benzo(a)pyrene were detected above human health risk-based screening criteria. The metals were considered to be not related to site activities in this report. Benzo(a)pyrene was detected at concentrations slightly above the residential RBC. Pesticides, PCBs, and explosives were either not detected in soil or were detected below their human health risk-based screening criteria.

VOCs, SVOCs, pesticides, PCBs, and explosives were either not detected or were detected below their ecological screening criteria in the sediment samples. The sediment sample analysis results showed several metals detected at concentrations exceeding the ecological

screening criteria, but lower than background concentrations. These metal concentrations are therefore not likely due to site related activities.

1.4.4.3 Remedial Investigation

An RI was conducted to supplement previous investigations. Results of the RI are documented in the *Remedial Investigation Report for SWMU 7, Vieques Island, Puerto Rico* (CH2M HILL, 2004). Activities of the investigation included geophysical surveys to define the debris boundaries, an MEC avoidance survey, installation of six groundwater monitoring wells to collect analytical groundwater data and to establish baseline static groundwater levels, and collection of surface and subsurface soil samples and sediment samples. Samples were analyzed for VOCs, SVOCs, metals, perchlorate, pesticides, PCBs, and munitions related constituents.

The most prevalent constituents identified during the RI were PAHs, pesticides, and metals. An HHRA and an ERA were also completed to assess whether any of the constituents posed an unacceptable risk to human health or the environment.

An MEC avoidance survey identified ORS items, comprising empty ordnance containers and empty propellant charge containers. No unexploded ordnance items were identified with ORS at the site.

The surface soil analytical results indicated the presence of metals in all of the samples. PAHs were detected in surface soil samples, along with three pesticides (heptachlor, DDT, and DDE). Of these, two PAHs (benzo(a)pyrene, and pyrene) and two pesticides (DDE and DDT) were identified above the screening criteria. Subsurface soil had detections of 23 metals, but only chromium exceeded its screening criteria. PAHs were detected in one subsurface soil sample.

Several metals were detected in unfiltered (total metals) groundwater samples above the MCLs and/or RBCs. Filtered (dissolved metals) results showed aluminum, iron, manganese, and vanadium above MCLs and/or EPA Region 9 RBCs. Metals were detected in all wells including the upgradient well, and no distribution patterns indicative of a release from the site were identified. The one groundwater monitoring well in which low-level perchlorate was detected in 2000 was re-sampled in 2003 to confirm its presence; it was not detected. None of the other munitions/explosives-group chemicals were detected in any site groundwater or soil samples.

The two sediment samples were collected from a location downstream of the site, in a depositional area along the drainage ditch near Vieques Passage downgradient of SWMU 7. These samples had detections of only metals. Only barium and copper were found to exceed ecological screening criteria; however these were below established background concentrations for west Vieques.

The results of the HHRA performed during the RI stated that site related constituent concentrations do not pose an unacceptable risk for existing and anticipated land uses.

Based on the ERA, it was concluded that constituents detected in soil do not pose unacceptable risks to directly exposed organisms or to upper trophic level wildlife feeding on various prey at the site. Many of the metals detected onsite were generally comparable to background. Average concentrations of remaining soil metals and the few detected organic

constituents were either below screening ecotoxicity values or had a low magnitude of exceedance.

1.4.5 Nature and Extent of Debris

A detailed discussion of the nature and extent of contamination at AOC J, AOC R, SWMU 6, and SWMU 7 is presented above and in their respective Draft RI Report (CH2M HILL, 2004), Expanded PA/SI (CH2M HILL, 2000), and other previous investigation reports. The RI has not been completed for AOC R is scheduled to be completed in 2005.

1.4.5.1 AOC J

Most of the solid waste at AOC J is on the slopes of the ditch, but some debris piles are up to 100 feet west of the ditch. The debris piles consist of metallic and non-metallic materials and one empty drum. Analytical results indicate that the site may have contributed to elevated levels of a few metals in the soils, groundwater, and sediments. The absence of VOCs, SVOCs, pesticides (except DDT at one location), PCBs, and explosives above PRGs or ecological screening values indicates that these constituents are not COCs at this site. Site conditions at AOC J were found not to pose an unacceptable risk to human health or ecological receptors (CH2M HILL, 2004). This EE/CA addresses only removal of the debris and soil containing debris located at AOC J.

An MEC avoidance survey conducted in May 2000 found no unexploded ordnance items at the site. However, 105-mm shell casings and empty ammunition boxes were observed.

A geophysical survey was conducted at AOC J to delineate the extent of the buried waste. The waste boundaries are shown in Figure 1-3. Subsurface debris does not extend beyond the western bank of the ditch. The volume of surface waste to be removed is approximately 90 feet long by 30 feet wide and 1 foot deep (approximate volume of 100 cubic yards). The total estimate of waste material at AOC J, including surface debris and an assumed 2 feet of contaminated soil beneath the waste piles and a 30% contingency at AOC J is 390 cubic yards.

1.4.5.2 AOC R

Based on previous investigations and a visual inspection of the site in April 2005 by CH2M HILL, there are four areas on site requiring waste removal. The first area contains a debris pile approximately 100 feet in length and 20 feet high along the bank of the ditch. The waste appears to have been pushed over the side of the ditch with some material buried approximately 2 feet deep. These waste materials appear to consist of a practice bomb, ammunition cans, metal pipes and rocket launchers. The second area, just north of the concrete pad consists of four 20-foot long, 18-inch diameter wood power poles with approximately 30 car tires on the power poles. On the east end of the concrete pad, a third debris pile about 10 feet long by 10 feet wide by 6 feet high consists of white corrugated roofing sheet material. The fourth waste area contains four partially buried practice bombs, and is estimated to require removal of 5.5 cubic yards. The practice bombs were visually identified as being inert. The total estimated waste at AOC R, including 2 feet of soil and a 30 percent contingency, is approximately 550 cubic yards. An additional survey of the extent of debris is recommended during the RI once site clearing activities have been completed to better delineate the volume of excavation required. Figure 1-4 shows the approximate locations of the four areas requiring waste removal.

1.4.5.3 SWMU 6

Waste discarded at the site includes rusty metal, car parts, rubber tires, broken glass, rubble, and empty containers of lubricants, oil, solvents, and paints. Most of the disposed items have deteriorated due to natural corrosion in the saltwater environment and wastes are present mostly in small pieces of metallic or glass debris. Analytical results documented in the Expanded PA/SI (CH2M HILL, 2000) and the RI Report (CH2M HILL, 2004) indicates that the site has metals and some organic chemicals detected in the soils, groundwater, and sediments. All detected chemicals were further evaluated in a HHRA and an ERA. The inorganic and organic chemicals in site soils, groundwater, sediment, and surface water were found not to present significant risks or hazards to human health (CH2M HILL, 2004). This EE/CA addresses only removal of the debris and soil containing debris located at SWMU 6.

No unexploded ordnance items have been identified at SWMU 6 during the two MEC avoidance surveys performed prior to field activities of the Expanded PA/SI and the RI. However, munitions related items such as inert concrete filled bombs, empty bomb dispensers, and empty shell casings were identified.

A geophysical investigation was conducted at SWMU 6 to delineate the lateral extent of buried waste at the site. The site was investigated using a combination of grids and transect lines based on terrain conditions. Within the grids established over the site, an electromagnetic survey was performed. Results of the geophysical investigation were used to develop Figure 1-5, which shows the approximate site boundary at SWMU 6. The debris located at SWMU 6 is non-contiguous. The main area of debris is just north of Highway 200 and runs along the road approximately 165 feet long by 10 feet wide by 2 feet deep. Additionally, there are five large concrete filled bombs partially buried in water and sediment on the site. The total estimated waste at SWMU 6 is 323 cubic yards, including 2 feet of soil and a 30 percent contingency.

1.4.5.4 SWMU 7

Disposal activities appear to have been concentrated in a segment of the ditch approximately 420 feet along the length of the dirt access road where waste materials were pushed over the edge. Most of the waste material is confined to the steep slopes, and no waste material has been observed upgradient of the slopes. The discarded material includes old tires, sheet metal, empty containers such as drums, cans, and bottles, used batteries, and construction rubble. Additionally, there are two sea mines, six rocket launchers, a Volkswagen Beetle, and hundreds of tires.

Based on the results of the RI, site conditions at SWMU 7 do not pose an unacceptable risk above background levels to human health or the environment (CH2M HILL, 2004). This EE/CA addresses only removal of the debris and soil containing debris located at SWMU 7.

The geophysical investigation indicated that the fill boundary at SWMU 7 appears to be delineated on all sides with the exception of a small lobe in the southeast. The waste boundary on the southeast could not be defined due to the thick vegetation preventing equipment access. However, a visual waste definition along with the waste boundary defined by the geophysical investigation is presented in Figure 1-6. Both conductivity and in-phase data indicate that some metal material extends across the road to the east. Data

collected along transects in the southwest do not indicate that any debris extends westward of the bottom of the drainage ditch. Estimated dimension of waste at SWMU 7 is 420 feet in length by 30 feet wide and 3 feet deep (approximate volume of 1,800 cubic yards, including 2 feet of soil and a 30 percent contingency).

1.4.6 Streamlined Risk Evaluation

According to USEPA *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA*, (1993), "...for the EE/CA, the streamlined risk evaluation should focus on the specific problem that the removal action is intended to address. If the action is intended to address a particular source of contamination, the risk evaluation should address the risks related only to that source of contamination."

A confirmatory sampling protocol will be established in the removal action work plan, including how the data will be evaluated in a streamlined risk evaluation to ensure the removal action goals are met, including eliminating the uncertainty associated with the debris being a continuing source of contamination that may result in unacceptable levels of potential risk. By removing the waste, the potential source of contaminants from historic disposal activities, and the uncertainty regarding the potential presence of contamination, will be eliminated.



Scale in Miles



Figure 1-1
Regional Location Map
Vieques, Puerto Rico

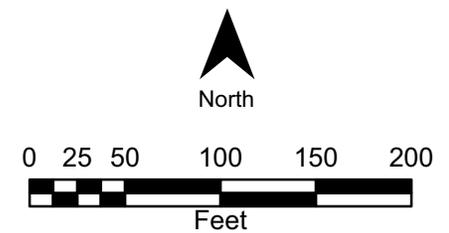
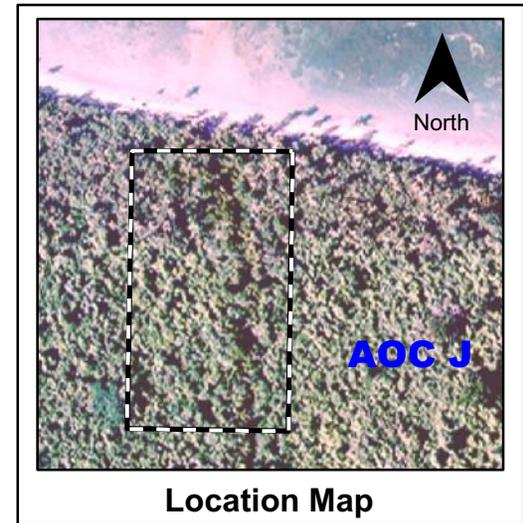
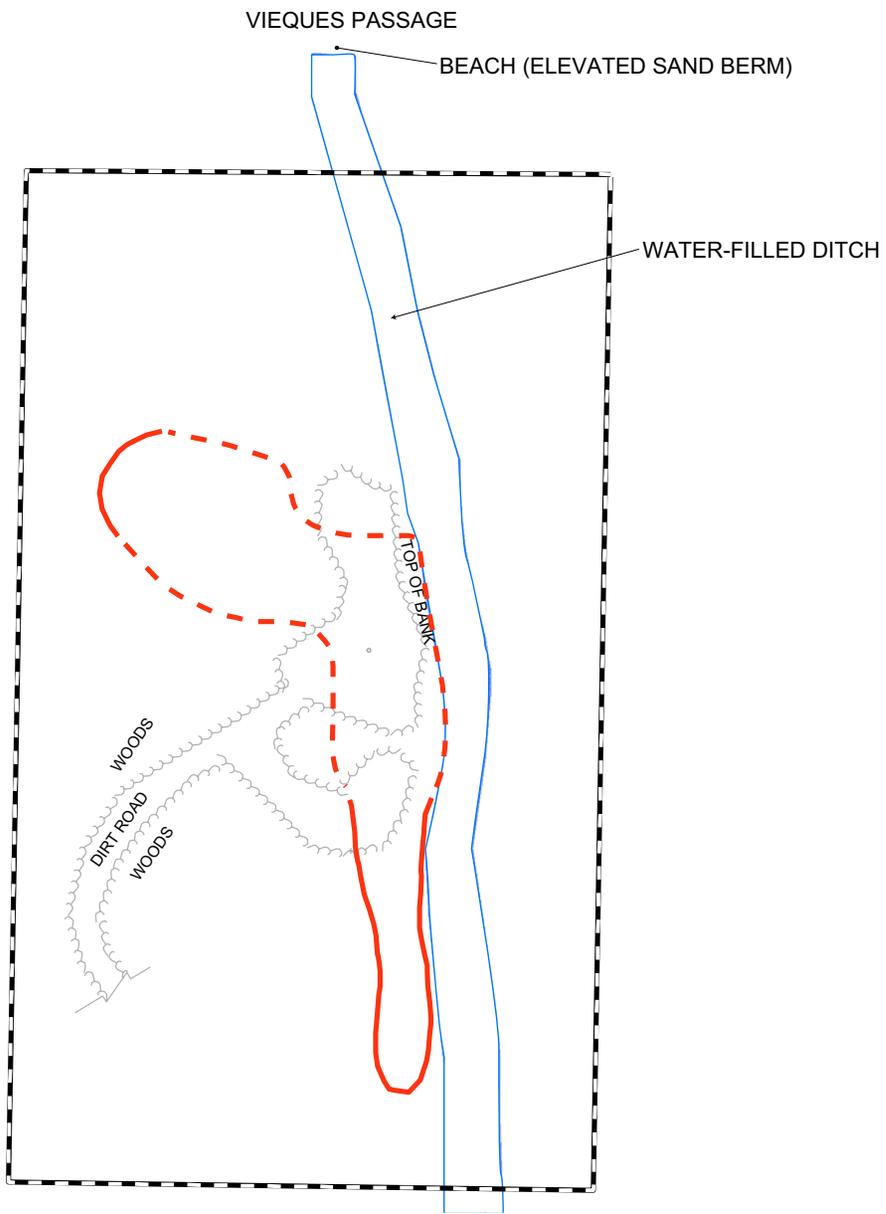
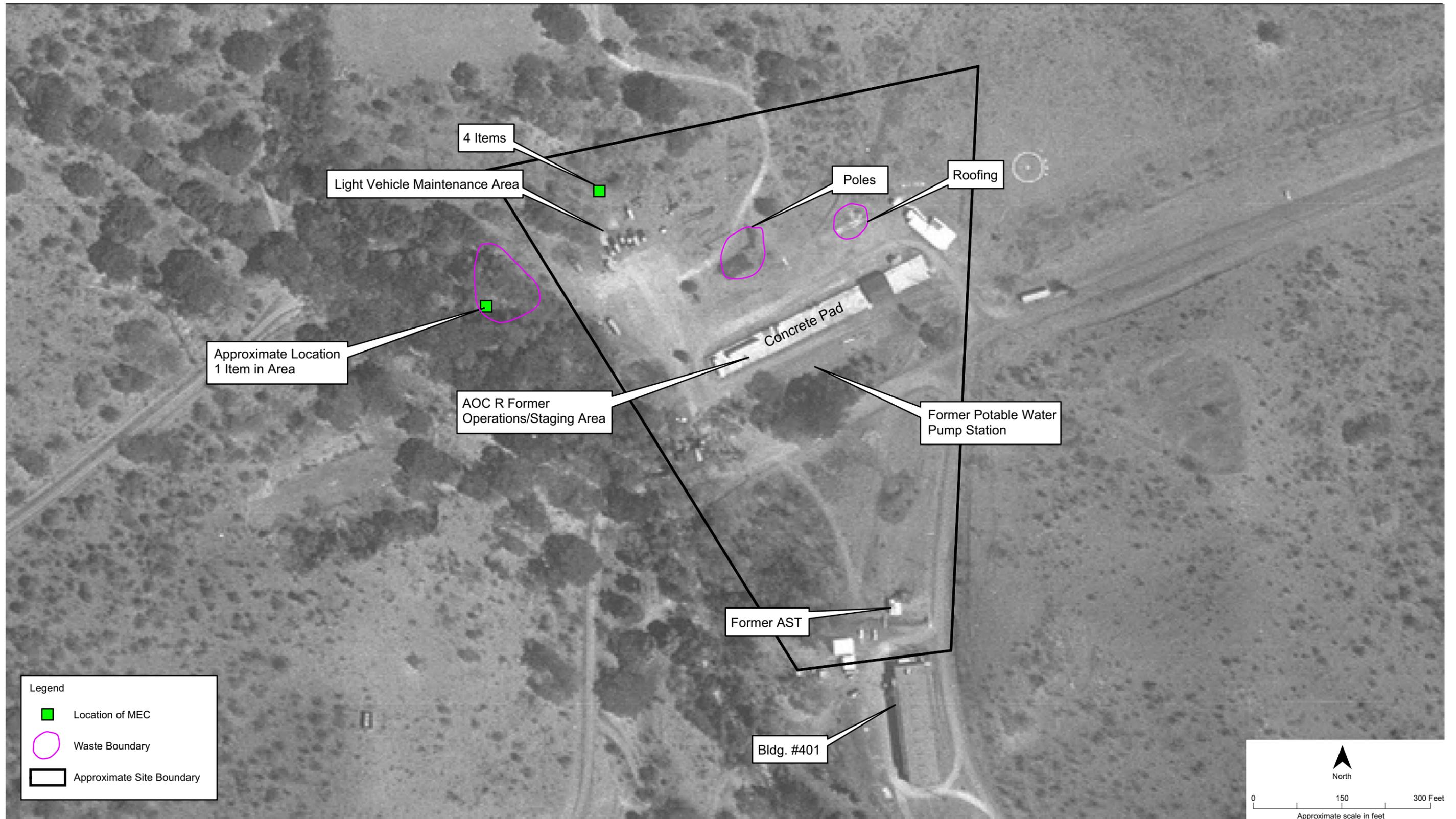
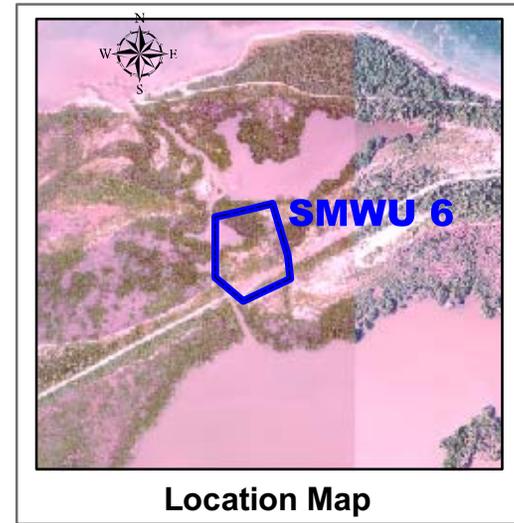


Figure 1-3
Site Map -AOC J
 AOC J, Former NASD, Vieques, Puerto Rico



Source: 1967 Aerial

FIGURE 1-4
Site Map - AOC R
 Former NASD, Vieques, Puerto Rico



Legend
 — Site Boundary



Figure 1-5
Site Map - SWMU 6
Former NASD, Vieques, Puerto Rico

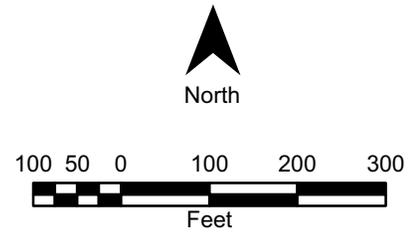
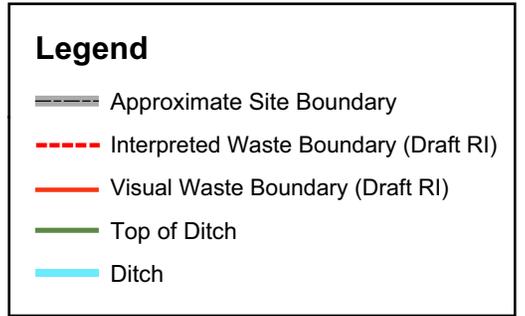
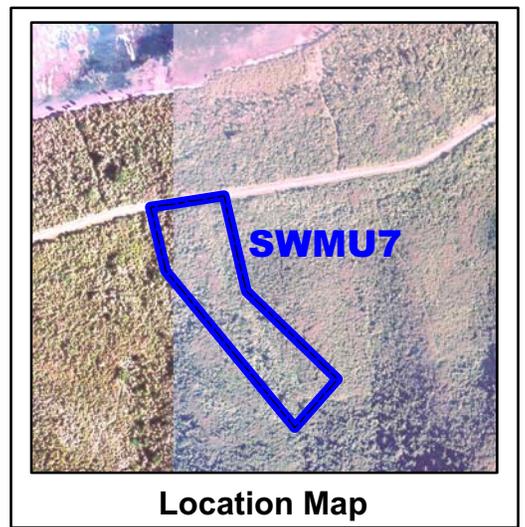
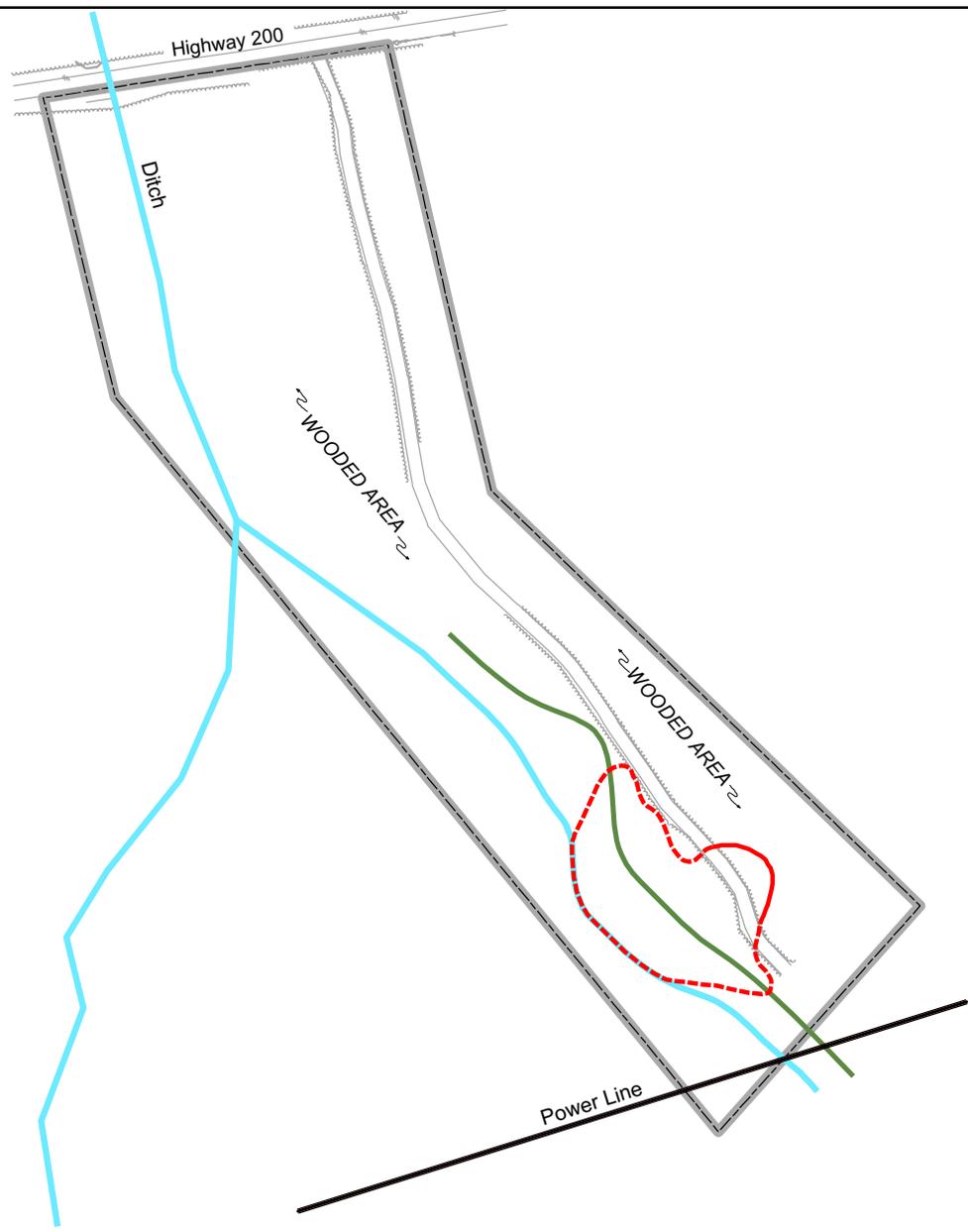


Figure 1-6
SWMU 7 Waste Boundary
SWMU 7, Former NASD, Vieques, Puerto Rico

Removal Action Objective and Scope

2.1 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 remedial action to be taken. This removal action will not be USEPA fund-financed. The Navy/Marine Corps Installation Restoration (IR) Manual does not limit the cost or duration of the removal action; however, cost-effectiveness is a recommended criterion for the evaluation of removal action alternatives.

2.2 Removal Action Objective and Scope

2.2.1 Removal Action Objective (RAO)

The proposed RAO is to implement measures at AOC J, AOC R, SWMU 6, and SWMU 7 that will isolate, reduce, or eliminate waste, including debris and soil containing debris, that may be the source of contaminants that may pose a potentially unacceptable risk to human health and the environment.

2.2.2 Removal Action Scope

In the preparation of this EE/CA, several removal action alternatives were evaluated that can meet the objective listed above. The general scope of each removal alternative evaluated is defined in this section.

#1 No Action: The no action alternative implies that no removal work will be done at this site. It is the baseline alternative against which the other alternatives are compared.

#2 Construction of a 2-foot soil cover: Construction of 2-foot soil cover, post-construction re-vegetation where possible (site restoration), and post-closure long-term groundwater monitoring and implementation of land use controls (LUCs)/institutional controls (ICs).

#3 Excavation, off-site disposal, and site restoration: Excavation of waste, including buried debris and soils containing debris. Upon removal of the waste, the excavated areas will be restored using backfill and revegetated with native plant species.

2.3 Determination of Removal Schedule

The EE/CA will be placed in the Administrative Record, and notice of its availability for public review along with a brief summary will be published in the local newspaper. The EE/CA is then available for a 30-day public comment period. A public information session will also be held during the public comment period. Following the public comment period, a Responsiveness Summary summarizing responses to significant comments will be prepared and included in the Administrative Record. Because this removal action has been

designated non-time critical, the start date for the removal action will be determined by several factors, including weather conditions.

The total project period is anticipated to last an estimated 10 months, from the end of the public comment period through completion of removal actions. This is just an estimated schedule for project completion, should critical milestones not be met the total project timeframe would also be extended. Critical milestone periods related to the EE/CA are summarized below:

- EE/CA Public Comment Period – 1 month
- Subcontracting – 2 months
- Preparation – 3 months (includes preparation of work plan, wetland delineation, (if required), threatened/endangered species inspection (if required), submittal reviews, and mobilization)
- Removal Actions and Demobilization – 5 months (minimum 1 month per site plus demobilization)

2.4 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 Puerto Rico environmental laws. **Appendix A** contains the ARAR tables and provides a summary of each potentially related environmental law. Other federal and Puerto Rico advisories, criteria, or guidance will be considered, as appropriate, in formulating the removal action. Applicable requirements are those requirements specific to the conditions at AOC J, AOC R, SWMU 6, and SWMU 7 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 AOC J, AOC R, SWMU 6, and SWMU 7 and surrounding vicinity, but are meant to address similar situations, and therefore, are suitable for use at these sites. Federal ARARs are determined by the lead agency. As outlined by 40 CFR 300.415(j), the lead agency 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 the following factors to consider in determining what requirements of environmental laws are relevant and appropriate:

- The purpose of the requirement in relation to the purpose of CERCLA;
- The medium (or 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; and
- 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 not 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 US EPA in the ARAR determination process: chemical-specific, location-specific, and action-specific. Each is described below.

Chemical-specific ARARs are health or risk management-based criteria or methodologies that result in the establishment of numerical values for a given medium 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. The results of confirmation soil samples associated with Alternative 3 will be compared to background concentrations and/or USEPA Region IX PRGs to confirm any contamination associated with the debris has been removed from the soil prior to site restoration. In addition, long-term monitoring associated with Alternative 2 will involve comparison of site-specific data to background concentrations and/or USEPA maximum contaminant levels (MCLs) and/or PRGs, and the Puerto Rico Water Quality Standards. Federal and Puerto Rico Chemical-specific regulations are summarized in Appendix A.

Location-specific ARARs restrict remedial activities and media concentrations based on the characteristics of the surrounding environments. Location-specific ARARs may include restrictions on remedial actions within wetlands or floodplains, near locations of known endangered species, or on protected waterways. Federal and Puerto Rico location-specific regulations that have been reviewed are summarized in **Appendix A**.

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

Description of Removal Action Alternatives

3.1 Alternatives Description

The removal action alternatives developed for AOC J, AOC R, SWMU 6, and SWMU 7 are:

1. No Action
2. Construction of soil cover and long-term monitoring
3. Excavation, off-site disposal, and site restoration

3.1.1 Alternative #1 – No Action

The no action alternative implies that no removal work would be done at the site. The site would be left as it currently exists, and no long-term monitoring would be conducted.

3.1.2 Alternative #2 – Construction of Soil Cover and Long-term Monitoring

This alternative assumes no excavation would take place. Instead, each area would be covered with a 2-foot soil layer and revegetated with native plant species. The larger above ground debris would be collected, removed to a predetermined location on each site, and covered with soil to reduce the likelihood of human contact. The soil cover would consist of a general backfill material for the first 18 inches and 6 inches of topsoil to promote vegetative growth. Prior to its use, the backfill soil would be sampled for metals, SVOCs, VOCs, PCBs, and TPH to ensure its acceptability. Soil would likely be obtained from a location on the Island of Vieques, but if it is not available, may be brought in from mainland Puerto Rico.

Following placement of the soil cover, the cover areas would be revegetated with native plant species (at SWMU-6, the native vegetation is Red, White, and Black Mangroves). Once the areas have been planted, semi-permanent erosion control measures would be installed. This may include erosion control matting, hay bales, silt fences, or other means necessary to control erosion of the cover soils until vegetation can be established.

LUCs and ICs would be implemented following the construction activities. LUCs would consist of placing gates at each site to prevent unauthorized access. ICs would consist of deed notations and land use restrictions.

Alternative #2 would also incorporate a long-term groundwater monitoring program that would include sampling of the onsite wells for selected constituents. For the purposes of the cost estimate, the groundwater monitoring program is expected to continue for approximately 30 years, although the monitoring program would need to be continued as long as the waste is onsite. See **Table 3-1** below for a summary of the cover sequence and details.

3.1.3 Alternative #3 – Excavation, Off-site Disposal and Site Restoration

This alternative consists of excavation and off-site disposal of surficial and buried waste at all four sites, including buried debris and debris-containing soils. Prior to excavation of

wastes, the areas would be cleared to remove vegetation. Clearing would be kept to a minimum to minimize potential damage to the surrounding landscape and to minimize the site restoration effort. The assumptions used in preparing the cost estimates summarized in this EE/CA, including the confirmatory sampling frequency, are presented in Appendix B. The actual confirmatory sampling frequency and analytical protocol will be presented in the removal work plan to be developed for regularity review prior to mobilization.

Figures 3-1, 3-2, 3-3, and 3-4 present the delineated areas of proposed excavation for AOC J, AOC R, SWMU 6, and SWMU 7, respectively. It is important to note that the removal areas shown in these figures are approximate and were used primarily to estimate the removal costs. The actual removal areas will be based on the extent of debris areas identified during the removal. For the purposes of scoping and cost estimating, it is assumed that the waste extends a maximum of 2 feet below the observed waste, although exact depths will be determined during the removal. Additional excavation beyond the estimated depths for each area may be required depending on the results of the post excavation confirmation samples and/or visual observations made during removal.

Historical information and visual assessments of the sites made during preparation of this EE/CA revealed buried and partially exposed wastes such as various metal debris, wooden power poles, tires, glass, cars and car parts, and some objects that appeared to be UXO. The total quantity of material to be removed from all three sites is estimated to be 5,550 tons, which comprises 702 tons from AOC J, 990 tons from AOC R, 582 tons from SWMU 6, and 3,276 tons from SWMU 7. Upon removal of the debris and soils containing debris, the excavated areas would be backfilled with soil (where required) for the planting of native plant species. Post excavation confirmation sampling would be completed at all four sites to confirm soils potentially impacted by debris present at the sites have been removed. Sampling of the incoming backfill to be used for site restoration for metals, SVOCs, VOCs, PCBs, and TPH would be performed prior to placement to confirm the off-site material is acceptable. A Removal Action Work Plan will be developed for regulatory review prior to site mobilization.

MEC may be encountered at the sites during clearing and/or excavation activities. UXO support would be provided to identify and properly dispose of these items should any be encountered. See **Table 3-2** below for a summary of the removal sequence and details.

TABLE 3-1
Alternative 2 Cover Details/Sequence

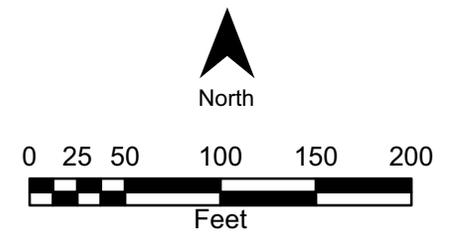
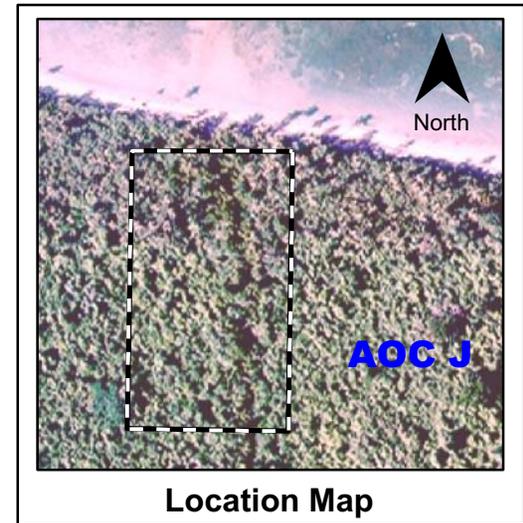
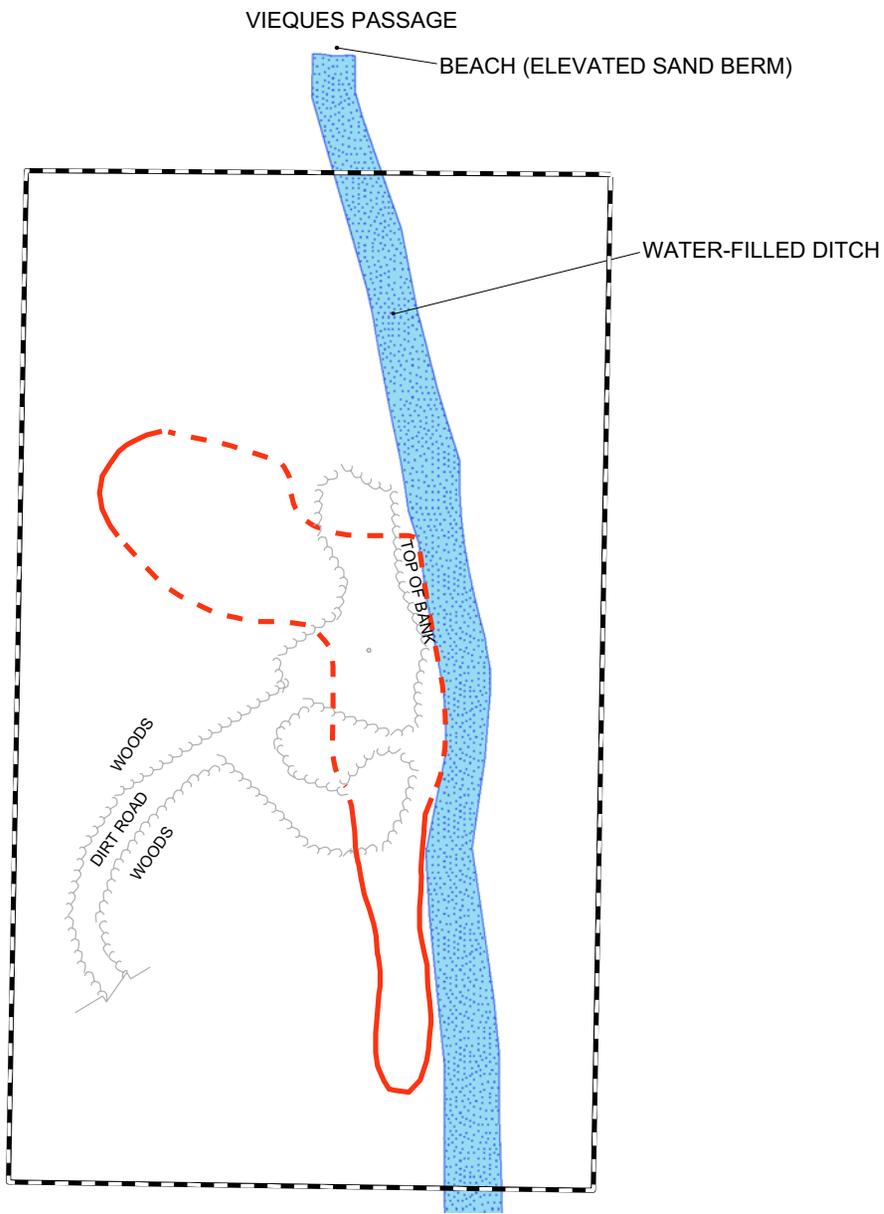
	AOC-J	AOC-R	SWMU 6	SMMU 7
Clearing	Approximately 2,700 square feet (SF) would be cleared to allow for excavation of waste materials. Larger trees would be left in place.	Approximately 2,236 SF would be cleared to allow for excavation of waste materials. Larger trees would be left in place.	Approximately 1,750 SF would be cleared to allow for excavation of waste materials. Larger trees would be left in place.	Approximately 12,600 SF would be cleared to allow for excavation of waste materials. Larger trees would be left in place.
Soil cover volumes	200 cubic yards (CY)	166 CY	130 CY	933 CY
Soil cover Sampling	Soil cover would be sampled to confirm it is acceptable. Analysis would comprise metals, SVOCs, VOCs, PCBs, and TPH.	Soil cover would be sampled to confirm it is acceptable. Analysis would comprise metals, SVOCs, VOCs, PCBs, and TPH.	Soil cover would be sampled to confirm it is acceptable. Analysis would comprise metals, SVOCs, VOCs, PCBs, and TPH.	Soil cover would be sampled to confirm it is acceptable. Analysis would comprise metals, SVOCs, VOCs, PCBs, and TPH.
Revegetation	Native Vegetation	Native Vegetation	Red, White, and Black Mangroves	Native Vegetation
Institutional and Land Use Controls (ICs/LUCs) to be implemented	May include deed notations, site signs, and site fencing and/or site access gates.	May include deed notations, site signs, and site fencing and/or site access gates.	May include deed notations, site signs, and site fencing and/or site access gates.	May include deed notations, site signs, and site fencing and/or site access gates.
Long-term groundwater monitoring	Periodic sampling of the monitoring wells onsite for selected constituents.	Periodic sampling of the monitoring wells onsite for selected constituents.	Periodic sampling of the monitoring wells onsite for selected constituents.	Periodic sampling of the monitoring wells onsite for selected constituents.
UXO Support	MEC may be encountered at the site. UXO support would be provided during vegetation clearance and emplacement of the cover to identify and properly dispose of these items.	MEC may be encountered at the site. UXO support would be provided during vegetation clearance and emplacement of the cover to identify and properly dispose of these items.	MEC may be encountered at the site. UXO support would be provided during vegetation clearance and emplacement of the cover to identify and properly dispose of these items.	MEC may be encountered at the site. UXO support would be provided during vegetation clearance and emplacement of the cover to identify and properly dispose of these items.

TABLE 3-2
Alternative 3 – Excavation/Restoration Details/Sequence

	AOC-J	AOC-R	SWMU 6	SMMU 7
Removal Action Work Plan	Identify estimated removal action areas, confirmatory sampling protocol, and data evaluation procedures. Submit for regulatory review.	Identify estimated removal action areas, confirmatory sampling protocol, and data evaluation procedures. Submit for regulatory review.	Identify estimated removal action areas, confirmatory sampling protocol, and data evaluation procedures. Submit for regulatory review.	Identify estimated removal action areas, confirmatory sampling protocol, and data evaluation procedures. Submit for regulatory review.
Clearing	Approximately 2,700 SF would be cleared to allow for excavation of waste materials.	Approximately 2,236 SF would be cleared to allow for excavation of waste materials.	Approximately 1,750 SF would be cleared to allow for excavation of waste materials.	Approximately 12,600 SF would be cleared to allow for excavation of waste materials.
Estimated Waste Material to be Excavated	702 tons	990 tons	582 tons	3,276 tons
Waste Characterization Sampling	Composite samples would be collected and analyzed for full TCLP and/or others requested by the disposal facility.	Composite samples would be collected and analyzed for TCLP and/or others requested by the disposal facility.	Composite samples would be collected and analyzed for TCLP and/or others requested by the disposal facility.	Composite samples would be collected and analyzed for TCLP and/or others requested by the disposal facility.
Sampling following excavation	Samples will be collected following excavation to confirm contaminants potentially associated with debris have been removed.	Samples will be collected following excavation to confirm contaminants potentially associated with debris have been removed.	Samples will be collected following excavation to confirm contaminants potentially associated with debris have been removed.	Samples will be collected following excavation to confirm contaminants potentially associated with debris have been removed.
Estimated Backfill Material to be Imported	390 CY	550 CY	323 CY	988 CY (area is a ravine, backfill quantities estimated to be 50% of excavated quantities)
Backfill Sampling	Imported backfill would be sampled to confirm it is acceptable. Analysis would comprise metals, SVOCs, VOCs, PCBs, and TPH.	Imported backfill would be sampled to confirm it is acceptable. Analysis would comprise metals, SVOCs, VOCs, PCBs, and TPH.	Imported backfill would be sampled to confirm it is acceptable. Analysis would comprise metals, SVOCs, VOCs, PCBs, and TPH.	Imported backfill would be sampled to confirm it is acceptable. Analysis would comprise metals, SVOCs, VOCs, PCBs, and TPH.
Revegetation	Native Vegetation	Native Vegetation	Red, White, and Black Mangroves	Native Vegetation
UXO Support	MEC may be encountered at the site. UXO support would be provided during vegetation	MEC may be encountered at the site. UXO support would be provided during vegetation	MEC may be encountered at the site. UXO support would be provided during vegetation clearance	MEC may be encountered at the site. UXO support would be provided during vegetation

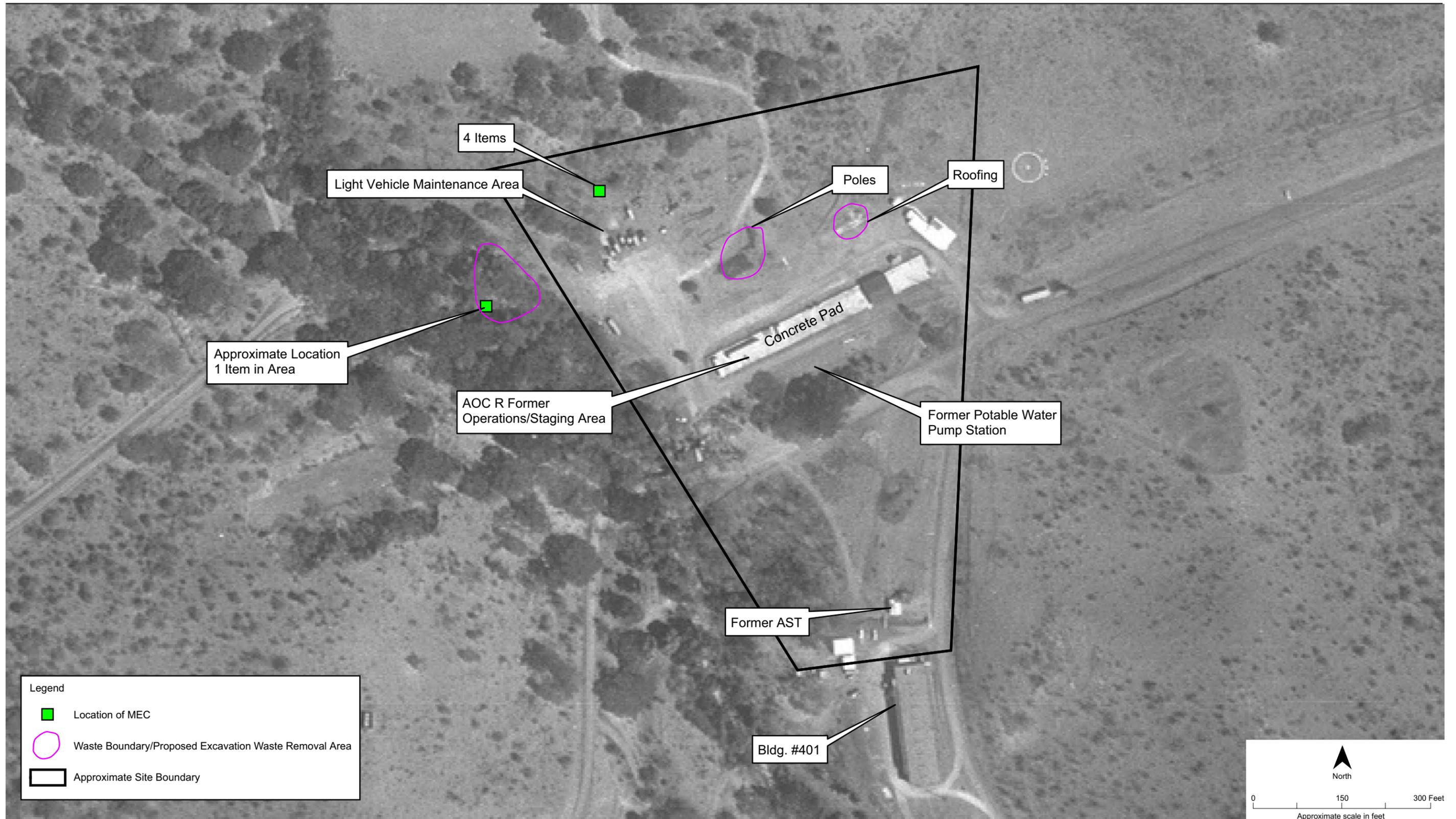
TABLE 3-2
Alternative 3 – Excavation/Restoration Details/Sequence

AOC-J	AOC-R	SWMU 6	SMMU 7
clearance and implementation of the cover to identify and properly dispose of these items.	clearance and implementation of the cover to identify and properly dispose of these items.	and implementation of the cover to identify and properly dispose of these items.	clearance and implementation of the cover to identify and properly dispose of these items.



Note: Actual waste limits to be field verified. Wastes along the water filled ditch were not visually apparent. Visual and interpreted waste boundaries are proposed excavation waste removal areas.

Figure 3-1
AOC J Proposed Excavation/Waste Removal Areas
AOC J, Former NASD, Vieques, Puerto Rico



Source: 1967 Aerial

FIGURE 3-2
AOC R Proposed Excavation/Waste Removal Areas
Former NASD, Vieques, Puerto Rico

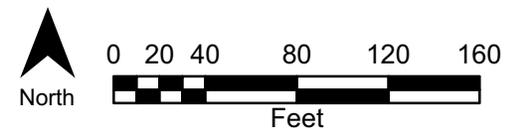
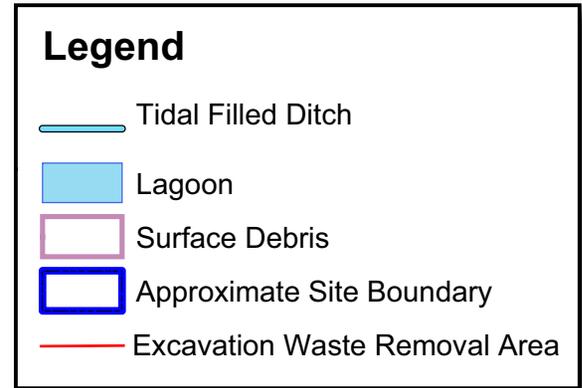
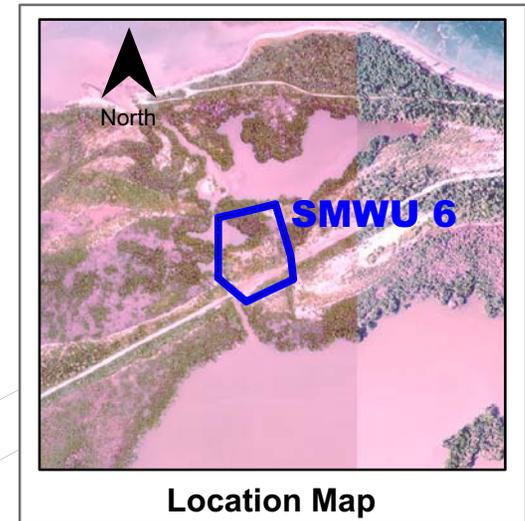
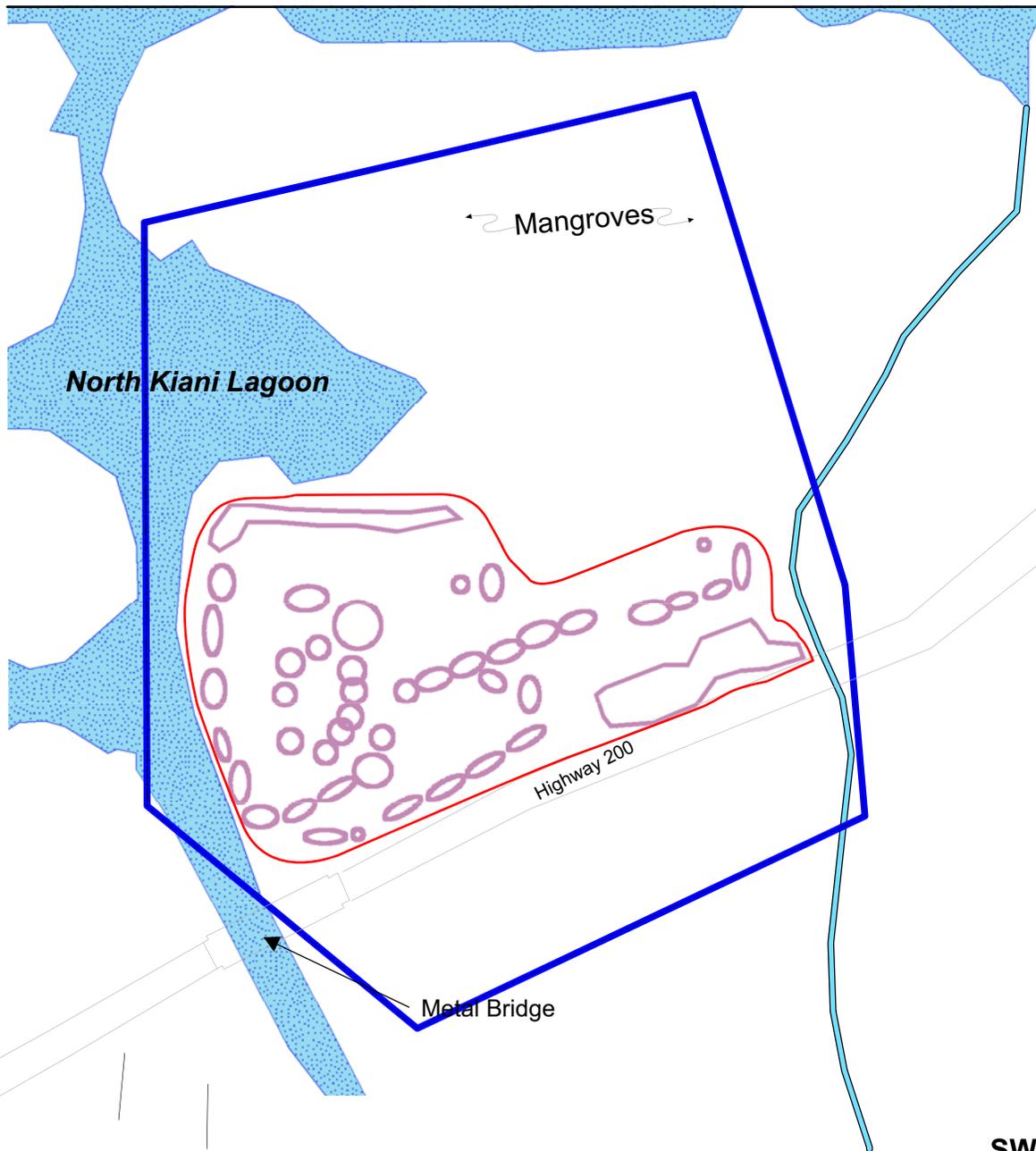
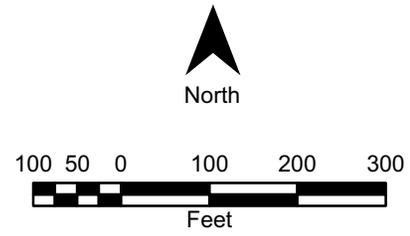
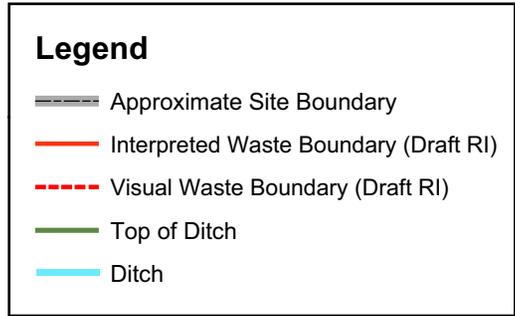
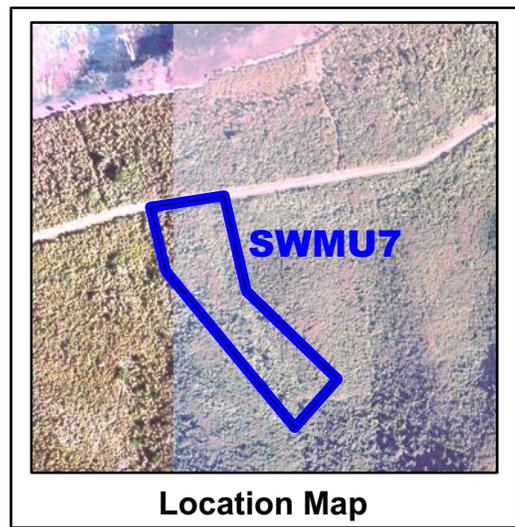


Figure 3-3
SWMU6 Proposed Excavation/Waste Removal Areas
SWMU 6, Former NASD, Vieques, Puerto Rico



Note: Actual waste limits to be field verified. Estimation of waste area is about 420 ft by 30 ft. The area from the top of the ditch to the dirt road is only sporadic wastes. The main area of wastes is along the ditch. Visual and interpreted waste boundaries are proposed excavation/waste removal areas.

Figure 3-4
SWMU 7 Proposed Excavation/Waste Removal Areas
SWMU 7, Former NASD, Vieques, Puerto Rico

SECTION 4

Detailed Analysis of Removal Action Alternatives

This section provides a detailed analysis of the alternatives presented in Section 3. The alternatives analysis uses the three main evaluation criteria of effectiveness, implementability, and cost, in accordance with the *U.S. EPA's Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA* (USEPA, 1993). Each evaluation criterion is described in **Table 4-1**.

The waste at AOC J, AOC R, SWMU 6, and SWMU 7 is anticipated to be classified as non-hazardous, based on historical data from the sites. However, this assumption will be evaluated by waste characterization samples collected prior to excavation. For the purpose of cost estimating in this EE/CA, non-hazardous waste disposal has been assumed. In addition, debris that can be recycled will be segregated and shipped to an appropriate recycling facility. Site restoration will take place following the completion of the selected alternative for all but the “no action” alternative. **Appendix B** contains the preliminary cost estimates for Alternatives 2 and 3. Should the assumption that the materials to be excavated from within these areas are non-hazardous for disposal prove to be false, a significant cost increase will occur due to handling and disposal of hazardous materials.

TABLE 4-1
Evaluation Criteria

Effectiveness	
Protection of human health and the environment	The assessment describes how the action achieves and maintains protection of human health and the environment and achieves site-specific objectives both during and after implementation.
Compliance with ARARs	An alternative is assessed in terms of its compliance with ARARs, or if a waiver is required, how it is justified.
Short-term effectiveness	An action is assessed in terms of its effectiveness in protecting human health and the environment during the implementation of a remedy before removal action objectives have been met. The duration of time until the removal action objectives are met is also factored into this criterion.
Long-term effectiveness and permanence	An action is assessed in terms of its long-term effectiveness in maintaining protection of human health and the environment after removal action objectives have been met. The magnitude of residual risk and adequacy and reliability of post-removal site controls are taken into consideration.
Reduction of toxicity, mobility or volume through treatment	An action is assessed in terms of anticipated performance of the specific treatment technologies it employs. Factors such as volume of materials destroyed or treated, the degree of expected reductions, the degree to which treatment is irreversible, and the type and quantity of remaining residuals are taken into consideration.

TABLE 4-1
Evaluation Criteria

Implementability	
Technical feasibility	The ability of the technology to implement the remedy is evaluated.
Administrative feasibility	The administrative feasibility factor evaluates requirements for permits, zoning variances, impacts on adjoining property, and the ability to impose institutional controls.
Availability of services and materials	The availability of offsite treatment, storage, and disposal capacity, personnel, services and materials, and other resources necessary to implement the alternative will be evaluated.
State and community acceptance	The acceptability of an alternative to the state (commonwealth) agency and the community is evaluated.
Cost	
Direct and indirect capital costs	Includes costs for construction (excavation and site restoration), equipment and materials, analytical services, engineering and design, and permit/licenses.
O and M costs	Includes ongoing monitoring and maintenance for a specific period.

4.1 Effectiveness

The *effectiveness* of a technology refers to its capability of removing the specific items in the volumes required, the degree to which the technology achieves the RAO, and the reliability and performance of the technology over time, including protection of human health and the environment, compliance with ARARs to the extent practical, long-term effectiveness and permanence, reduction in toxicity, mobility or volume, and short-term effectiveness.

As explained in Section 2, the RAO for AOC J, AOC R, SWMU 6, and SWMU 7 is to implement measures at AOC J, AOC R, SWMU 6, and SWMU 7 that would isolate, reduce, or eliminate waste materials that may be the source of contaminants that may pose a potentially unacceptable risk to human health and the environment.

Levels of effectiveness were assessed based upon the number of “effectiveness criteria” that would be satisfied by each alternative. The “effectiveness criteria” are described in **Table 4-1**.

4.1.1 Protection of Human Health and the Environment

4.1.1.1 Alternative #1 – No Action

Alternative 1 provides the least protection to human health and the environment for AOC J, AOC R, SWMU 6, and SWMU 7. The waste would remain onsite and uncovered which would not prevent or restrict human contact or protect the environment from future potential releases from the waste that may pose environmental impacts. Although the RIs have concluded that AOC J, SWMU 6 and SWMU 7 do not currently pose an unacceptable risk to human health and the environment, this alternative serves to address uncertainties associated with the debris.

4.1.1.2 Alternative #2 – Construction of Soil Cover and Long-term Monitoring

Alternative 2 provides a higher level of protection to human health and the environment at AOC J, AOC R, SWMU 6, and SWMU 7. Because the waste at each of these sites would be covered with a minimum of 2 feet of soil, the likelihood of human or ecological contact would be decreased, but not eliminated. Similarly, potential leaching of contaminants from the waste would be reduced, but not eliminated. LTM would be implemented to restrict site access and to monitor for releases to the environment.

4.1.1.3 Alternative #3 – Excavation, Off-site Disposal and Site Restoration

Alternative 3 provides the highest level of protection to human health and the environment for sites AOC J, AOC R, SWMU 6, and SWMU 7. Because the waste would be excavated and disposed of off site, there is no chance for future human contact or releases to environmental media.

4.1.2 Protection of Workers

4.1.2.1 Alternative #1 – No Action

Because Alternative #1 is the No Action alternative, this criterion is not applicable.

4.1.2.2 Alternative #2 – Construction of Soil Cover and Long-term Monitoring

As with any construction project, Alternative 2 does have worker safety issues to address prior to implementation. An MEC survey would be performed at all sites, as necessary, prior to field work. One concern specific to SWMU 6 is the changing water levels due to tidal influences. Work may have to be scheduled during low tide or cofferdams may need to be used to prevent the inflow of water. Steep slopes at AOC R and SWMU 7 may require stability measures be implemented. An additional hazard to workers during implementation associated with this alternative is working around construction equipment. Worker safety would be a concern for this alternative, but is a normal, manageable component of construction activities.

Following implementation of the soil cover alternative, future onsite utility or construction workers may be exposed to buried waste and debris if subsurface activities are conducted within the limits of the soil cover. Signs, fencing, or other means of restricting access and prohibiting subsurface activities without proper notification and approval will be required under this alternative.

4.1.2.3 Alternative #3 – Excavation, Off-site Disposal and Site Restoration

Alternative 3 would also have the same worker safety concerns as Alternative 2, and would additionally include concerns specific to excavation and removal of the wastes. Excavation poses some risks to workers due to potential exposure to contaminants, debris hazards, and hazards associated with working around construction equipment. Deeper excavations, if necessary, pose additional hazards, such as cave-ins, falling, and falling loads, etc., which may require additional safety measures be implemented. This alternative may require more significant safety measures at AOC R and SWMU 7 due to the steep slopes. Stability of the slopes and limitations of the excavation and back-filling equipment would need to be checked prior to implementation. Additional concerns associated with SWMU 6 include fluctuating water levels and potential swampy conditions in which excavation equipment

and other equipment may become stuck. As with Alternative #2, an MEC survey would need to be performed at all sites, as necessary, prior to field work.

Following implementation of Alternative 3, which includes post-removal action confirmation sampling to demonstrate that residual constituent levels do not pose an unacceptable level of risk, there would not be unacceptable risk to future onsite utility or construction workers.

4.1.3 Compliance with Chemical, Action and Location Specific ARARs

Chemical specific ARARs for removal include established background concentrations for Vieques Island and Region 9 PRGs. For the long-term monitoring associated with the soil cover alternative, chemical specific ARARs for monitoring data would likely be MCLs and/or PRGs. All other action-specific and location specific ARARs are summarized in **Appendix A**.

4.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

4.1.4.1 Alternative #1 – No Action

Alternative #1 is the No Action alternative; therefore, there would be no reduction of toxicity, mobility, or volume through this alternative.

4.1.4.2 Alternative #2 – Construction of Soil Cover and Long-term Monitoring

Alternative 2 does not include the removal of any waste from AOC J, AOC R, SWMU 6, and SWMU 7, which is the potential source of contamination. The sites would be covered with a soil cover, but the cover is intended primarily to prevent human contact with the wastes. Only a small reduction in toxicity (through isolation) is expected to be achieved by this alternative, because wastes will not be removed from the site. No reduction of volume would be achieved through this alternative. Mobility would be reduced by providing the soil cover over consolidated waste piles.

4.1.4.3 Alternative #3 – Excavation, Off-site Disposal and Site Restoration

Alternative 3 provides for removal of the wastes, the potential source of contamination, from all of the sites. Therefore, this alternative would provide for 100 percent reduction of toxicity, mobility, and volume of the waste.

4.1.5 Short-term Effectiveness

4.1.5.1 Alternative #1 – No Action

Alternative 1 does not provide any short term effectiveness at AOC J, AOC R, SWMU 6, and SWMU 7.

4.1.5.2 Alternative #2 – Construction of Soil Cover and Long-term Monitoring

Alternative #2 is effective in the short term by reducing the possibility of human contact with the waste and by providing LUCs/ICs to restrict access to and development of all the sites. Worker safety is a short term concern during implementation due to hazards associated with working around construction equipment. Public safety is another short term

hazard that would be addressed during implementation of this alternative. All areas of construction would be barricaded to prevent non-site workers from entering.

4.1.5.3 Alternative #3 – Excavation, Off-site Disposal and Site Restoration

Alternative 3 is effective in the short term at all the sites because the wastes are removed. Confirmation sampling will be conducted to ensure that the wastes are sufficiently removed from sites, so that the site may be restored.

Worker safety is a short term concern during implementation due to hazards associated with working around construction equipment. Public safety is another short term hazard that would be addressed during implementation of this alternative. All areas of excavation would be barricaded to prevent non-site workers from entering.

4.1.6 Long-term Effectiveness and Permanence

4.1.6.1 Alternative #1 – No Action

Alternative #1 does not provide any long-term effectiveness.

4.1.6.2 Alternative #2 – Construction of Soil Cover and Long-term Monitoring

Alternative 2 is effective in the long-term by effectively maintaining the cover system to reduce the possibility of human contact with the waste, and by providing LUCs/ICs to restrict access to and development of the site in the future. Implementation of this alternative leaves the long-term possibility for circumstances to arise that could affect human health or the environment (e.g., leaching of contaminants). The sites will also require long-term maintenance and monitoring to evaluate and ensure the effectiveness of this alternative.

4.1.6.3 Alternative #3 – Excavation, Off-site Disposal and Site Restoration

Alternative 3 is effective in the long-term because the wastes are removed. Confirmation sampling and/or visual verification will also be conducted to ensure that the wastes are sufficiently removed from the site, so that the site may be restored.

4.2 Implementability

The *ease of implementation* of a technology refers to the availability of commercial services to support it, the constructability of the technology under specific site conditions, and the acceptability of the technology to all parties involved (regulators, public, owner, etc.), including technical feasibility, administrative feasibility, availability of services, support agency acceptance, and community acceptance. Levels of implementability were assessed based upon the number of “implementability criteria” satisfied by each alternative summarized in **Table 4-1**.

4.2.1 Alternative #1 – No Action

Alternative #1 is the No Action alternative; therefore, Implementability does not apply.

4.2.2 Alternative #2 – Construction of Soil Cover and Long-term Monitoring

Alternative 2 would be the most complex alternative to implement. The construction phase of this alternative should take less than 1 year, and no significant construction concerns are associated with AOC J. Special construction concerns during the implementation of this alternative would be the steep slopes at AOC R and SWMU 7 and the varying tidal water levels and swamp conditions in SWMU 6. The steep slopes at AOC R and SWMU 7 could cause problems during the delivery, spreading, and compacting of the cover soil. Stability of the slopes, soil conditions, and associated limitations of the construction equipment would need to be understood prior to implementation. SWMU 6 has varying water levels due to the tidal influence, and part of the site is underwater during high tide. This could cause equipment to become stuck in soft soil, and there are safety concerns associated with working in or near standing water. Work may need to be scheduled during low tide times or cofferdams may need to be used to prevent the inflow of water. Also, the mobilization of equipment to Vieques Island may include additional costs, but should not be difficult to accomplish.

The more resource consuming part of this alternative would be the long-term maintenance and monitoring requirements expected to continue for 30 years (the monitoring would likely be required as long as the waste remains on site, but 30 years was assumed for the purpose of this estimate). This is assumed to include periodic sampling events and enforcement of LUCs and ICs. The ICs/LUCs may include deed notations, and physical devices such as gates and/or fences to restrict entrance to the sites. These physical controls would require regular monitoring to ensure their integrity.

4.2.3 Alternative #3 – Excavation, Off-site Disposal and Site Restoration

Alternative 3 is anticipated to have some concerns associated with implementation during the construction phase, but the overall implementation would be easier than that of Alternative 2. Further, after excavation, off-site disposal, and site restoration are completed, this alternative does not require LTM or the use of LUCs/ICs because the waste would be removed from the sites.

This alternative has the same construction concerns as Alternative 2, such as the steep slopes at AOC R and SWMU 7 and the inflow of water and swamp conditions at SWMU 6, which would make removing wastes from these sites difficult. However, all concerns are considered manageable.

There are also some concerns with the disposal of the wastes once excavated. Wastes would have to be either disposed on Vieques Island or shipped to mainland Puerto Rico for final disposal. If the waste is shipped to Puerto Rico, trucks would either have to unload onto a barge ship to transport the wastes, or each truck would have to be ferried over to mainland Puerto Rico, unloaded, and returned.

4.3 Cost

For the *detailed cost analysis* of alternatives, the expenditures required to complete each alternative were estimated in terms of capital costs, operation and maintenance (O&M) costs, LTM costs, and indirect costs. Capital costs include costs to complete initial

construction activities. O&M costs will be incurred to ensure the continued effectiveness of the remedial action. Costs were also estimated for a groundwater LTM program associated with Alternative 2. Indirect costs include engineering expenses, license or permit costs, and contingency allowances. By combining the different costs associated with each alternative, a present-worth calculation for each alternative can be made for comparison. Present worth calculations are based upon a 3.7 percent discount rate, applicable for 2005.

The costs estimated for this section are provided to an accuracy of +50 percent and -30 percent. The alternative cost estimates are in 2005 dollars and are based on information published by R.S. Means *Site Work and Landscape Cost Data* and *Environmental Cost, Handling, Options and Solutions (ECHOS)*. Where R.S. means data are not available or not applicable, phone quotes or engineering estimates are used for unit pricing. Please refer to **Appendix B** for all cost estimate details pertaining to each alternative discussed in the following subsections.

4.3.1 Alternative #1 – No Action

There are no costs associated with this alternative.

4.3.2 Alternative #2 – Construction of Soil Cover and Long-term Monitoring

The estimated total cost to complete the soil covers, site restorations, institute LUCs and ICs, and perform LTM at AOC J, AOC R, SWMU 6, and SWMU 7 for 30 years following construction is estimated to be \$1,552,000. This cost assumes each site can be completed with one equipment mobilization. If additional mobilizations are required, each is estimated at \$25,000. **Table B-2** in **Appendix B** contains a combined preliminary cost estimate for this alternative for AOC J, AOC R, SWMU 6, and SWMU 7.

4.3.3 Alternative #3 – Excavation, Off-site Disposal and Site Restoration

The capital cost to complete excavation, off-site disposal, backfilling, and site restoration at AOC J, AOC R, SWMU 6, and SWMU 7 with one mobilization for all four sites is estimated to be \$1,323,000. Mobilization costs were estimated at \$25,000; if the sites are not completed with one mobilization, additional costs will be incurred. **Table B-3** in **Appendix B** contains a preliminary cost estimate based on the assumption that disposal on mainland Puerto Rico is required. **Table B-4** in **Appendix B** is a comparison of Alternatives 1, 2, and 3, including a -30% to +50% contingency per the EE/CA guidance.

Comparative Analysis of Removal Action Alternatives

The relative effectiveness of each of the three alternatives was compared using the three criteria summarized in Section 4: effectiveness, implementability, and cost. In Section 4, these alternatives were evaluated according to their effectiveness (including protection of human health and the environment, compliance with ARARs to the extent practical, long-term effectiveness and permanence, reduction in toxicity, mobility or volume, and short-term effectiveness), ease of implementation (including technical feasibility, administrative feasibility, availability of services, support agency acceptance, and community acceptance), and cost. In this section, the alternatives are compared to one another for each of these three criteria.

Table 5-1 presents a relative comparison of these alternatives with respect to effectiveness, ease of implementation, and cost of each alternative for AOC J and AOC R, SWMU 6, and SWMU 7.

TABLE 5-1
Remedial Alternative Comparison, AOC J and AOC R, SWMU 6, and SWMU 7

Alternative	Effectiveness	Implementation	Cost
AOC R			
Alternative 1—No Action	Not Effective	Straightforward	No cost
Alternative 2—Soil Cover	Effective	Moderate	Most Expensive
Alternative 3—Excavation, Off-Site Disposal	Most Effective	Moderate	Moderate
AOC J			
Alternative 1—No Action	Not Effective	Straightforward	No cost
Alternative 2—Soil Cover	Effective	Moderate	Most Expensive
Alternative 3—Excavation, Off-Site Disposal	Most Effective	Moderate	Moderate
SWMU 7			
Alternative 1—No Action	Not Effective	Straightforward	No cost
Alternative 2—Soil Cover	Effective	Moderate	Most Expensive
Alternative 3—Excavation, Off-Site Disposal	Most Effective	Moderate	Moderate
SWMU 6			
Alternative 1—No Action	Not Effective	Straightforward	No cost
Alternative 2—Soil Cover	Effective	Moderate	Most Expensive
Alternative 3—Excavation, Off-Site Disposal	Most Effective	Moderate	Moderate

Alternative 1, no action, is not effective in that it does not accomplish the goals of addressing the uncertainty of the debris being a potential future source of contamination. Although this alternative is easy to implement, and has no cost associated with it, it is not a desirable alternative because the RAO is not met for AOC J, AOC R, SWMU 6, and SWMU 7.

Alternative 2, construction of a soil cover and implementation of LUCs/ICs and LTM, is effective in reducing potential risks to human health and the environment and has a moderate ease to implement. However, this alternative is not as effective as Alternative 3, especially over the long-term. Additionally, Alternative 2 has the highest cost associated with implementation at AOC J, AOC R, SWMU 6, and SWMU 7 due the need for long-term maintenance/monitoring at the sites following implementation of the alternative. Direct excavation at AOC J, AOC R, SWMU 6, and SWMU 7 would eliminate potential risks to human health and the environment because the wastes, the source of potential contamination, would be removed from the sites. Although Alternative 3 has moderate concerns associated with implementation, it is less costly to implement and the overall short-term effectiveness, long-term effectiveness and permanence of this approach makes it the most desirable alternative.

Recommended Removal Action Alternative

This EE/CA was prepared in accordance with current US EPA and DoN guidance documents for a NTCRA under CERCLA. The purpose of this EE/CA was to identify and analyze alternatives to address waste (i.e., debris and soil containing debris) currently present at AOC J, AOC R, SWMU 6, and SWMU 7. Three alternatives were evaluated: no action; construction of a soil cover and LTM; and excavation, off-site disposal, and site restoration.

The comparative analysis of the alternatives comprised evaluating the effectiveness, implementability, and cost of each. The evaluation of effectiveness comprised 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 objectives. Implementability evaluation comprised assessing the technical feasibility, availability, and administrative feasibility; support agency acceptance, and probable community acceptance of the alternatives. The evaluation of cost included an estimate of capital cost.

Based on the comparative analysis of the removal alternatives completed in Section 5, the recommended removal action for AOC J, AOC R, SWMU 6, and SWMU 7 is Alternative 3, excavation, off-site disposal, and site restoration. Alternative 3 is the preferred alternative for AOC J and AOC R, SWMU 6, and SWMU 7 because of its high level of efficiency in meeting the RAO, its moderate ease of implementation, the lack of LTM requirements and subsequent O&M, and its moderate cost. Implementation of Alternative 3 may result in no further action necessary and unrestricted land use if confirmatory data show acceptable constituent levels.

References

- CH2M HILL, March 2004. *Remedial Investigation Report Solid Waste Management Unit (SWMU) 7*, Former Ammunition Naval Support Detachment, Vieques Island, Puerto Rico.
- CH2M HILL, April 2004. *Remedial Investigation Report Area of Concern (AOC) J*, Former Ammunition Naval Support Detachment, Vieques Island, Puerto Rico.
- CH2M HILL, April 2004. *Remedial Investigation Report Solid Waste Management Unit (SWMU) 6*, Former Ammunition Naval Support Detachment, Vieques Island, Puerto Rico.
- CH2M HILL, January 2005. *Remedial Investigation/Feasibility Study Work Plan for AOC R*, Former Ammunition Naval Support Detachment, Vieques Island, Puerto Rico.
- CH2M HILL, November 2002. *Expanded Preliminary Assessment/Site Investigation Phase II Seven Sites*, Former Ammunition Naval Support Detachment, Vieques Island, Puerto Rico.
- CH2M HILL, October 2002. *Final Soil, Groundwater, Surface Water, and Sediment Background Investigative Report for NASD*, Former Ammunition Naval Support Detachment, Vieques Island, Puerto Rico.
- Geo-Marine, August 2000. *Habitat Characterization of Solid Waste Management Unit (SWMU) 4, SWMU 5, SWMU 6, SWMU 7, and the Public Works Area*. Naval Ammunition Support Detachment (NASD) Vieques Island, Puerto Rico.
- Greenleaf/Telesca Planners, Engineers, Architects, Inc. and Ecology and Environment, Inc., September 1984. *Initial Assessment Study*, Naval Station Roosevelt Roads, Puerto Rico.
- USEPA, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), <http://www4.law.cornell.edu/uscode/42/ch103.html>
- USEPA, 1993. *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA*, PB93-963402. August 1993.
- USEPA, National Contingency Plan (NCP), <http://www.epa.gov/oilspill/lawsregs.htm>
- USEPA, Superfund Amendments and Reauthorization Act of 1986 (SARA), <http://www4.law.cornell.edu/uscode/42/ch103.html>
- United States Geological Survey, November 1989. *Water Resources Investigation, Reconnaissance of the Groundwater Resources of Vieques Island, Puerto Rico*. Report 86-4100 (by Sigfredo Torres-Gonzalez).

Appendix A

ARARs

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References

- EQB, *Regulation for the Control of Hazardous and Non-Hazardous Solid Waste*, #2863, Office of the Governor, Puerto Rico, November 13, 1980 (Rule 503.A.).
- EQB, *Regulation for the Management of Non-Hazardous Solid Waste*, #5717, Office of the Governor, Puerto Rico, December 17, 1997 (Rule 512.A.).
- Fidler Gonzalez & Rodriguez, PSC, *Puerto Rico Environmental Law Handbook*, Third Edition, 2003.
- King & Spalding, *The Resource Conservation and Recovery Act*, white paper, 1990.
- The Resource Conservation and Recovery Act of 1976*, BNA, 1988.
- U. S. EPA, *RCRA Orientation Manual*, OSWER, 2003

**Table A-1
Federal Location-Specific ARARs
AOC J, AOC R, SWMU 6, and SWMU 7 at the former NASD at Vieques Island, Puerto Rico**

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comment
Protection of Floodplain*					
Within floodplain	Actions taken should avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial values.	Action that will occur in a floodplain (i.e., lowlands and relatively flat areas adjoining inland and coastal waters and other flood-prone areas).	40 CFR Part 6, Appendix A; excluding Sections 6(a)(2), 6(a)(4), 6(a)(6); 40 CFR 6.302	Applicable	Removal activities may require compliance with this order. Measures required may include erosion control.
Protection of Wetlands*					
Wetland	Action to minimize the destruction, loss, or degradation of wetlands.	Wetland as defined by Executive Order 11990 Section 7.	40 CFR 6, Appendix A; excluding Sections 6(a)(2), 6(a)(4), 6(a)(6); 40 CFR 6.302	Relevant and Appropriate	Federal or Puerto Rico regulated wetlands are present. Nationwide Permit No. 38 allows for activities in wetlands to contain, stabilize, or remove hazardous or toxic materials. "Notification" is required to the District Engineer and the wetlands on the site should be delineated. Activities undertaken entirely on a CERCLA site by authority of CERCLA, as approved or required by EPA, are not required to obtain permits under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act, although the substantive requirements of these permits shall be met. NWP 38 notification will put in place coordination with natural resource and historic resource trustees regarding the potential to adversely affect threatened and endangered species and sites protected under the National Historic Preservation Act.

**Table A-1
Federal Location-Specific ARARs
AOC J, AOC R, SWMU 6, and SWMU 7 at the former NASD at Vieques Island, Puerto Rico**

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comment
Clean Water Act, Section 404*a					
Wetland	Action to prohibit discharge of dredged or fill material into wetland without permit.	Wetland as defined by Executive Order 11990 Section 7.	40 CFR 230.10; 40 CFR 231 (231.1, 231.2, 231.7, 231.8)	Relevant and Appropriate	Non-time critical removal action may include removal and restoration of wetland sediments. Activities undertaken entirely on a CERCLA site by authority of CERCLA, as approved or required by EPA, are not required to obtain permits under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act, although the substantive requirements of these permits shall be met.
Endangered Species Act of 1978*					
Endanger- ed species	Action to ensure that any action is not likely to jeopardize the continued existence of endangered or threatened species or adversely affect its critical habitat.	Applies to actions that affect endangered or threatened species or their habitat.	16 USC 1531 50 CFR Part 402	Relevant and Appropriate	Except for the occasional transient individuals, no federally listed or proposed endangered species are known to exist at AOC J, AOC R, SWMU 6, and SWMU 7. A Section 7 Consultation with US Fish and Wildlife Service (if necessary) will be completed under this ARAR.
Federal Fish and Wildlife Conservation Act					
Fish and Wildlife	Requires that activities avoid, minimize, or compensate for impacts to fish and wildlife and their habitats.	Applies to actions that affect fish and wildlife and their habitat.	16 USC §662 et seq.	Relevant and Appropriate	Site Restoration at AOC J, AOC R, SWMU 6, and SWMU 7, including the tidally influenced wetland area of SWMU 6, will provide enhanced habitat for fish and wildlife species.

**Table A-1
Federal Location-Specific ARARs
AOC J, AOC R, SWMU 6, and SWMU 7 at the former NASD at Vieques Island, Puerto Rico**

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comment
Coastal Zone and Management Act					
Coastal Zone	Requires that activities conducted within a coastal zone be consistent with an approved state management program.	Applies to sites located within a coastal zone.	16 USC §1451 et seq.	Relevant and Appropriate	AOC J, AOC R, SWMU 6, and SWMU 7 and surrounding vicinity are located within the coastal zone. Activities will be conducted in accordance with applicable management program(s).
National Historical Preservation Act (NHPA) of 1966 and Archaeological Resources Protection Act of 1979					
Historical Locations and Archaeological Artifacts	Provides for the recovery and preservation of historical and archaeological significant artifacts. Implementing regulations for NHPA (36 CFR Part 65) establish the National Register of Historic Places and provide for preservation of historic properties and minimization of damage to historic landmarks.	Applies to historical properties and landmarks, and archaeological artifacts.	NHPA: 16 USC §470; 36 CFR Part 65. Archaeological Resources Protection Act.	Relevant and Appropriate	Based upon historical site use and filling activities that were conducted in the vicinity, it is not likely that historical landmarks or artifacts exist at AOC J, AOC R, SWMU 6, and SWMU 7 and surrounding vicinity.
<p>* 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 Navy accepts the entire statutes or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs.</p> <p>ARARs - Applicable or relevant and appropriate requirements CFR - Code of Federal Regulations NWP - Nationwide Permit USC - United States Code</p>					

Table A-2
Puerto Rico Location-Specific ARARs
AOC J, AOC R, SWMU 6, and SWMU 7 at the former NASD at Vieques Island, Puerto Rico

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comment
Puerto Rico Water Control Laws and Puerto Rico Wetlands Regulations*					
Coastal Zone Management Act; NOAA Regulations of Federal Consistency with approved State Coastal Zone Management Programs (Natural Patrimony Program Law of Puerto Rico)					
Within coastal zone	Conduct activities within a coastal Management Zone in a manner consistent with local requirements.	Activities conducted at Natural Reserves and Special Areas of Planification	Section 307(c) of 16 USC 1456(c); also see 15 CFR 930 and 923.45	Relevant and Appropriate	AOC J, AOC R, SWMU 6, and SWMU 7 are located in the Coastal Zone, but are not located in areas classified as Natural Reserves or Special Areas of Planification.
Magnuson-Stevens Fishery Conservation and Management Act (1996)					
Essential fish habitat (EFH)	Federal agencies must consult with NOAA NMFS regarding any action they authorize, fund or undertake that may adversely affect EFH.	Activities that may adversely affect EFH	Public Law 94-265	TBC	The mangrove estuary east of AOC J and the mangrove swamp, tidal marsh area and lagoons within SWMU 6 are considered EFH.

Table A-2
Puerto Rico Location-Specific ARARs
AOC J, AOC R, SWMU 6, and SWMU 7 at the former NASD at Vieques Island, Puerto Rico

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comment
<p>* 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 Navy accepts the entire statutes or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs.</p> <p>ARARs - Applicable or relevant and appropriate requirements</p> <p>CFR - Code of Federal Regulations</p> <p>CWA - Clean Water Act</p> <p>EFH - Essential Fish Habitat</p> <p>NOAA - National Oceanic and Atmospheric Administration</p> <p>NMFS - National Marine Fisheries Service</p> <p>TBC - To Be Considered</p> <p>USACE - United States Army Corps of Engineers</p> <p>VAC - Virginia Administrative Code</p> <p>VDEQ - Virginia Department of Environmental Quality</p>					

Table A-3
Puerto Rico Action-Specific ARARs
AOC J, AOC R, SWMU 6, and SWMU 7 at the former NASD at Vieques Island, Puerto Rico

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comment
Puerto Rico Environmental Impact Statement Regulations*					
Environmental Impact Statements	Regulations to establish content requirements and administrative procedures for complying with the Environmental Impact Statement (EIS) procedure required by the Environmental Public Policy A	Determination of whether or not actions will have a significant environmental impact in the normal course of their activities	Regulation on Puerto Rico Environmental Impact Statement	Not Applicable	Proposed removal actions do not trigger the requirement to perform an Environmental Impact Statement at AOC J, AOC R, SWMU 6, and SWMU 7.
Puerto Rico Pollutant Discharge Elimination System (PRPDES) Permit Regulations*					
Discharge of Treated Water to Surface Waters	Regulates point-source discharges. Permit requirements include compliance with corresponding water quality standards, establishment of a discharge monitoring system, and completion of regular discharge monitoring records.	Applicable to point source discharge of water to surface water. Does not include storm water discharges.	Puerto Rico Water Quality Standards Regulations, Puerto Rico Regulation 4282.	Not Applicable	AOC J, AOC R, SWMU 6, and SWMU 7 currently do not have any NPDES Permits or direct discharges to surface waters. Storm water discharges are not covered under this regulation

Table A-3
Puerto Rico Action-Specific ARARs
AOC J, AOC R, SWMU 6, and SWMU 7 at the former NASD at Vieques Island, Puerto Rico

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comment
Puerto Rico Underground Injection					
Underground Injection Control	A set of rules for the protection, conservation and maintenance of underground water resources. The Regulation establishes a permit system which controls the disposal of industrial and domestic wastes through injection wells (by pressure or gravity flow) as well as through multi-family and non-residential septic tanks and other systems, or through sinkholes or natural drainage cavities. The Regulation also controls the underground storage of fluids in tanks.	Applicable to underground injection facilities.	Underground Injection Control Regulations, Puerto Rico Regulation 3029.	Not Applicable	No underground injection will take place as part of the proposed removal actions at AOC J, AOC R, SWMU 6, or SWMU 7
Puerto Rico Control of Noise					
Noise Control Requirements	These regulations define requirements for the management and control of noise pollution.	Applicable to any activity which may include site preparation, demolition, removal, or disposal, excavation, occurring on premises, right-of-ways, public or private structures or similar property.	Regulation for the Control of Noise Pollution, Puerto Rico Regulation 3418	Applicable	Applicable to management of noise during waste removal and site restoration activities at AOC J, AOC R, SWMU 6, and SWMU 7.

Table A-3
Puerto Rico Action-Specific ARARs
AOC J, AOC R, SWMU 6, and SWMU 7 at the former NASD at Vieques Island, Puerto Rico

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comment
Puerto Rico Certification of Blueprints and Documents					
Certification of all Blueprints and Documents	The certification of blueprints and documents by a responsible professional must be submitted to the Environmental Quality Board prior to the issuance of permits.	Blueprints and documents submitted in support of Control of Erosion and Sedimentation Permits, Fugitive Dust Permits, etc.	Regulation for the Certification of Plans and Documents before The Environmental Quality Board, Puerto Rico Regulation 4209	Applicable	Applicable to blueprints and documents to meet the substantive requirements of permits for removal alternatives associated with AOC J, AOC R, SWMU 6, and SWMU 7, such as for Control of Erosion and Sedimentation Permit.
Puerto Rico Underground Storage Tank (UST) Regulations					
UST Management and Requirements	These regulations define the requirements for the management of USTs.	A UST must be present on site	Underground Storage Tank Control Regulations, Puerto Rico Regulation 4362	Not Applicable	No USTs are expected to be present at AOC J, AOC R, SWMU 6, and SWMU 7.
Puerto Rico Hazardous Waste and Non-Hazardous Solid Waste Regulations					
Hazardous Waste Staging Transport, and Disposal	These regulations and laws define the requirements for the management of hazardous wastes.	Wastes must meet definition of hazardous waste.	Regulation for the Control of Hazardous and Non-Hazardous Solid Waste, Puerto Rico Regulation 2863.	Relevant and Appropriate	Soil, sediment, and debris excavated during the removal action at AOC J, AOC R, SWMU 6, and SWMU 7 will be characterized for disposal. Existing data indicate waste will be non-hazardous; however, any identified hazardous waste will be managed accordingly.

Table A-3
Puerto Rico Action-Specific ARARs
AOC J, AOC R, SWMU 6, and SWMU 7 at the former NASD at Vieques Island, Puerto Rico

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comment
Solid Waste Staging Transport, and Disposal	These regulations and laws define the requirements for the management of solid wastes, including the submittal of a Non-Hazardous Solid Waste Operating Plan. Any disposal facility must be properly permitted and in compliance with all operational and monitoring requirements of the permit and regulations.	Wastes must meet definition of solid waste.	Regulation for the Control of Hazardous and Non-Hazardous Solid Waste, Puerto Rico Regulation 2863	Applicable	Applicable to management and staging, transportation, and off-site disposal of any debris classified as a solid waste at AOC J, AOC R, SWMU 6, and SWMU 7.
Puerto Rico Solid Waste Management Regulations					
Solid Waste Staging Transport, and Disposal	These regulations and laws define the requirements for the management of solid wastes. Any disposal facility must be properly permitted and in compliance with all operational and monitoring requirements of the permit and regulations.	Wastes must meet definition of solid waste.	Regulation for the Management of Non-Hazardous Solid Waste, Puerto Rico Regulation 5717	Applicable	Applicable to management and staging, transportation, and off-site disposal of any debris classified as a solid waste.
Puerto Rico Air Pollution Control Regulations*					
Discharge to air	Puerto Rico Ambient Air Quality Standards - standards for ambient air quality to protect public health and welfare (including standards for particulate matter and lead).	Contamination of air affecting public health and welfare.	Regulation For The Control Of Atmospheric Pollution Of The Commonwealth Of Puerto Rico., Puerto Rico Regulation 5300	Applicable	Applicable for all site removal activities that may generate air discharges. No discharges to air are anticipated other than fugitive dust.

Table A-3
Puerto Rico Action-Specific ARARs
AOC J, AOC R, SWMU 6, and SWMU 7 at the former NASD at Vieques Island, Puerto Rico

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comment
Discharge of visible emissions and fugitive dust	Fugitive dust/emissions may not be discharged to the atmosphere at amounts in excess of standards.	Any source of fugitive dust/emissions.	Regulation For The Control Of Atmospheric Pollution Of The Commonwealth Of Puerto Rico., Puerto Rico Regulation 5300	Applicable	Applicable for any site removal activities that generate fugitive dust.
Discharge of toxic pollutants	Toxic pollutants may not be discharged to the atmosphere at amounts in excess of standards.	Any source of toxic pollutants	Regulation For The Control Of Atmospheric Pollution Of The Commonwealth Of Puerto Rico., Puerto Rico Regulation 5300	Not Applicable	No toxic air pollutants are anticipated as part of this NTCRA.
Puerto Rico Regulation for the Control of Erosion and Prevention of Sedimentation					
Erosion / Sediment Control	Regulates erosion / sedimentation control practices and management, including a Control of Erosion and Sediment (CES) Plan and a CES Permit.	Land disturbing activities.	Regulation for the Control of Erosion and Prevention of Sedimentation, Puerto Rico Regulation 5754	Applicable	Applicable for any site removal activities resulting in possible erosion and sedimentation. The NTCRA will include meeting the substantive requirements for erosion and sediment control including a CES Plan and CES Permit.
<p>* Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs. Specific ARARs are addressed in the table below each general heading.</p> <p>ARAR - Applicable or relevant and appropriate requirement</p> <p>CFR - Code of Federal Regulations</p> <p>NTCRA - Non-time critical removal action</p> <p>TBC - To Be Considered</p>					

**Table A-4
Federal Chemical-Specific ARARs
AOC J, AOC R, SWMU 6, and SWMU 7 at the former NASD at Vieques Island, Puerto Rico**

Requirement	Prerequisite	Citation	ARAR Determination	Comment
Soil				
Toxicity Characteristic Leaching Procedure (TCLP) regulatory levels	Hazardous waste treatment, storage, or disposal	40 CFR Section 261.24	Applicable	Waste characterization sampling will be completed to confirm waste characteristics. Hazardous waste is not anticipated. All debris and soil are expected to be non-hazardous.
Definition of RCRA Hazardous Waste	Waste soil	40 CFR Sections 261.21, 261.22(a)(1); 261.23; 261.24(a)(1); and 261.100	Applicable	Waste characterization sampling will be completed to confirm waste characteristics. Hazardous waste is not anticipated. All debris and soil are expected to be non-hazardous.
Chemical-specific risk-based concentration preliminary remediation goals (PRGs) screening levels	CERCLA site	EPA Region IX PRG Tables	TBC	Site concentrations are screened against PRGs as a preliminary indicator of the presence of risk. Background concentrations will be used to screen out those constituents found at background levels exceeding applicable screening values.
Groundwater				
National primary drinking water standards are health-based standards for public water systems (maximum contaminant levels [MCLs]).	Public water system	40 CFR Part 141 Subparts B & G	TBC	Long term groundwater monitoring would require comparison criteria.
Risk Based Concentrations (RBCs) or Preliminary Remediation Goals (PRGs)	Public water system	EPA Region IX RBC/PRG Tables	TBC	Long term groundwater monitoring would require comparison criteria.
Surface Water				

Table A-4
Federal Chemical-Specific ARARs
AOC J, AOC R, SWMU 6, and SWMU 7 at the former NASD at Vieques Island, Puerto Rico

Requirement	Prerequisite	Citation	ARAR Determination	Comment
Ambient Water Quality Criteria	Surface Waters of the US	40 CFR Parts 130 and 131 Subparts B & D	TBC	All surrounding bodies of water are classified as recreational.
<p>* Listing the statutes and policies does not indicate that Navy accepts the entire statutes or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs.</p> <p>ARARs - Applicable or relevant and appropriate requirements</p> <p>CFR - Code of Federal Regulations</p> <p>NWP - Nationwide Permit</p> <p>USC - United States Code</p>				

**Table A-5
Puerto Rico Chemical-Specific ARARs
AOC J, AOC R, SWMU 6, and SWMU 7 at the former NASD at Vieques Island, Puerto Rico**

Requirement	Prerequisite	Citation	ARAR Determination	Comment
Soil				
PREQB TPH screening values	TPH screening criteria	PR EQB UST Control Regulation Rule 205	TBC	Soil imported to the site must meet the screening criteria for TPH to be considered clean fill.
Groundwater				
Puerto Rico Water Quality Standards	Maximum allowable concentrations in surface, estuarine and groundwater	PR Water Quality Standards Regulation 3.1.9(A)	TBC	Long term groundwater monitoring would require comparison criteria.
<p>* Listing the statutes and policies does not indicate that Navy accepts the entire statues or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs.</p> <p>ARARs - Applicable or relevant and appropriate requirements</p> <p>PR EQB - Puerto Rico Environmental Quality Board</p> <p>TBC - To Be Considered</p> <p>TPH - Total Petroleum Hydrocarbons</p> <p>UST - Underground Storage Tank</p>				

Appendix B
Cost Estimate

**TABLE B-1
COST ESTIMATE
WASTE AREA AND VOLUME CALCULATIONS**

Site: SWMU 7, SWMU 6, AOC J, AOC R
Location: Former Naval Installation, Vieques, Puerto Rico
Phase: Engineering Evaluation/Cost Analysis

Notes: Waste areas and above ground waste volumes estimated from visual site assessment on April 17th, 2005. For each area it is assumed that the waste extends into the ground approximately 2 ft. Actual extend of waste will be confirmed during construction. A 30% contingency factor was also added to the volumes to account for unknown waste quantities.

Date: 5-May-05

CALCULATIONS

Individual Site Areas:

		AREA	@	DEPTH	VOLUME	VOLUME	VOLUME (+30% contingency)	NOTES
AOC-J AREA	90ftx30ftx1ft =	2700 SF	@	3 FT	8100 CF	300 CY	390 CY	Scrap metal debris, metal cans, bottles
AOC-R AREA	100ftx20ftx2ft =	2000 SF	@	5 FT	10000 CF	370 CY	481 CY	Quebrada dumping area
	10ftx10ftx6ft =	100 SF	@	8 FT	800 CF	30 CY	39 CY	Corrugated Roofing
	20ftx5ftx2ft =	100 SF	@	4 FT	400 CF	15 CY	19 CY	Power Poles
	6ftx6ftx4ft =	36 SF	@	6 FT	216 CF	8 CY	10 CY	Bombs
	TOTALS	2236 SF			11416 CF	423 CY	550 CY	
SWMU-6	165ftx10ftx2ft =	1650 SF	@	4 FT	6600 CF	244 CY	318 CY	Main dump area - rusted metal, bottles, car parts, cans, tires
	10ftx10ftx6ft =	100 SF	@	8 FT	100 CF	4 CY	5 CY	Concrete filled bombs
	TOTALS	1750 SF			6700 CF	248 CY	323 CY	
SWMU-7	420ftx30ftx3ft =	12600 SF	@	5 FT	37800 CF	1400 CY	1820 CY	Main dump area - 100's of tires, rocket launchers, sea mines, general waste debris
	TOTAL	19286 SF			64016 CF	2371 CY	3082 CY	

**TABLE B-2
COST ESTIMATE
ALTERNATIVE 2 - SOIL COVER AND ASSOCIATED MONITORING**

Site: SWMU 7, SWMU 6, AOC J, and AOC R
Location: Former Naval Installation, Vieques, Puerto Rico
Phase: Engineering Evaluation/Cost Analysis
Date: 2-May-05
Description: Construction of 2-foot soil cap, post-construction re-vegetation where possible (site restoration), along with post-closure requirements including long-term groundwater monitoring and implementation of land use controls (LUCs)/institutional controls (ICs).

CALCULATIONS

Individual Site Areas:

AOC J Area =	2700 SF
SWMU 7 Area =	12600 SF
SWMU 6 Area =	1750 SF
AOC R Area =	2236 SF
TOTAL AREA	19286 SF

Soil Requirements:

Soil Cover Thickness =	2 FT			
AOC J Area =	5400 CF	200	CY	360 TONS
SWMU 7 Area =	25200 CF	933	CY	1680 TONS
SWMU 6 Area =	3500 CF	130	CY	233 TONS
AOC R Area =	4472 CF	166	CY	298 TONS

Total Volume of Soil Required (Area x Depth) = 38572 CF
 = 1429 CY
 Assumed soil weight = 1.8 TONS/CY
Total Cap Material Required = 2571 TONS

CAPITAL COSTS

Description	Qty	Unit	Unit Cost	Total Cost	Notes
Mobilization	1	EA	\$20,000.00	\$20,000	Engineer's Estimate from recent bid at Vieques
Demobilization	1	EA	\$7,500.00	\$7,500	Engineer's Estimate from recent bid at Vieques
Site Preparation					
Removal of brush, trees, stumps, w/in identified areas and collection of debris	0.44	ACRE	\$30,000.00	\$13,282	Engineer's Estimate
Soil Cover					
Soil material (includes haul, spread, compaction)	1,429	CY	\$80.00	\$114,287	Engineer's estimate from recent bid
Soil cover characterization sampling (includes shipping costs)	15	EA	\$450.00	\$6,750	Average quotes from US labs
Site Restoration					
Revegetation w/ native plant species (includes materials and installation labor)	19286	SF	\$1.25	\$24,108	Engineer's estimate from recent bid
Erosion Control (includes materials and installation labor)	19286	SF	\$0.75	\$14,465	Engineer's estimate from recent bid
Long Term Groundwater Monitoring					
Monitoring well construction	0	WELLS	\$9,500.00	\$0	Assumption: no new monitoring wells are required
Institutional Controls					
Establish institutional controls (fencing, signs, deed restrictions)	1	UNIT	\$10,000.00	\$10,000	Engineer's estimate
SUBTOTAL				\$210,392	
Contingency				\$84,157	Engineer's estimate
SUBTOTAL				\$294,548	
Construction Management				\$44,182	
Engineering Services During Construction				\$8,836	Source: Typical percentage for CH2M HILL government cost estimates
Conceptual Work Plans				\$8,836	
Design				\$17,673	
Work Plans, As Builts, Final Reports				\$8,836	
Project Management				\$29,455	
G&A				\$32,400	
Fee				\$17,673	

TOTAL CAPITAL COST \$462,441

OPERATION AND MAINTENANCE COSTS (Year 1)

Long Term Groundwater Monitoring					
Groundwater sampling (labor)	1	EVENT	\$9,520.00	\$9,520	Engineer's estimate, 25 MW's, annual sampling
Groundwater sampling (hotel/per diem)	6	DAYS	\$300.00	\$1,800	Engineer's estimate, \$150/day/person
Groundwater sampling (travel)	1	EVENT	\$1,400.00	\$1,400	Engineer's estimate, \$700/roundtrip flight/person
Groundwater sampling (Equipment)	1	EVENT	\$750.00	\$750	Engineer's estimate from experience
Laboratory analysis (including shipping)	31	SAMPLES	\$740.00	\$22,940	Average quotes from US labs (analytical includes Volatiles, Semi-volatiles, Pest/PCB, Metals)
Annual Report	1	UNIT	\$2,500.00	\$2,500	Engineer's estimate
SUBTOTAL				\$38,910	
Soil Cover Monitoring					
Mowing areas	6	EA	\$1,000.00	\$6,000	Engineer's Estimate from experience, 1 mowing every 2 months
Monitoring and upkeep of erosion control materials	6	EA	\$1,000.00	\$6,000	Engineer's Estimate, 1 inspection every 2 months for the 1st year
SUBTOTAL				\$12,000	
SUBTOTAL				\$50,910	
Contingency				\$20,364	
SUBTOTAL				\$71,274	
Project Management				\$4,276	

TOTAL ANNUAL OPERATION AND MAINTENANCE COST (Year 1) \$75,550

OPERATION AND MAINTENANCE COSTS (Years 2-30)

Long Term Groundwater Monitoring					
Groundwater sampling (labor)	1	EVENT	\$9,520.00	\$9,520	Engineer's estimate, 25 MW's, annual sampling
Groundwater sampling (hotel/per diem)	6	DAYS	\$300.00	\$1,800	Engineer's estimate, \$150/day/person
Groundwater sampling (travel)	1	EVENT	\$1,400.00	\$1,400	Engineer's estimate, \$700/roundtrip flight/person
Groundwater sampling (Equipment)	1	EVENT	\$750.00	\$750	Engineer's estimate from experience
Laboratory analysis (including shipping)	31	SAMPLES	\$740.00	\$22,940	Average quotes from US labs (analytical includes Volatiles, Semi-volatiles, Pest/PCB, Metals)
Annual Report	1	UNIT	\$2,500.00	\$2,500	Engineer's estimate
SUBTOTAL				\$38,910	
Contingency				\$15,564	Engineer's estimate
SUBTOTAL				\$54,474	
Project Management				\$3,268.44	

TOTAL ANNUAL OPERATION AND MAINTENANCE COST (Years 2-30) \$57,742

PRESENT VALUE ANALYSIS

i = 0.037
t = 1
t = 29

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor (3.7%)	Present Value	
Capital	0	\$462,441	\$462,441	1.000	\$462,441	
O&M	1	\$75,550	\$75,550	0.964	\$72,855	
O&M	2-30	\$1,674,531	\$57,742	17.603	\$1,016,468	
		<u>\$2,212,522</u>			<u>\$1,551,764</u>	

*Discount factor established per "Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis", OSWER Directive No. 9355.3-20, June 25, 1993.

TOTAL PRESENT VALUE OF ALTERNATIVE \$1,552,000

ASSUMPTIONS

- 1) Clearing and Grubbing
 - * Does not require removal of larger trees - soil can be placed around these areas
 - * All brush and smaller trees will be mulched and used onsite for revegetation purposes
- 2) Backfill Sampling
 - * Assume 1 backfill characterization sample per 100 CY, or 11 samples + 4 field duplicates (15 total) for all 4 sites, analysis will include SVOCs (\$200), PCB's (\$78), TPH (\$50), and VOCs (\$100)
- 3) Groundwater Sampling
 - * Assume 2 field technicians at \$85/hr
 - * Assume 2 hours per well 4 wells/day, 3 hours mob/demob
 - * Total # of wells = 25 + 6 field duplicates (31 total) for all 4 sites, and assumes analysis will include VOCs (\$100), Pest/PCB's (\$130), SVOCs (\$200), and Total & Diss. Metals (\$280)
 - * Actual Long term Monitoring requirements will need to be negotiated by the Navy. Conservative assumptions included herein.
- 4) Soil Cover Maintenance
 - * Assume that cap will be mowed once every 2 months
 - * Assume annual cost for potential cap and erosion control repairs
 - * Assume vegetation will only be mowed/monitored for the 1st year or until vegetation is established

**TABLE B-3
COST ESTIMATE
ALTERNATIVE 3 - EXCAVATION OF MATERIALS INCLUDING SUBSEQUENT SITE RESTORATION (DISPOSAL ON VIEQUES ISLAND)**

Site: SWMU 7, SWMU 6, AOC J, AOC R
Location: Former Naval Installation, Vieques, Puerto Rico
Phase: Engineering Evaluation/Cost Analysis
Date: 2-May-05
Description: Direct excavation of waste, including all buried debris and impacted soils, with disposal of materials at an approved location on Vieques Island Upon removal of all contaminated soils, the excavated areas would be replaced with a "clean" backfill and revegetated with native plant species.

CALCULATIONS

Individual Site Areas:

AOC J Area =	2700 SF	Waste areas estimated from visual site assessment on April 17th, 2005
SWMU 7 Area =	12600 SF	Waste areas estimated from visual site assessment on April 17th, 2005
SWMU 6 Area =	1750 SF	Waste areas estimated from visual site assessment on April 17th, 2005
AOC R Area =	2236 SF	Waste areas estimated from visual site assessment on April 17th, 2005
TOTAL AREA	19286 SF	

Waste Volumes to be removed from each site:

AOC J =	390 CY	Waste volumes estimated from visual site assessment on April 17th, 2005. Extend of waste below ground was assumed to be 2 feet.
SWMU 7 =	1820 CY	Waste volumes estimated from visual site assessment on April 17th, 2005. Extend of waste below ground was assumed to be 2 feet.
SWMU 6 =	323 CY	Waste volumes estimated from visual site assessment on April 17th, 2005. Extend of waste below ground was assumed to be 2 feet.
AOC R =	550 CY	Waste volumes estimated from visual site assessment on April 17th, 2005. Extend of waste below ground was assumed to be 2 feet.
TOTAL VOLUME	3082 CY	
@	1.8 TONS/CY	
TOTAL TONNAGE	5548 TONS	

Site Restoration Soil Requirements:

General Backfill Material

AOC J =	357 CY	*General backfill will be used to backfill excavations to 4" below original grade
SWMU 7 =	832 CY	*General backfill will be used to backfill excavations to 4" below original grade - SWMU 7 will only require approx. 50% of backfill due to slopes
SWMU 6 =	301 CY	*General backfill will be used to backfill excavations to 4" below original grade
AOC R =	522 CY	*General backfill will be used to backfill excavations to 4" below original grade
TOTAL =	2012 CY	

Topsoil Backfill Material

AOC J =	33 CY	*Top 4" of backfill will be topsoil
SWMU 7 =	156 CY	*Top 4" of backfill will be topsoil
SWMU 6 =	22 CY	*Top 4" of backfill will be topsoil
AOC R =	28 CY	*Top 4" of backfill will be topsoil
TOTAL =	238 CY	

CAPITAL COSTS

Description	Qty	Unit	Unit Cost	Total Cost	Notes
Mobilization	1	EA	\$25,000.00	\$25,000	Engineer's Estimate from recent bid at Vieques
Demobilization	1	EA	\$10,000.00	\$10,000	Engineer's Estimate from recent bid at Vieques
Site Preparation					
Removal of brush, trees, stumps, w/in identified areas	0.44	ACRE	\$35,000.00	\$15,496	Engineer's Estimate
Site Remediation					
Removal of wastes from site (includes excavation, transportation, and disposal)	5548	TONS	\$85.00	\$471,585	Engineer's estimate from recent projects. Cost assumes waste will be disposed on Vieques Island.
Waste characterization sampling (includes shipping costs)	26	EA	\$968.00	\$25,168	Average quotes from US labs
Confirmation sampling following excavation (includes shipping costs)	20	EA	Varies	\$11,800	Average quotes from US labs
Site Restoration					
General Backfill Material (including transporation, spreading, and compaction)	2012	CY	\$80.00	\$160,954	
Topsoil Backfill Material (including transporation, spreading, and compaction)	238	CY	\$85.00	\$20,238	
Revegetation w/ native plant species (includes materials and installation labor)	19286	SF	\$0.85	\$16,393	Engineer's estimate from recent bid
Erosion Control (includes materials and placement)	19286	SF	\$0.75	\$14,465	Engineer's estimate from recent bid
Backfill characterization sampling (includes shipping costs)	15	EA	\$450.00	\$6,750	Average quotes from US labs
SUBTOTAL				\$771,099	
Contingency	40%			\$308,440	Engineer's estimate
SUBTOTAL				\$1,079,539	
Construction Management	15%			\$161,931	
Engineering Services During Construction	3%			\$32,386	Source: Typical percentage for CH2M HILL government cost estimates
Conceptual Work Plans	3%			\$32,386	
Design	6%			\$64,772	
Work Plans, As Builts, Final Reports	3%			\$32,386	
Project Management	10%			\$107,954	
G&A	11%			\$118,749	
Fee	6%			\$64,772	
TOTAL CAPITAL COST				\$1,306,242	

OPERATION AND MAINTENANCE COSTS (Year 1)

Site Restoration Monitoring					
Mowing areas	6	EVENT	\$1,000.00	\$6,000	Engineer's Estimate from experience, 1 mowing every 2 months
Monitoring and upkeep of erosion control materials	6	EVENT	\$1,000.00	\$6,000	Engineer's Estimate, 1 inspection every 2 months for the 1st year
SUBTOTAL				\$12,000	
Contingency	40%			\$4,800	
SUBTOTAL				\$16,800	
Project Management	6%			\$1,008	
TOTAL ANNUAL OPERATION AND MAINTENANCE COST (Year 1)				\$17,808	

OPERATION AND MAINTENANCE COSTS (Years 2-30)

Soil Cover Monitoring					
Mowing areas	0	EVENT	\$1,000.00	\$0	Engineer's Estimate
Monitoring and upkeep of erosion control materials	0	EVENT	\$2,000.00	\$0	Engineer's Estimate
Annual inspection and report	0	UNIT	\$2,000.00	\$0	Engineer's estimate
SUBTOTAL				\$0	
Contingency	40%			\$0	Engineer's estimate
SUBTOTAL				\$0	
Project Management	6%			\$0	
TOTAL ANNUAL OPERATION AND MAINTENANCE COST (Years 2-30)				\$0	

PRESENT VALUE ANALYSIS

i = 0.037
t = 1
t = 29

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor (7%)	Present Value
Capital	0	\$1,306,242	\$1,306,242	1.000	\$1,306,242
O&M	1	\$17,808	\$17,808	0.964	\$17,173
O&M	2-30	\$0	\$0	17.603	\$0
		<u>\$1,324,050</u>			<u>\$1,323,414</u>
TOTAL PRESENT VALUE OF ALTERNATIVE					\$1,323,000

*Discount factor established per "Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis", OSWER Directive No. 9355.3-20, June 25, 1993.

- ASSUMPTIONS**
- Clearing and Grubbing
 - Clearing and grubbing will require the removal of all vegetation at the sites including larger trees
 - All brush and smaller trees will be mulched and used onsite for revegetation purposes, larger trees may be timbered or mulched
 - Characterization/Confirmation/Backfill Sampling
 - Assume 26 waste characterization samples for disposal for all 4 sites, analysis will include TCLP (\$750), PCB's (\$78), TPH (\$50), and BTEX (\$75)
 - Assume confirmation samples at a frequency of 1 per 1,000 sq. ft of area for debris/soil removal. Analytes vary by site - See RI Report(s)
 - Assume 1 backfill characterization sample per 100 CY, or 11 samples + 4 field duplicates (15 total) for all 4 sites, analysis will include SVOCs (\$200), PCB's (\$78), TPH (\$50), and VOCs (\$100)
 - Labor associated with sampling is included in the Construction Management costs
 - Vegetation and Erosion Control Maintenance
 - Assume that vegetated areas will be mowed once every 2 months
 - Assume annual cost for potential vegetation and erosion control repairs
 - Assume vegetation will only be mowed/monitored for the 1st year or until vegetation is established

TABLE B-4 SUMMARY OF COST ESTIMATES			
Alternative	Estimate	EE/CA Range	
		-30%	+50%
Alternative 2	\$1,552,000	\$1,086,400	\$2,328,000
Alternative 3b	\$1,323,000	\$926,100	\$1,984,500

Appendix C
Response to Comments

Preliminary Response to Comments on *Draft Engineering Evaluation/Cost Analysis for Areas of Concern J and R, Solid Waste Management Units 6 and 7, Former Naval Ammunition Support Detachment, Vieques Island, Puerto Rico (CH2M HILL, August 2005)*

TO: CERCLA Technical Subcommittee
COPIES: CH2M HILL
FROM: NAVFAC, Atlantic
DATE: November 3, 2005

This memorandum compiles the Navy's responses to all of the comments received on the *Draft Engineering Evaluation/Cost Analysis for Areas of Concern J and R, Solid Waste Management Units 6 and 7, Former Naval Ammunition Storage Detachment, Vieques Island, Puerto Rico (CH2M HILL, August 2005)*. For each reviewing agency, the comments have been reproduced, followed by the response in bold type. Please note that where applicable, the responses refer to pages in the original document, not the revised text with comments incorporated.

USEPA

1. Executive Summary: The Site Descriptions for AOC J, SWMU 6 and SWMU 7 included in this EE/CA state that the draft RI reports conclude that each site does not pose an unacceptable risk. However, since these reports are draft, they have not yet been accepted and approved by the regulatory agencies, and any conclusions presented in the draft RI reports are solely based on the perspective of the Navy. This potential misrepresentation of the status of the reports continues throughout the document. The text should be written to more clearly state that the draft RI reports contain information on the nature and extent of contamination and that these reports are currently under review by the regulatory agencies.

The site description text to which the comment refers references the draft remedial investigation reports which, by definition, are under regulatory review. However, for clarification, the following sentence will be added as the third paragraph of both the Executive Summary and Section 1 (Introduction): "Discussions in this EE/CA regarding the nature and extent of contamination and the presence or absence of potential risks associated with the contamination at each site are summarized from the draft Remedial Investigation reports, and as such, are currently under regulatory consideration." In addition, the word "Draft" will be added to the remedial investigation reports when they are referenced throughout the EE/CA.

2. Section 1.1, Regulatory Framework, page 1-2: In the first complete paragraph on this page, the text states, “[i]t is important to note that no unacceptable levels of potential risks were identified for AOC J, SWMU 6, and SWMU 7 (AOC R is currently being investigated).” This implies that all agencies have reached this conclusion, which is not the case. Please revise the text to more accurately reflect the status of the evaluation of these sub sites, which is that the draft RI reports suggest that no unacceptable levels of risk are associated with these sub sites, and these reports are currently being reviewed by the appropriate agencies.

The first sentence of the fourth paragraph of Section 1.1 will be revised to read: “It is important to note that no unacceptable levels of potential risks were identified in the Draft RI Report for each of the sites included in this EE/CA. The Draft RI Reports are currently under regulatory review.”

3. Section 1.3, Site Description and Background, page 1-4: In the first complete paragraph on this page, please include the use designation of the aquifer. This is important, as it is critical in identifying ARARs.

Based on the scope of the EE/CA (i.e., removal of debris and collection of confirmatory soil samples), the paragraph regarding the Resolucion Valley Aquifer (first full paragraph on page 1-4) will be deleted from the background section. It is recognized that the use designation of the aquifer is relevant to the ultimate remediation and closure of the sites, and as such will be addressed in the remedial investigation process.

4. Section 1.3.1.1, AOC J, and Section 1.3.1.2, AOC R, page 1-5: Please note that this Site is adjacent to an intermittent stream whose head waters are in Monte Pirata and not a “water-filled ditch.” The reference made to the “water filled ditch” at AOC J should be changed to ephemeral stream. The report should note that the ephemeral stream that traverses a portion of the western boundary of AOC R actually is part of the ephemeral stream (up gradient) at AOC J.

The fourth sentence of the second paragraph in Section 1.3.1.1 will be revised to read: “The site is in a wooded area adjacent to an ephemeral stream.” Further, the following sentence will be added to the end of the first paragraph in Section 1.3.1.2: “This ephemeral stream is the same ephemeral stream adjacent to AOC J, which is topographically downgradient of AOC R.”

5. Section 1.4, Previous Site Investigations, page 1-7: In the discussion of data, please note whether the comparisons to “applicable screening criteria” include screening against values protective of ecological receptors. Though the report notes that an RI will be conducted for AOC R to further delineate the nature and extent of contamination and assess whether or not the site poses an unacceptable risk to human health and/or the environment, the report also indicates that the draft RIs completed for AOC J, SWMU 6 and SWMU 7 concluded that the human health and environmental risk assessments conducted for the sites support the conclusion that the contaminants present do not pose an unacceptable risks (See comment number 1).

It is important to emphasize that the EBS and PA/SI were done as screening level investigations, but that the Remedial Investigations for AOC J, SWMU 6, and SWMU 7 represented the culmination of the historical environmental investigations at these sites, and included both human health and ecological risk assessments using applicable data. However, for clarification, the following revisions will be made in Section 1.4

- The last sentence in Section 1.4.1.1 will be revised to read: “No constituent concentrations were detected above human health risk-based screening criteria.”
 - The second sentence of the third paragraph in Section 1.4.1.3 will be revised to read: “VOCs, SVOCs, PCBs, and pesticides were either not detected or were detected at concentrations below MCLs and/or PRGs.”
 - The fourth paragraph in Section 1.4.1.3 will be revised to read: “In surface water, only mercury exceeded its EPA Region IX surface water criterion and its background concentration, but its detection was at the method detection limit and, therefore, its result is estimated. VOCs, SVOCs, PCBs, pesticides, and explosives were either not detected or were detected below the Region IX surface water criterion.”
 - The second sentence of the fifth paragraph in Section 1.4.1.3 will be revised to read: “No exceedances of Region IX PRGs were detected in subsurface soil samples, and no exceedances of ecological screening values were detected in sediment samples.”
 - The last sentence of the second paragraph in Section 1.4.2 will be revised to read: “VOCs, PCBs, and pesticides were either not detected or were detected at concentrations below the screening criteria listed above.”
 - The fourth paragraph in Section 1.4.3.2 will be revised to read: “All VOCs, SVOCs, pesticides, PCBs, and explosives were either not detected or were detected below their human health and ecological screening criteria (where applicable) in subsurface soil, surface water, and sediment samples.”
 - The first sentence of the third paragraph in Section 1.4.4.2 will be revised to read: “Surface soil sample analytical results indicated that aluminum . . . were detected above human health risk-based screening criteria.”
 - The last sentence of the third paragraph in Section 1.4.4.2 will be revised to read: “Pesticides, PCBs, and explosives were either not detected in soil or were detected below their human health risk-based screening criteria.”
 - The first sentence of the fourth paragraph in Section 1.4.4.2 will be revised to read: “VOCs, SVOCs, pesticides, PCBs, and explosives were either not detected or were detected below their ecological screening criteria in the sediment samples.”
6. Section 1.4.5.2, AOC R, page 1-14: The relationship of the waste pile near the ditch to the area that is planned for surface water and sediment sampling for the RI for AOC R should be clarified. If they are in the same area, the timing of the two activities should be discussed.

Section 4.3.2.4 of the RI Work Plan for AOC R states that a sediment (soil) sample will

be collected at the location of the munitions item identified in the stream bed. This munitions item is the practice bomb referred to in Section 1.4.5.2 of the EE/CA. The sediment (soil) sampling will take place during the AOC R RI; removal of the munitions and debris will take place after the RI fieldwork has been completed.

7. Section 1.4.6, Streamlined Risk Evaluation, page 1-16: This section is inadequate. Although EPA agrees that the streamlined risk assessment can be focused to address the risks related only to the source of contamination, post-removal soils samples are necessary to ensure that the removal action has effectively eliminated any potential threats via direct contact with contaminated soil under the debris piles as well as any possible impacts to groundwater. The EE/CA work plan does not discuss how many post-removal samples will be collected or how these data will be used to ensure that the goals of eliminating potential threats to public health are met.

Please note that the EE/CA is not the removal action work plan. The removal action work plan will identify the confirmatory sampling protocol and how the data will be evaluated with respect to ensuring the removal action goals are met (including eliminating the uncertainty associated with the debris being a continuing source of contamination that may result in unacceptable levels of potential risk). Section 1.4.6 does discuss the uncertainty of the debris being a continuing source of contamination. However, to help eliminate the confusion about the streamlined risk evaluation, the first four sentences of the second paragraph will be replaced with the following sentence: "A confirmatory sampling protocol will be established in the removal action work plan, including how the data will be evaluated in a streamlined risk evaluation to ensure the removal action goals are met, including eliminating the uncertainty associated with the debris being a continuing source of contamination that may result in unacceptable levels of potential risk."

8. Figure 1-2, Location Map: The map should show the ephemeral stream that connects AOC R and AOC J. Also, please clarify why SWMU 4 is identified by the thatched area on this figure.

The ephemeral stream connecting AOC R and AOC J will be added to Figure 1-2. The SWMU 4 area will be removed from the figure.

9. Section 2.4, Applicable or Relevant and Appropriate Requirements (ARARs), page 2-2 and Appendix A: Missing from the list of Location-specific ARARs is the Magnuson-Stevens Fishery Conservation and Management Act (1996), a federal law that requires federal agencies to consult with NOAA National Marine Fisheries Service (NMFS) regarding any action they authorize, fund or undertake that may adversely affect essential fish habitat (EFH). EFH is defined as, "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." This would include the mangrove estuary area located to the east of AOC J and the mangrove swamp, tidal marsh area and lagoons at SWMU 6. Efforts should be taken, to the extent practicable, to minimize adverse impacts to these areas that might result from debris removal. For more information regarding EFH consultations, please contact Lisamarie Carrubba of NOAA's NMFS Habitat Conservation Division at (787) 851-3700.

The Magnuson-Stevens Fishery Conservation and Management Act (1996) will be added to Appendix A as a Location-specific ARAR. In addition, the last sentence of the third paragraph on page 2-3 will be revised to read: "In addition, long-term monitoring associated with Alternative 2 will involve comparison of site-specific data to background concentrations and/or USEPA maximum contaminant levels (MCLs) and/or PRGs and the Puerto Rico Water Quality Standards." In addition, a final sentence will be added that says "Federal and Puerto Rico Chemical-specific regulations are summarized in Appendix A." The Puerto Rico Water Quality Standards will be added to Appendix A as Chemical-specific TBC. The Federal Ambient Water Quality Criteria will also be added to Appendix A as Chemical-specific TBC for surface water.

10. Section 2.4, Applicable or Relevant and Appropriate Requirements (ARARs), page 2-3, Paragraph 3: The statement that, "No constituents of concern have been identified at these sites," should be modified to reflect the draft status of the RI documents and pending RI for AOC R (as discussed above).

The statement will be removed from the third sentence of the paragraph, such that the sentence reads: "The results of confirmation soil samples associated with Alternative 3 will be compared to background concentrations and/or USEPA Region 9 PRGs to confirm any contamination associated with the debris has been removed from the soil prior to site restoration."

11. Section 3.1.3, Alternative # 3 - Excavation, Off-site Disposal and Site Restoration, page 3-2, and Table 3-2 Alternative 3 - Excavation/Restoration Details/Sequence: Please note that a sampling plan outlining how post-excavation samples will be collected and analyzed and how data will be interpreted should be submitted to EPA for review.

A removal action work plan is the planned next step in the removal process. The removal action work plan will identify the estimated removal action areas, confirmatory sampling protocol, and data evaluation procedure. Section 3.1.3, page 3-2, and Table 3-2 will be modified to state a removal action work plan will be developed for regulatory review prior to mobilization.

12. Section 3.1.3, Alternative # 3 - Excavation, Off-site Disposal and Site Restoration, page 3-2: Prior to excavating areas, the type of vegetation currently on-site should be noted. Clearing should be kept to a minimum to minimize the potential damage to the surrounding landscape and to minimize the site restoration activities. More details need to be provided regarding the actual anticipated impacts to the marsh and mangrove areas and what the re-vegetation activities will involve. The decision to backfill excavated areas should be made in conjunction with USFWS to maximize the success of re-vegetation efforts and to restore the areas to conditions that reflect what the areas were like prior to the Navy's activities.

Comment noted. Details of the removal and restoration activities will be provided in the removal action work plan.

13. Figure 3-3, SWMU 6 Proposed Excavation/Waste Removal Areas: The site boundary shown in this figure does not extend to the south of Highway 200 as shown in Figure 1-5.

Figure 1-5 is the historical site boundary associated with SWMU 6. Figure 3-3 shows the area for excavation/waste removal, based upon site surveys to delineate the location of waste piles. Figure 3-3 better represents those areas where waste/debris piles are present within the historical site boundary. To clarify that the areas shown in the figures were primarily for cost estimating purposes, the following sentences will be added after the first sentence of the first full paragraph on page 3-2: "It is important to note that the removal areas shown in these figures are approximate and were used primarily to estimate the removal costs. The actual removal areas will be based on the extent of the debris areas identified during the removal."

14. Section 4, Detailed Analysis of Removal Action Alternatives, page 4-1: As the waste has not been sampled and will undergo TCLP analysis prior to disposal, it may not necessarily be true that the waste in these four areas has been determined to be non-hazardous. Similarly, in the discussion of the effectiveness of the remedy, the reduction of toxicity of the waste does not make sense if this waste is not considered to be hazardous.

The first sentence of the second paragraph of Section 4 will be revised to read: "The waste at AOC J, AOC R, SWMU 6, and SWMU 7 is anticipated to be classified as non-hazardous, based on historical data from the sites. However, this assumption will be evaluated by waste characterization samples collected prior to excavation. For the purposes of cost estimating in this EE/CA, non-hazardous waste disposal has been assumed. In addition, debris that can be recycled will be segregated and shipped to an appropriate recycling facility." The TCLP sampling protocol will be included in the removal work plan.

The second part of the comment is inaccurate. Even if the waste is determined to be non-hazardous, there is the potential that leaching of constituents from the debris, if left in place, could result in unacceptable levels of potential human health and/or ecological toxicity. The purpose of this EE/CA and, therefore, the removal action is to eliminate the uncertainty associated with the debris being a future source of contamination.

15. Section 4.1.1.2, Alternative # 2 - Construction of Soil Cover and Long-term Monitoring, page 4-3: Please discuss the protectiveness of this action to ecological receptors.

The second sentence of Section 4.1.1.2 will be revised to read: "Because the waste at each of these sites would be covered with a minimum of 2 feet of soil, the likelihood of human or ecological contact would be decreased, but not eliminated." Section 3.1.2 defines this alternative as a 2-foot soil cover.

16. Section 4.1.2, Protection of Workers During Implementation, page 4-3: The protection of workers implementing a remedy is not typically considered in an evaluation of the EE/CA alternatives. This population is usually considered in a site health and safety plan. EPA typically evaluates the effectiveness of the alternatives for the protection of

workers once the remedy has been implemented, meaning, construction or utility workers that will access the site once the action has been taken. Please revise the text accordingly.

Protection of Workers During Implementation is considered under the short-term effectiveness criteria to evaluate the protection of on-site workers prior to, during, and following implementation of each of the alternatives. Site worker safety during implementation will be addressed in detail in a site-specific health and safety plan for the removal actions. The heading for Section 4.1.2 will be revised to “Protection of Workers” with “During Implementation” removed. The discussion of post-removal onsite utility or construction workers will be added as the last paragraph of Section 4.1.2.2 to read: “Following implementation of the soil cover alternative, future onsite utility or construction workers may be exposed to buried waste and debris if subsurface activities are conducted within the limits of the soil cover. Signs, fencing, or other means of restricting access and prohibiting subsurface activities without proper notification and approval will be required under this alternative.”

Under the desired no further action site characterization for Alternative 3, there will not be potential risk to future workers. The discussion of post-removal onsite utility or construction workers will be added as the last paragraph in Section 4.2.1.3 that states: “Following implementation of Alternative 3, which includes post-removal action confirmation sampling to demonstrate that residual constituent levels do not pose an unacceptable level of risk, there would not be unacceptable risk to future onsite utility or construction workers.”

17. Section 4.1.3, Compliance with Chemical, Action and Location Specific ARARs, page 4-4: In addition to ARARs, a list of TBCs should also be included in Appendix A. TBCs should include media-specific screening values protective of ecological receptors. Also, please ensure that the PR EQB ARAR for TPH is included in the ARAR evaluation.

The tables currently indicate whether each requirement is applicable, or relevant and appropriate, or to be considered (TBC). As shown in Table A-4, the chemical-specific screening values are TBC criteria. Ecological screening values and the PREQB TPH screening values (from the PREQB UST regulation) will be added as TBC criteria to the list of chemical specific ARARS.

18. Section 4.1.5.3 and Section 4.1.6.3, Alternative # 3 - Excavation, Off-site Disposal and Site Restoration, pages 4-4 and 4-5: Please note that removal of waste material may not automatically result in the preparation of a NFA ROD.

Both sentences in Sections 4.1.5.3 and Section 4.1.6.3 will be ended after “. . . site may be restored.”

Area Specific Comments

AOC J

AOC J was used as a solid waste disposal site for construction activities from 1965 until 1973, when some of the unidentified waste materials were removed and placed in an off-base municipal landfill. This EE/CA addresses only removal of the debris and underlying soil containing debris located at AOC J. The EE/CA recommends removal of vegetation and excavation/ removal of trash piles and re-vegetation with native vegetation. Please note that all efforts should be made to preserve the mangrove area to the east of the Site.

Comment noted. The removal action work plan will indicate that areas outside the limits of excavation, including the mangrove area to the east, will be preserved to the maximum extent reasonably possible. Further, the two individuals of *Stahlia monosperma* identified in the vicinity of where debris removal is planned at AOC J will be protected as described in the November 3, 2005 letter issued to the USFWS from the Navy.

AOC R

AOC R was used as a construction staging and public works operational area from 1965-1971. There are four areas on site containing solid waste to be removed. A more detailed survey of the waste in the stream may need to be conducted by the Navy to determine the extent of the dumping. The stream should be clearly identified in the accompanying Site figures. The stream banks are steep and heavily vegetated; vegetation removal should be kept to a minimum. Stream bank restoration should be coordinated with FWS.

An additional survey of the extent of the debris will be added as a recommendation in Section 1.4.5.2. This survey will be conducted during the RI and will benefit from the vegetation clearing activities. In addition, the vegetation clearance, re-vegetation, and site restoration protocols will be included in the removal action work plan.

SWMU 6

Similarly, SWMU 6 was used for disposal of solid waste. This EE/CA addresses removal of wastes, including debris and any contaminated soil beneath the waste piles. In order to adequately remove and excavate all the material it will be necessary to remove some or all of the existing mangrove vegetation. Close coordination with FWS Refuge Staff is recommended. Restoration and reforestation plans should be discussed with Refuge personnel prior to implementation. After the removal of the known trash piled, additional geophysical work should be conducted to ensure that there are no buried items.

The vegetation clearance, re-vegetation, and site restoration protocols will be included in the removal action work plan. The need for institutional controls following the removal action will be based on whether the confirmatory data suggest residual constituent levels pose an acceptable or unacceptable risk to human health or the environment. Further, excavation will continue until the debris is removed. Use of an excavator and visual observation of the excavation are reliable means of determining the extent and depth of debris.

SWMU 7

At SWMU 7 a steep ditch at the Site was used for the disposal of solid waste materials. Disposal activities appear to have been concentrated in a segment of the ditch

approximately 420 feet along the length of the dirt access road where waste materials were pushed over the edge. This EE/CA addresses waste, including debris and any contaminated soil beneath the waste piles. Because the stream is deeply incised at this site, care should be taken to avoid excess vegetation removal along the stream banks. Ingress and egress sites should be clearly marked and used exclusively to access the waste piles. Staging areas should also be pre-selected to avoid impacts to the stream. Re-vegetation of the stream banks should be coordinated with FWS.

The vegetation clearance, re-vegetation, site preparation, removal action activities, and site restoration protocols will be included in the removal action work plan.

PREQB

General Comment

Section 1.1 and the summaries of previous investigations presented in Section 1.4 should indicate that the information provided is based on draft remedial investigation (RI) reports and that agency comments on the draft reports have not been incorporated into the summaries presented in the EE/CA.

The following sentence will be added as the third paragraph of both the Executive Summary and Section 1 (Introduction): “Discussions in this EE/CA regarding the nature and extent of contamination and the presence or absence of potential risks associated with the contamination at AOC J, SWMU 6, and SWMU 7 are summarized from the draft Remedial Investigation reports, and as such, are currently under regulatory consideration.”

PAGE-SPECIFIC COMMENTS

1. Page 1-5, Section 1.3.1.1, paragraph 1 - The first sentence states that AOC J was used as a solid waste disposal site for construction staging activities. However, Section 1.4.1.3 lists ordnance-related items that were found during an MEC avoidance survey conducted at AOC J. Therefore, the description of the historic use of AOC J should be revised to indicate that it was a solid waste disposal site, and the phrase “for construction staging activities” should be removed from the sentence.

The sentence will be revised to remove the phrase “for construction staging activities.”

2. Page 1-5, Section 1.3.1.1, paragraph 2 - Please clarify whether the “water-filled ditch” is a man-made surface water feature. If not, then the surface water body should be identified as a natural surface water feature and labeled appropriately.

The fourth sentence of the second paragraph in Section 1.3.1.1 will be revised to read: “The site is in a wooded area adjacent to an ephemeral stream.” Further, the following sentence will be added to the end of the first paragraph in Section 1.3.1.2: “This

ephemeral stream is the same ephemeral stream adjacent to AOC J, which is topographically downgradient of AOC R."

3. Page 1-5, Section 1.3.1.2 – Please add a discussion of solid waste disposal activities that took place at AOC R to be consistent with the rest of this section.

Based upon a review of available documentation for AOC R, there is limited information available on the history of solid waste disposal activities at AOC R. However, the following sentence will be added to the end of the second paragraph: "In addition, during site visits conducted in 2004 and 2005 several areas of debris disposal have been identified, including one area that encroaches on the ephemeral stream located along the western boundary of the site."

4. Page 1-8, Section 1.4.1.4 - The Remedial Investigation Report for AOC J dated April 2004 is a draft document with outstanding regulator comments. The status of reports should be noted in this section. The summary of the RI presented does not address PREQB comments provided on the Draft RI report. For example, the summary indicates that metals concentrations in groundwater within the range of background are the basis for risk exceedances; however, the draft report indicates that perchlorate also contributes to elevated risk. Also, PREQB has requested additional perchlorate analysis to address elevated detection limits. This comment also applies to Sections 1.4.3 (SWMU 6) and 1.4.4 (SWMU 7) with respect to denoting the status of the RI reports and that agency comments have not been addressed in drafting the summaries presented in these sections.

Please see response to the General Comment and response to EPA comments.

5. Section 3 - The EE/CA should specify the analytical methods and frequency for the post-excavation sampling. The EE/CA cost estimate in Appendix B indicates that "Analytes vary by site – See RI Report(s)". The analyses, and the rationale for the analyses, should be specified in the EE/CA.

Like a feasibility study (FS), the intent of the EE/CA is to evaluate various removal alternatives, not to define the specifics of the removal action and associated confirmatory sampling. The confirmatory sampling and analytical protocol and rationale for the analyses will be documented in the removal action work plan. This document will be made available for agency review prior to implementation of the removal action.

6. Section 3 - The frequency/density of post-excavation sampling at each location should be specified. The cost estimate in Appendix B reveals that post-excavation samples will be conducted at a frequency of one per 1,000-square feet. This coverage may be insufficient at some sites as they may only have two post-excavation samples. The EE/CA should specify that a minimum of 4 to 5 samples will be obtained from each area to ensure adequate coverage.

The frequency and density of post-excavation samples was based upon reasonable assumptions for cost estimating purposes. A sentence will be added at the end of the first paragraph of Section 3.1.3 that states: "The assumptions used in preparing the cost estimates summarized in this EE/CA, including the confirmatory sampling frequency, are presented in the Appendix B cost tables. The actual confirmatory sampling frequency and analytical protocol will be presented in the removal work plan to be developed for regulatory review prior to mobilization."

7. Page 3-2, Section 3.1.3, First full paragraph on the page and Table B-1 - The text and Table B-1 should be revised for consistency. The text states for scoping and costing purposes it was assumed the maximum depth of waste is 2 feet below grade. A review of Table B-1 shows that the costing actually considered depths of waste ranging from 3 to 8 feet below grade.

The inconsistency will be corrected. The assumption is that waste extends a maximum of approximately 2 feet below the lowest observed depth of waste to provide for additional excavation as required. The text of Section 3.1.3 (first full paragraph on Page 3-2) will be revised to clarify an additional 2 feet of depth below the observed waste as opposed to below ground surface. This will make the text consistent with the estimates included in Appendix B.

8. Page 3-2, Section 3.1.3 - The last line should be deleted as Table 3-2 does not provide remedy sequence or detail. Detail regarding the activities and sequence of the proposed remedies will need to be reviewed and approved prior to implementation.

Table 3-2 is intended to provide general information regarding activities associated with the alternative as necessary for scoping and costing purposes. Details regarding the activities and sequence of the proposed remedies will be provided for agency review in the removal action work plan prior to implementation.

9. Page 6-1, Section 6 - Remove the last sentence of the final paragraph of this section. The last sentence states that "Implementation of Alternative 3 will result in no further action necessary and unrestricted land use." This conclusion is premature, considering the RI reports are draft. Results will need to be reviewed from soil samples collected from beneath the debris once the debris has been removed to determine if further impacts are present.

This sentence will be revised to read: "Implementation of Alternative 3 may result in no further action necessary and unrestricted land use if confirmatory data show acceptable constituent levels."

10. Table A-3 - The EE/CA should clarify why the solid waste being removed will not be characterized to determine if it is hazardous. Currently, only soil and sediment excavated during the removal actions will be characterized for disposal.

In the comment column of Table A-3 under the Puerto Rico Hazardous Waste and Non-Hazardous Solid Waste Regulations, the word "Debris" will be added to the first sentence.

USFWS

AOC J

This site is located within the Vieques National Wildlife Refuge. The site is adjacent to an intermittent stream, not a water-filled ditch as implied in Section 1.3.1.1, whose head waters are in Monte Pirata. From the mouth up to 300 meters (980 feet) inland the stream always contains water. Water salinity can vary and the stream grades from a small mangrove estuary to a deeply incised channel with a gravel/sand bottom. AOC J was used as a solid waste dump, although some Ordinance Related Scrap (ORS) items have been found. The site grades into the mangrove estuary to the east. AOC J has been cleared on two occasions for investigative work. The EECA recommends removal of vegetation, excavation and removal of trash piles followed by revegetation with native plant species. We recommend that prior to vegetation clearing, the mangrove area be flagged to avoid unnecessary impacts. Prior to revegetation, Navy contractors should coordinate with Refuge staff for the selection of native species to be planted in the area.

The fourth sentence of the second paragraph in Section 1.3.1.1 will be revised to read: "The site is in a wooded area adjacent to an ephemeral stream." Further, the following sentence will be added to the end of the first paragraph in Section 1.3.1.2: "This ephemeral stream is the same ephemeral stream adjacent to AOC J, which is topographically downgradient of AOC R." With respect to vegetation clearing and re-vegetation, the specific protocols will be included in the removal action work plan.

AOC R

AOC R had many uses over the years; the lands were transferred to the Municipality of Vieques in 2001. This site is upstream of AOC J and is contiguous with AOC J via the intermittent stream. Previous site investigations did not extend to the stream; however site investigations in 2005 found metal scrap, ORS and other items that were dumped, pushed or buried in the stream. The EECA calls for the removal of the scrap at various locations, however the waste boundary shown in Figure 1-4 may not be correct. A survey carried out by the U.S. Fish and Wildlife Service (Service) and U.S. Environmental Protection Agency found metal scrap and other items buried in the stream bank down stream of the main trash piles. A more detailed survey of the waste in the stream may need to be conducted by the Navy to determine the extent of the dumping. The stream at this point is deeply incised with the stream bed some three to four meters below the existing ground level. The stream banks are heavily vegetated and steep. Vegetation removal should be kept to a minimum and any necessary revegetation should be coordinated with the Department Natural and Environmental Resources (DNER).

An additional survey of the extent of the debris will be added as a recommendation in Section 1.4.5.2. This survey will be conducted during the RI and will benefit from the vegetation clearing activities. In addition, the vegetation clearance, re-vegetation, and site restoration protocols will be included in the removal action work plan.

SWMU 6

This site lies within the Vieques National Wildlife Refuge. SWMU-6 consists of various trash piles scattered throughout a mangrove area. This site was first reported in the late 1970's as part of the initial studies for the 1979 Vieques Environmental Impact Statement. It was subsequently reported in various mangrove surveys in the 1980's and it was recommended that these trash piles be removed. Recent investigations on the site have resulted in the detections of semi volatile organic compounds, metals, DDT and other compounds. Metal scrap, rubble and some ORS are found on the site. The site is currently sparsely vegetated with scrub/shrub black mangroves. The site is low lying and at times is completely inundated. In order to adequately remove and excavate all the material, it will be necessary to remove some or all of the existing mangrove vegetation. The Service does not object to this action because it will result in the removal of a potential source of contamination. Restoration and reforestation plans should be discussed with Refuge personnel prior to implementation. We recommend that any institutional controls should not include the existing chain linked fence; instead this fence should be removed. After the removal of the known trash piles, we recommend that additional geophysical work be done to assure that there are no buried items.

The vegetation clearance, re-vegetation, and site restoration protocols will be included in the removal action work plan. The need for institutional controls following the removal action will be based on whether the confirmatory data suggest residual constituent levels pose an acceptable or unacceptable risk to human health or the environment. Further, excavation will continue until the debris is removed. Use of an excavator and visual observation of the excavation are reliable means of determining the extent and depth of debris.

SWMU 7

This site is a deeply incised ephemeral stream located on lands that have been transferred to the Municipality of Vieques. Trash, ORS and other debris was dumped into the stream. This stream only transports water during periods of rain. The stream crosses Highway 200 via a culvert and eventually forms an estuary area due to salt water intrusion from the sand berm. Because the stream is deeply incised at this site, care should be taken to avoid excess vegetation removal along the stream banks. Ingress and egress sites should be clearly marked and used exclusively to access the waste piles. Staging areas should also be selected to avoid impacts to the stream. Revegetation of the stream banks should be coordinated with DNER.

The vegetation clearance, re-vegetation, site preparation, removal action activities, and site restoration protocols will be included in the removal action work plan.

The above sites fall within the range of the endangered brown pelican (*Pelecanus occidentalis*), the Antillean manatee (*Trichechus manatus manatus*) and the roseate tern (*Sterna dougalli*). Based on the site and the scope of the project, we believe that the proposed activities would not affect these species. Therefore, no further consultation is required. Nevertheless, if the project is modified or if information on impacts to listed species becomes available this office should be contacted concerning the need for the initiation of consultation under section 7 of the Act.

There are two individuals of *Stahlia monosperma* identified in the vicinity of where debris removal is planned at AOC J. Protective measures outlined in the November 3, 2005 letter issued to the USFWS from the Navy will be followed for these specimens during the removal action.